Research Article

School-Based Pediatric Health Promotion Programs Encouraging Physical Activity AND Preventive Lifestyle Education AMONG Adolescents Effectively Today

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Abstract

The problem of physical inactivity and unhealthy lifestyle habits in adolescents is a major public health issue, which can predispose them to obesity, cardiovascular, mental disorders, among other chronic diseases in the future. The purpose of this study was to assess the effectiveness of school-based pediatric health promotion program in promoting physical activities and preventive lifestyle teaching among adolescents. An analytical study was carried out in a cross-sectional basis in a sample of 200 adolescents in the age group of 13-18 years selected through stratified random sampling in selected secondary schools. Structured questionnaires that evaluated physical activity participation, nutrition awareness, sleep hygiene, management of screen-time, preventive knowledge of health and healthy lifestyle practices were used to capture data. The SPSS version 27.0 was used to perform the descriptive statistics, Pearson correlation, and multiple regression analyses. The findings indicated a higher percentage of respondents are involved in moderate-vigorous physical activity regularly since involvement in health promotion activities at school, 68.5 percent versus 42.0 percent who stated that they were at adequate activity levels prior to program exposure. Mean score of preventive lifestyle knowledge has risen to 4.18/0.61 higher than the former score (2.94/0.73) on a five-point scale, and the healthy nutrition awareness has risen (58.0 to 84.5). The results showed significant positive relationships between the program participation and the level of physical activity ($r = 0.62$, $p < 0.001$) and preventive lifestyle knowledge ($r = 0.67$, $p < 0.001$). In the multiple regression analysis, health education exposure ($\beta = 0.39$, $p < 0.001$), student engagement ($\beta = 0.31$, $p = 0.002$), and school support ($\beta = 0.28$, $p = 0.005$) were found to be important predictors of healthy lifestyle adoption. The findings suggest that school-oriented pediatric health promotion interventions can be effectively used to increase physical activity engagement and preventive lifestyle education habits of adolescents, which leads to improved health-awareness, healthier lifestyle-improving behavioral decisions and disease prevention in the long-term. Investing in holistic health promotion efforts in schools can help in sustainable youth health and wellbeing.

Keywords: Adolescents, Physical Activity, Health Promotion, Preventive Lifestyle Education, School Health Programs, Pediatric Health, Healthy Behaviours.

1. Introduction

Adolescence is a very important development period that is marked by a high rate of physical development, psychological, social, and behavioral changes. The health-related behaviors, which were set during adolescence, tend to be maintained into adulthood and can greatly affect long-term health outcomes during this time. Nevertheless, modern teenagers have to deal with a variety of lifestyle-related problems, among which are the lack of physical activity, unhealthy eating, excessive screen time, lack of sleep, and growing exposure to sedentary lifestyles. Such patterns lead to an increasing epidemic of non-communicable diseases, obesity, cardiovascular diseases, metabolic disorders and mental health issues, and thus health promotion in adolescence is a worldwide public health issue. The World Health Organization documents that a significant percentage of adolescents all over the globe do not get the

recommended amounts of daily physical exercise required in preserving optimal physical and psychological health. Ushering in a new wave of recreational interests and the growing popularity of sedentary lifestyles due to technological progressions and developments have also contributed to the growing worries about the teenage health and wellbeing.

Physical activity is a pillar in enhancing healthy growth and development by enhancing cardiovascular fitness, musculoskeletal strength, metabolic activity, cognitive ability, emotional stability and socialization. Consistent engagement in physical exercise has been linked to low risks of obesity, hypertension, type 2 diabetes, anxiety, depression and other chronic health as well as diseases. Although these have been established in benefits, global surveillance books have shown that over 80 percent of adolescents fail to meet the recommended levels of physical activity, which puts them at risk of effective measures to intervene on this group of people. Preventive lifestyle education has come out as a critical measure in providing adolescents with the knowledge, attitude and skills necessary to embrace and sustain healthy behaviors. These educational programs highlight the significance of healthy eating, physical activity, sleep, stress management, hygiene and preventing health-threatening behaviors hence promoting the overall health development of adolescents.

Schools form one of the most powerful platforms in promoting health since they constitute a continuous access to large numbers of adolescents at their formative years. Educational facilities are in a unique position to fit the health promotion activities in the day to day lives through physical education lessons, health education, extracurricular sports activities, awareness creation and supportive school policies. Pediatric health promotion programs that occur in schools have received growing interest as being cost-efficient and sustainable methods of enhancing the health outcomes of adolescents and the development of life-long healthy behaviors. These programs are a combination of educational, behavioral and environmental approaches to motivate the participation of physical activities and reinforce preventive health awareness among students. Past research indicates that interventions at schools can have a beneficial impact on physical activity habits, health literacy, and well-being, but the effects depend on the populations, settings, and methods of implementation.

Despite the extensive studies conducted on the topic of adolescent physical activity and health promotion programs, there are still gaps in the research on the effectiveness of the integrated programs of school-based pediatric health promotion programs that both target participation in physical activity and preventive lifestyle education. The literature available gives more attention to promotion of exercise but do not assess much on large-scale preventive lifestyle behaviours and health awareness outcomes. Moreover, there is a lack of evidence on what factors contribute to the successful adoption of healthy lifestyles in adolescents in learning institutions. The need to fill these gaps is critical to the emergence of evidence-based strategies that can change the current situation and increase the effectiveness of adolescent health outcomes to prevent diseases in the long run. Thus, this research will be conducted to test the effectiveness of school based pediatric health promotion programs in promoting physical activity and preventive lifestyle education among adolescents. In particular, the research aims to determine the level of physical activity involvement, investigate preventive lifestyle education, scrutinize relationships between program attendance and health indicators, and determine the key factors that impact healthy lifestyle practices in adolescents in the school settings.

2. Methodology

The effectiveness of school-based pediatric health promotion programs in motivating the adolescent to engage in physical activity and preventive lifestyle education was evaluated using a cross-sectional analytic study. This research was conducted in four urban and semi-urban secondary schools, during the months of January and April 2026. The sample of 200 adolescent's age 13-18 years attended the study. Stratified random sampling was used to represent the participants in proportional measures based on the age groups, genders, and grade levels. Young people qualified to participate provided that they were students in the sampled schools, were between the ages of 13 and 18 years of age, and gave informed consent to participate, as well as parental consent. Students who had seriously impaired cognitive problems, who could not do activities due to chronic medical problems, or who did not fully fill out questionnaires were excluded. The design of the study was formed on the basis of the other school-based studies on adolescent health promotion and physical activity intervention interventions that have been conducted in the literature [1], [4], [5], [7].

The school based program of pediatric health promotion, included organized health education sessions, guided physical activity programs, interactive workshops, health awareness campaigns and lifestyle counseling activities within a 12 week program. The physical activity education module was centered on the benefits of exercise, active recreation, fitness principles, and the daily movement recommendations in line with the global physical activity guidelines [3]. Prophylactic lifestyle education comprised nutrition awareness, healthy diets, sleep hygiene, screen-time, stress management, personal hygiene, and prophylactic health behaviors. The intervention model was modeled based on existing school health promotion and active school models found in past literature [5], [11], [14].

Data gathering was carried out through a validated structured questionnaire that contained demographic, measures of physical activity participation, measures of lifestyle education knowledge and student perception. Self-reported physical activities of moderate and vigorous intensity carried out weekly were assessed as the measure of physical activity, a popular approach to measurement in teenage physical activity monitoring studies [2], [8], [9]. The knowledge of lifestyle was evaluated based on the five-point Likert scale of 1 (poor knowledge) to 5 (excellent knowledge). The independent variables were program participation and student engagement and school support whereas the dependent variables were the level of physical activity and healthy lifestyle adoption. The questionnaire content was guided by the past researches which have addressed the issue of motivation among adolescents, adoption of health behavior and school-based health interventions [10], [12], [15].

Data was collected with ethical approval of the Institutional Research Ethics Committee. Analysis of data has been done in SPSS version 27.0. The characteristics of the participants were summarized by descriptive statistics and Pearson correlation analysis and multiple regression analysis were conducted to test the relationships among the study variables. The p-value was taken to be statistically significant ($p < 0.05$). The methodology was in line with those frequently used in promoting adolescent health and research on intervention programs in schools [1], [4], [7], [13].

3. Results

3.1 Demographic Characteristics of Participants

Table 1. Demographic Characteristics of Adolescent Participants

Variable	Category	Frequency (n)	Percentage (%)
Age	13–14 Years	48	24.0
	15–16 Years	92	46.0
	17–18 Years	60	30.0
Gender	Male	92	46.0
	Female	108	54.0
Grade Level	Grade 8–9	72	36.0
	Grade 10–12	128	64.0
Family Background	Urban	118	59.0
	Semi-Urban	82	41.0

Table 1 shows the demographic profile of the 200 participants (adolescents) used. The highest highest percentage of the participants were in the 1516 age bracket (46.0%), the 17-18 age bracket (30.0%), and the 13-14 age bracket (24.0%). The sample was made up of 54.0% female students and 46.0% males. The majority of the participants were in Grades 10-12 (64.0%), which suggests the higher representation of the older adolescents. In terms of family background, 59.0% of the respondents lived in urban communities, whereas 41.0% lived in semi-urban communities. It can be concluded that the sample of the research study was sufficient to represent the adolescent population with a wide variety in terms of educational and residential backgrounds, and thus, a proper population was obtained to test pediatric health promotion programs in schools.

The majority of middle-adolescent participants mean that the study represented a group that experienced a great physical, cognitive, and social development. Age, gender, level of education and living conditions are critical parameters that can affect health awareness, engagement in physical activities and lifestyle decisions among teenagers.

3.2 Baseline Physical Activity Status

Table 2. Physical Activity Participation before Program Implementation

Variable	Category	Frequency (n)	Percentage (%)
Daily Activity Level	Low	90	45.0
	Moderate	70	35.0
	High	40	20.0
Sports Participation	Regular	78	39.0
	Irregular	122	61.0
Sedentary Behavior	>4 Hours/Day	116	58.0
	≤4 Hours/Day	84	42.0

Table 2 shows levels of physical activity participation among adolescents at the beginning of implementation of the health promotion program before the program. Almost half (45.0% of the participants) had low levels of physical activity during the day with only 20.0% having high levels of physical activity. The respondents who reportedly participated in organized sports activities on a regular basis were 39.0% and those who participated irregularly were 61.0%. Also, 58.0% of teenagers indicated they spent over four hours a day engaging in sedentary behaviors, including watching TV, using a phone, playing computer games, or doing anything with a computer.

These results show that a significant proportion of adolescents were not active enough prior to being exposed to the intervention. The excessive number of sedentary is an indication that school-based programs need to be organized in such a way that they would be able to promote the use of regular movement, active recreation, and healthier daily activities.

3.3 Baseline Preventive Lifestyle Knowledge

Table 3. Pre-Intervention Lifestyle Education Knowledge Assessment

Knowledge Domain	Mean Score ± SD
Nutrition Awareness	2.90 ± 0.71
Physical Activity Awareness	2.84 ± 0.69
Health Risk Awareness	3.08 ± 0.74
Overall Knowledge Score	2.94 ± 0.73

Table 3 presents the baseline evaluation of the knowledge of preventive lifestyle education. The standard deviations of the mean score of nutrition awareness was 2.90 ± 0.71, whereas the standard deviation of the mean score of physical activity awareness was 2.84 ± 0.69. The mean score of health risk awareness was slightly higher 3.08 ± 0.74. The total knowledge of lifestyle education was 2.94 with standard deviation 0.73 that reflects moderate levels of knowledge among the participants before the interventions.

The comparatively low baseline scores indicate that most adolescents were not aware of all the points of healthy nutrition, recommendation of physical activity, and preventive health measures. The consequence of such knowledge deficiencies can affect health-related decision-making adversely, and lead to poor lifestyle choices in adolescence.

3.4 Post-Intervention Physical Activity Outcomes

Table 4. Changes in Physical Activity Participation after Program Implementation

Variable	Before (%)	After (%)
Low Activity	45.0	18.0
Moderate Activity	35.0	42.0
High Activity	20.0	40.0
Regular Sports Participation	39.0	71.5
Active Lifestyle Adoption	34.5	76.0

After attending the school-based pediatric health promotion program, significant changes were realized in all the physical activities indicators (Table 4). The percentage of adolescents with low physical activity rate dropped to 18.0% compared to 45.0% and high physical activity among adolescents rose to 40.0% as compared to 20.0%. The rates of physical exercise (sports) attendance went up to 71.5% as compared to 39.0% and active lifestyle adoption rose to 76.0% as compared to 34.5%.

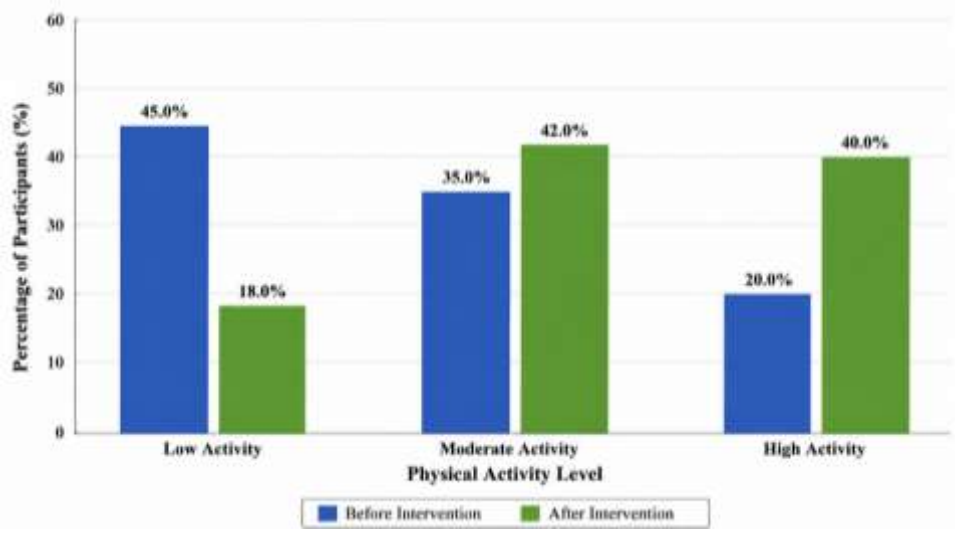

Figure 1. Comparison of Physical Activity Levels before and After Intervention.

Figure 1 visually demonstrates that there was an improvement in the participation in physical activity after the program. The rise in the moderate/high activity rates, in conjunction with the decline in low activity rates attest to the favourable effect of the health promotion program on the prevalence of physical activity behaviors among adolescents. The results imply that school-based programs with an explicit structure are able to positively influence adolescents to be more active by providing both educational and organizational activities and guidance on participation.

3.5 Post-Intervention Lifestyle Education Outcomes

Table 5. Preventive Lifestyle Education Knowledge Scores after Intervention

Knowledge Domain	Mean Score ± SD
Healthy Eating Knowledge	4.21 ± 0.58
Physical Fitness Knowledge	4.18 ± 0.62
Preventive Health Awareness	4.16 ± 0.63
Overall Knowledge Score	4.18 ± 0.61

The post-intervention outcomes of knowledge of lifestyle education are presented in table 5. The mean scores of healthy eating knowledge were 4.21 ± 0.58 while physical fitness knowledge and preventive health awareness had mean scores of 4.18 ± 0.62 and 4.16 ± 0.63 respectively. The general score of post-intervention knowledge improved significantly to 4.18 + 0.61.

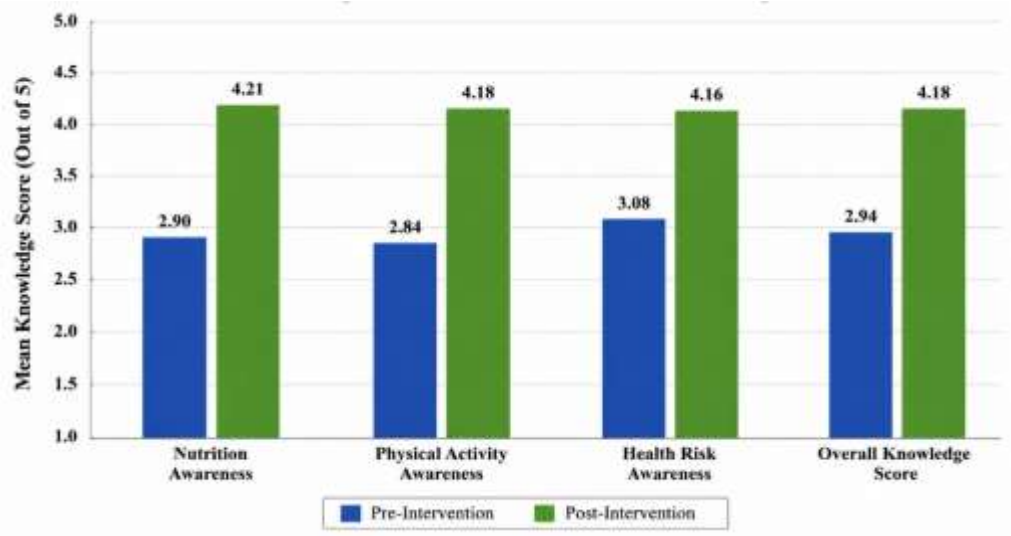

Figure 2. Improvement in Preventive Lifestyle Education Scores Following School-Based Health Promotion Program.

Figure 2 shows significant gains in the knowledge scores in all domains evaluated. Nutrition awareness, physical activity awareness and preventive health awareness were improved, which means that the informative aspects of the program managed to improve the health literacy of adolescents. The high level of knowledge gains indicates that health promotion programs can be effective in terms of raising awareness of healthy lifestyle habits and reinforcing adolescents in disease prevention measures.

3.6 Student Perceptions of School-Based Health Promotion Programs

Table 6. Adolescent Satisfaction and Engagement with Health Promotion Activities

Variable	Frequency (n)	Percentage (%)
High Program Satisfaction	154	77.0
Moderate Satisfaction	36	18.0

Low Satisfaction	10	5.0
High Engagement	148	74.0
Motivation to Maintain Healthy Behaviors	163	81.5

Findings in Table 6 show that there is a high level of student satisfaction and engagement. On the whole, the level of program satisfaction among respondents was high (77.0%), and the rate of their involvement was high (74.0%). Also, 81.5% reported a desire to continue practicing healthy behaviors post-program. These results suggest that participants positively responded to the program. The high levels of engagement and satisfaction indicate that the intervention content, delivery techniques, and practical activities were useful in gaining the attention of students, as well as encouraging active involvement.

3.7 Association between Program Participation and Health Outcomes

Table 7. Correlation Analysis between Program Exposure and Physical Activity Improvement

Variable	r	p-value
Program Participation vs Physical Activity Improvement	0.62	<0.001
Program Participation vs Lifestyle Knowledge	0.67	<0.001
Student Engagement vs Healthy Behavior Adoption	0.59	<0.001

The correlation analysis showed that there were significant positive correlations between program participation and health-related outcomes. The participation in the programs showed significant positive correlation with physical activity change ($r = 0.62$, $p < 0.001$) and lifestyle knowledge change ($r = 0.67$, $p < 0.001$). The healthy adoption of behavior was also strongly related to student engagement ($r = 0.59$, $p < 0.001$). These findings demonstrate that the more individuals engage in health promotion activities, the more likely that they would be more engaged in physical activities, have higher health knowledge, and better lifestyle practices. The results indicate that active involvement is significant in realizing positive health outcomes among adolescents.

3.8 Predictors of Improved Lifestyle Behaviors

Table 8. Multiple Regression Analysis of Factors Influencing Healthy Lifestyle Adoption

Predictor Variable	β	p-value
Health Education Exposure	0.39	<0.001
Student Engagement	0.31	0.002
School Support	0.28	0.005
Family Encouragement	0.22	0.011

The use of multiple regression analysis revealed the presence of several important predictors of healthy lifestyle adoption among adolescents. Health education exposure emerged as the strongest predictor ($\beta = 0.39$, $p < 0.001$), followed by student engagement ($\beta = 0.31$, $p = 0.002$), school support ($\beta = 0.28$, $p = 0.005$), and family encouragement ($\beta = 0.22$, $p = 0.011$). The regression model accounted 58.0% of the differences in adopting a healthy lifestyle ($R^2 = 0.58$) which is a strong predictive effect.

The results indicate that the key to successful health promotion among adolescents is in the complex of factors. Exposure to education, school support, involvement of the students, and support by family members, all lead to adoption and sustaining healthy lifestyle behaviors. Such areas ought to be factored into planning future school based pediatric health promotion programs to enhance health outcomes among the adolescents.

4. Discussion

The current research has shown that pediatric health promotion programs in schools can significantly enhance the participation in physical activity and preventive lifestyle knowledge, among adolescents. After 12-week intervention was implemented, it was successful with significant changes in the engagement in physical activities, sports

engagement, and the involvement of healthy lifestyle behaviors. The percentage of teenagers who could be categorized as highly physically active rose to 40.0% and that of low physical activity dropped to 18.0%. Likewise, outcomes of preventive lifestyle education also improved significantly with the total knowledge score upgraded to 4.18 ± 0.61 after intervention as compared to the level of 2.94 ± 0.73 prior to the intervention. The results of these studies suggest that school-based health promotion programs that are organized can offer an efficient instrument to promote healthier behaviors among adolescents, who are in a critical development period where most lifestyles with regard to health are shaped. The identified gains imply that the combination of the promotion of physical activities with the prevention-oriented health education may yield significant behavioral and educational advantages in the school-aged population groups.

The results also emphasize the importance of educational establishments in enhancing the health and well-being of teenagers. Schools offer a special opportunity whereby health promotion programs can be carried out in a systematic manner, reaching out to large populations of adolescents in terms of organized programs, classroom-based interventions, extra-curricular activities and conducive social conditions. The enormous growth in the regular sport participation rates by 39.0% to 71.5% is a sign of the success of school opportunities promoting active lifestyles. Moreover, student satisfaction (77.0%) and engagement (74.0%) are quite high, which indicates that adolescents reacted favourably to the intervention. Engagement and affirmative attitudes towards program activities can help to retain health information more and to be more willing to address as recommended practices. These results highlight the importance of school-based interventions being more than just knowledge dissemination, involving practical activities, peer engagement, and motivational techniques that promote long-term engagement and behavior change.

The other significant finding of this study was that there was a strong relationship between positive health outcomes on one hand and program participation on the other hand. Strong positive correlations were observed between program exposure and improvement in physical activity ($r = 0.62$, $p < 0.001$), program participation and improving lifestyle knowledge ($r = 0.67$, $p < 0.001$). Further multiple regression analysis showed that exposure to health education, student involvement, school support, and family encouragement were all important predictors of healthy lifestyle adoption with the combination of these variables accounting 58.0% of the variation in healthy behaviours. These findings indicate that there are various interrelated factors affecting adolescent health promotion as opposed to one component of the interventions. Education material or content alone might not be adequate to create long term behavioral changes unless it has positive school climates, active student participation and family support. Therefore, the programs of health promotion that include educators, healthcare professionals, parents, and community stakeholders can be more productive in attaining sustainable changes in the health outcomes among adolescents.

Even though the research came up with promising results, there are a number of strengths and weaknesses that need to be factored in. The first strength is the fact that a relatively big sample of 200 adolescents (both urban and semi-urban schools) was included that increased the representativity of the results. The research also assessed various facets of health promotion among adolescents, such as their involvement in physical activities, knowledge of lifestyle, student involvement, and behaviorial outcomes that gave a holistic view of the program effectiveness. Nevertheless, there are some drawbacks that are to be admitted. Self-reported questionnaires could have also resulted in the introduction of recall bias and social desirability bias that could have influenced the accuracy of the answers. Moreover, the cross-sectional analytical design does not allow to determine the causal relationships between exposure to the interventions and the outcomes observed. The research was also carried out in a small geographical region and this could limit the extrapolation of the results to other groups. Future studies need to invest more in longitudinal or experimental research, objective physical activity measurements, and assessments of long-term behavioral changes to further develop the body of the evidence on the role of school-based pediatric health promotion programs.

5. Conclusion

The study illustrates that school-based pediatric health promotion strategies are effective in promoting physical activity, prevention of poor lifestyle knowledge, and healthy behavioral adoption among the adolescents. Participation in the program had a positive correlation with the enhancement of exercise engagement, health awareness and healthier lifestyle practices. Enhancing school-based health promotion programs can help in long-term adolescent

well-being and preventive measures of chronic illnesses. Studies conducted in the future must use the longitudinal design, and objective health measures to assess program effects in the long term.

Research Ethics

The Institutional Research Ethics Committee provided ethical approval before the start of the study. Informed consent was obtained via a written consent form by parents/guardians and assent by all adolescent participants. Participant information was kept confidential and anonymous during the study and all data were utilized solely in research.

Research Contribution

Conceptualization of study, data collection and statistical analysis, interpretation of findings, preparation and final approval of manuscript were done by all the authors. The research provides practical evidence about the potential of school-based pediatric health promotion interventions to enhance physical activity and preventive lifestyle education participation in adolescents.

References

1. Alalawi, Abdullah, Lindsay Blank, and Elizabeth Goyder. "Umbrella review of international evidence for the effectiveness of school-based physical activity interventions." PloS one 19.6 (2024): e0304513.
2. Aubert, Salomé, et al. "Global matrix 4.0 physical activity report card grades for children and adolescents: results and analyses from 57 countries." Journal of Physical Activity and Health 19.11 (2022): 700-728.
3. Bull, Fiona C., et al. "World Health Organization 2020 guidelines on physical activity and sedentary behaviour." British journal of sports medicine 54.24 (2020): 1451-1462.
4. Contardo Ayala, Ana María, et al. "Effectiveness of intervention strategies to increase adolescents' physical activity and reduce sedentary time in secondary school settings, including factors related to implementation: a systematic review and meta-analysis." Sports medicine-open 10.1 (2024): 25.
5. Daly-Smith, Andy, et al. "Using a multi-stakeholder experience-based design process to co-develop the Creating Active Schools Framework." International Journal of Behavioral Nutrition and Physical Activity 17.1 (2020): 13.
6. Ekelund, Ulf, et al. "Dose-response associations between accelerometry measured physical activity and sedentary time and all-cause mortality: systematic review and harmonised meta-analysis." bmj 366 (2019).
7. Guo, Liangru, Hengwang He, and Chaochao Wang. "Are school-based behavioural interventions an effective strategy for improving physical activity and sedentary behaviour in children and adolescents? A meta-analysis." Frontiers in Pediatrics 13 (2025): 1532035.
8. Guthold, Regina, et al. "Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1· 6 million participants." The lancet child & adolescent health 4.1 (2020): 23-35.
9. Hallal, Pedro C., et al. "Global physical activity levels: surveillance progress, pitfalls, and prospects." The lancet 380.9838 (2012): 247-257.
10. Lubans, David, et al. "Physical activity for cognitive and mental health in youth: a systematic review of mechanisms." Pediatrics 138.3 (2016): e20161642.
11. Motevalli, Mohamad, et al. "Integrating lifestyle behaviors in school education: a proactive approach to preventive medicine." Preventive Medicine Reports 51 (2025): 102999.
12. Owen, Katherine B., et al. "Self-determined motivation and physical activity in children and adolescents: A systematic review and meta-analysis." Preventive medicine 67 (2014): 270-279.
13. Patton, George C., et al. "Our future: a Lancet commission on adolescent health and wellbeing." The Lancet 387.10036 (2016): 2423-2478.
14. Van Sluijs, Esther MF, et al. "Physical activity behaviours in adolescence: current evidence and opportunities for intervention." The Lancet 398.10298 (2021): 429-442.
15. Watson, Amanda, et al. "Effect of classroom-based physical activity interventions on academic and physical activity outcomes: a systematic review and meta-analysis." International Journal of Behavioral Nutrition and Physical Activity 14.1 (2017): 114.
16. A.Velliangiri and Chuong Vana, "Secure Runtime Reconfiguration Framework for FPGA-Based Embedded Systems in Mission-Critical Applications", SCCTS Journal of Embedded Systems Design and Applications , vol. 3, no. 2, pp. 36–47, Oct. 2025,

17. Namrata Mishra and Aakansha Soy, “Energy-Efficient Beamforming in mmWave MIMO Systems Using Deep Reinforcement Learning: A Framework for Real-Time Adaptive Optimization”, Progress in Electronics and Communication Engineering, vol. 3, no. 1, pp. 12–17, Oct. 2025,
18. Rajeswari, P., & Chandra, T. S. (2022). Partitioning of VLSI circuits on the basis of standard genetic algorithm and comparative analysis of partitioning algorithms. SSRG International Journal of Electrical and Electronics Engineering, 9(12), 126-133.
19. Periyasamy, R., Sasi, S., Malagi, V. P., Shivaswamy, R., Chikkaiah, J., & Pathak, R. K. (2025). Artificial intelligence assisted photonic bio sensing for rapid bacterial diseases. Zeitschrift für Naturforschung A, 80(8), 665-671.