

Effects of Group Exercise Training on Self-Esteem, Body Image, and Health-Related Physical Fitness in Physically Inactive Adolescents

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Article Info	Abstract
Article type: Research Article Article history: Received 10 January 2026 Received in revised form 19 March 2026 Accepted 02 April 2026 Available online 29 June 2026 Keywords: Adolescent, Exercise Therapy, Self-Concept, Body Image, Physical Fitness.	Introduction: Physical inactivity during adolescence is associated with reduced physical fitness and poorer psychosocial well-being, including low self-esteem (SE) and negative body image (BI). School-based group exercise programs may offer a practical approach to improving both psychological and physical health in this population. Objective: To examine the effects of a 12-week school-based group exercise training program on SE, BI, and health-related physical fitness (HRPF) in physically inactive adolescents. Method: In this two-arm randomized controlled trial, physically inactive adolescents aged 13–15 years were randomized to Group Exercise Training (GET) or Control (CON). GET participated in supervised group exercise sessions 3 times/week for 12 weeks (~60 min/session), including aerobic activities, functional bodyweight circuit exercises, and cool-down stretching. Outcomes assessed at baseline and post-intervention. Intervention effects were evaluated using ANCOVA. Results: Compared with CON, GET demonstrated significantly higher post-intervention SE ($p=0.002$) and improved BI ($p=0.001$). GET also showed superior improvements in PACER performance ($p<0.001$), curl-up ($p<0.001$), push-up ($p<0.001$), and sit-and-reach ($p=0.004$). Conclusions: School-based group exercise program significantly improved SE, BI, and HRPF in physically inactive adolescents. Group exercise delivered in schools may be an effective and scalable strategy for adolescent health promotion. Cite this Article: Eskandarnejad, M. (2026). Effects of Group Exercise Training on Self-Esteem, Body Image, and Health-Related Physical Fitness in Physically Inactive Adolescents. <i>Physical Activity in Children</i>, 3(1), 49-56. https://doi.org/10.22034/pach.2026.586472.1089

1. Introduction

Adolescence represents a formative stage of development during which substantial changes occur across physical, psychological, and social domains (1). During these years, young people experience substantial shifts in body composition, physical competence, peer relationships, and self-perception, all of which can influence psychological well-being (2). Among the psychosocial constructs that become especially important during adolescence, self-esteem (SE) and body image (BI) have received considerable attention because of their strong associations with mental health, social functioning, and health-related behaviors. Low SE has been linked to depressive symptoms, social withdrawal, reduced motivation, and poorer quality of life, whereas negative BI is associated with body dissatisfaction, unhealthy weight-control behaviors, emotional distress, and reduced participation in physical activity (PA) (3). Because these issues often emerge or intensify during early and middle adolescence, identifying practical strategies to support both psychological and physical health is an important goal in pediatric and adolescent research.

One factor that may contribute to poor psychosocial outcomes in youth is physical inactivity (4-7). Despite well-established recommendations encouraging regular PA, many adolescents do not meet

the suggested daily activity levels (8,9). Physically inactive adolescents are at increased risk not only for unfavorable physical health outcomes, such as lower cardiorespiratory fitness, reduced muscular endurance, and excess adiposity, but also for poorer psychosocial well-being (10). Low PA participation may reduce opportunities for mastery, social interaction, and positive physical self-evaluations, all of which are relevant to SE development (11). In addition, physically inactive youth may be more vulnerable to body dissatisfaction due to lower physical competence, less positive engagement with their bodies, and fewer experiences of supportive movement environments (8,12).

Exercise has been widely studied as a means of improving physical health in young people, but its psychological effects are also increasingly recognized. Several theoretical frameworks provide a rationale for these psychosocial benefits. According to Self-Determination Theory (SDT), exercise environments that support psychological needs promote intrinsic motivation and psychological well-being (13,14). Likewise, Competence Motivation Theory (CMT) proposes that successful movement experiences enhance perceived competence, which in turn strengthens SE and encourages continued participation in PA (13-15). Participation in regular exercise may enhance SE through several pathways.



First, participation in exercise strengthens perceived physical competence and functional capacity, thereby fostering more positive self-appraisals (13,14). Second, exercise can promote social connectedness, especially when delivered in a group setting, where adolescents have opportunities for encouragement, shared goals, and positive peer interaction (15,16). Third, repeated participation in structured exercise may strengthen feelings of mastery, autonomy, and achievement, thereby reinforcing general and physical self-worth (17,18). Regarding BI, exercise may improve satisfaction not only by changing body composition or fitness but also by shifting attention toward body function, strength, and capability rather than appearance alone (19,20).

The group-based format of exercise may be particularly advantageous when psychosocial outcomes are targeted because it provides opportunities for social support, peer acceptance, and positive interpersonal experiences that extend beyond the physiological effects of exercise alone. Group exercise can create a socially supportive climate that encourages participation, reduces isolation, and increases enjoyment (21,22). For adolescents, who are especially sensitive to peer influence and social belonging, the group environment may be a powerful contributor to engagement and psychological benefit (23). When appropriately supervised, group exercise can provide structured opportunities for cooperation, positive feedback, and normalization of differing skill levels (24). These elements may be especially beneficial for physically inactive adolescents, who may feel less confident entering traditional competitive sports or performance-oriented exercise settings. Thus, a school-based group exercise intervention may represent a feasible and inclusive strategy for improving both mental and physical health.

With respect to physical health, maintaining regular exercise throughout adolescence can enhance key dimensions of health-related physical fitness (HRPF), particularly cardiorespiratory endurance, muscular endurance, and flexibility (25-27). These dimensions of fitness extend beyond their relevance to sports performance, contributing to everyday physical functioning, overall health, and the prevention of chronic diseases over the life course. Among them, cardiorespiratory fitness is particularly important, as it serves as a robust indicator of both present and subsequent cardiometabolic health in young people (28). Muscular fitness is associated with functional movement capacity, injury prevention, and metabolic health, while flexibility contributes to movement quality and physical comfort (29). Because physically inactive adolescents often display reduced fitness across multiple domains, multicomponent group exercise may offer broad benefits. Although improvements in HRPF and psychosocial well-being frequently occur together, the mechanisms linking these outcomes remain incompletely understood, and psychological benefits may arise through multiple interacting physiological, behavioral, and social pathways.

Schools are an ideal setting for implementing exercise interventions in adolescents because they offer accessibility, familiar infrastructure, and the potential to reach a broad range of students regardless of socioeconomic background (30). A school-based

approach also reduces barriers related to transport, cost, and scheduling, which commonly limit participation in community programs. In addition, school-based interventions can be delivered in a standardized way and integrated into the weekly routine, increasing feasibility and adherence (31). For physically inactive adolescents, a well-designed school-based group exercise program may therefore serve as a practical model for improving both psychological well-being and HRPF.

Although previous research suggests that exercise can positively influence SE, BI, and HRPF in youth (10,11,21,22), several important gaps remain. First, relatively few randomized controlled trials have specifically targeted physically inactive adolescents, a population at particularly high risk for both poor HRPF and diminished psychosocial well-being. Second, although school-based exercise interventions are increasingly common, the independent contribution of supervised group exercise to psychological outcomes remains insufficiently investigated. Third, most previous studies have focused primarily on either psychosocial variables or HRPF outcomes, whereas comparatively few have evaluated both domains simultaneously within the same intervention. Finally, despite theoretical models suggesting that supportive exercise environments may enhance SE and BI through increased competence, autonomy, and social connectedness, empirical evidence integrating these theoretical perspectives in school-based interventions remains limited. Therefore, the aim of the present study was to investigate the effects of a 12-week school-based group exercise training program on SE, BI, and HRPF in physically inactive adolescents. It was hypothesized that adolescents in the exercise group would demonstrate significant improvements in SE, BI, and HRPF compared with the control group after 12 weeks.

2. Methods

2.1. Study Design

This study was designed as a two-arm parallel randomized controlled trial.

2.2. Participants

Participants were boys and girls aged 13-15 years recruited from local schools. Physical inactivity was defined as not meeting recommended levels of PA and not participating in any structured exercise or organized sports program during the previous 3 months, based on screening questionnaire responses. Inclusion criteria were aged 13-15 years, physically inactive at baseline, able to participate in school-based exercise sessions, and provided written assent. Exclusion criteria included having any medical or orthopedic condition that precluded safe participation in exercise, current enrollment in a structured sport or exercise program, having a diagnosed condition likely to substantially influence participation or test performance, and absence during baseline testing or inability to commit to the intervention schedule.

An a priori sample size calculation was performed using G*Power software (version 3.1). Assuming a moderate effect size ($f = 0.25$), an alpha level of 0.05, statistical power of 80%, and two groups with repeated measurements, the minimum required sample size

was estimated to be 40 participants. To account for an anticipated attrition rate of approximately 15%, the target recruitment was increased to 48 participants.

Participants were randomly allocated to GET or CON using a computer-generated random sequence created by an independent researcher who was not involved in participant recruitment, assessment, or intervention delivery. Participant enrollment was conducted by the principal investigator, whereas group assignment was implemented by a separate researcher using sequentially numbered, opaque, sealed envelopes to ensure allocation concealment. Because of the nature of the intervention, participants and exercise instructors could not be blinded to group assignment. However, outcome assessors were blinded to allocation during post-intervention testing whenever feasible.

2.3. Intervention

2.3.1. Group Exercise Training (GET)

Intervention participants completed a supervised, school-based group exercise program over 12 weeks, with three 60-minute sessions scheduled each week. Sessions were conducted in the school gymnasium or a similar indoor activity space and were led by qualified exercise staff. Each intervention session followed a four-part structure. It began with a 10-minute warm-up incorporating light aerobic movements, mobility work, and dynamic stretching. This was followed by a 20–25-minute aerobic and group-activity phase that included rhythmic exercises, relay activities, low-impact games, and group aerobic drills. The third component consisted of a 15–20-minute functional bodyweight circuit involving exercises such as squats, lunges, push-ups, sit-ups, planks, jumping jacks, step-based movements, and partner activities. Sessions concluded with a 5–10-minute cool-down involving low-intensity movements and stretching. The intervention was designed to emphasize participation, enjoyment, positive peer interaction, and progressive overload rather than competition. Exercise intensity was monitored using the Children's OMNI Rating of Perceived Exertion (RPE) scale, with a target intensity of 5–8 (i.e., moderate-to-vigorous intensity) throughout the intervention. The average achieved session RPE across the intervention was approximately 6.7 ± 0.8 , indicating that the intended exercise intensity was successfully maintained. Progression across the 12-week intervention was achieved by increasing movement duration, number of rounds, coordination complexity, and overall exercise challenge. Attendance was recorded at each session, and any adverse events were documented throughout the study. All exercise sessions were delivered by the same certified exercise instructor with experience in youth PA programs. A standardized intervention manual was used throughout the study, and the instructor followed identical exercise protocols to ensure consistency across sessions. Regular supervision meetings were conducted during the intervention to monitor protocol adherence and intervention fidelity.

2.3.2. Control Group

Participants in the CON group maintained their regular daily routines throughout the study period and were not exposed to any organized or supervised exercise intervention. They continued their regular school routines and were asked not to begin any new

organized PA program during the study. To minimize contamination, participants were contacted every two weeks and asked whether they had initiated any structured exercise or sports participation outside their usual activities. No participant reported commencing a regular exercise program during the intervention period.

2.4. Measurements

2.4.1. Self-esteem

Global SE was assessed using the Rosenberg Self-Esteem Scale (RSES) (32). This widely used self-report instrument includes 10 items rated on a Likert scale, with higher scores indicating more positive SE. A validated local-language version of the RSES was administered. In the present sample, internal consistency was excellent (Cronbach's $\alpha = 0.89$).

2.4.2. Body image

BI concerns were assessed using the Body Shape Questionnaire (BSQ) (33). The BSQ evaluates concerns related to body shape and body dissatisfaction, with higher scores indicating greater BI disturbance. A validated local-language version of the BSQ was used, and internal consistency in the present study was high (Cronbach's $\alpha = 0.93$).

2.4.3. Anthropometric Variables

Height was measured to the nearest 0.1 cm using a portable stadiometer, and body mass was measured to the nearest 0.1 kg using a calibrated digital scale with participants wearing light clothing and no shoes. Body mass index (BMI) was calculated as body mass divided by height squared (kg/m^2).

2.4.4. Health-related physical fitness

HRPF was assessed using a field-based test battery appropriate for adolescents. Cardiorespiratory fitness was evaluated using the Progressive Aerobic Cardiovascular Endurance Run (PACER) test. Muscular endurance was assessed using the curl-up and push-up tests, and flexibility was measured with the sit-and-reach test. Standardized instructions were provided before each assessment, and the same testing procedures were applied at baseline and post-intervention.

2.5 Statistical Analysis

Statistical analyses were conducted in SPSS, version 27 (IBM Corp., Armonk, NY, USA), using a two-sided significance level of .05. Continuous variables are reported as mean $\pm$ standard deviation (SD). The Shapiro-Wilk test was applied to examine the normality of the data distribution. To evaluate baseline comparability, independent-samples *t* tests were used for continuous characteristics, whereas categorical variables were compared using chi-square tests. The primary analyses were conducted according to a per-protocol framework and included only participants who completed assessments at both baseline and post-intervention. Intervention-related differences were examined using analysis of covariance (ANCOVA). In these models, post-intervention scores served as the dependent variables, intervention group was entered as the fixed between-subjects factor, and the corresponding baseline scores were included as covariates. The magnitude of group effects was quantified using partial eta-squared (η^2). For the primary psychosocial outcomes, adjusted between-

group mean differences and their associated 95% confidence intervals were additionally estimated to provide a clearer interpretation of the intervention effects.

3. Results

3.1. Participant Flow and Adherence

A total of 79 adolescents were assessed for eligibility. Of these, 48 met the inclusion criteria and were randomly assigned to either the GET group ($n=24$) or the CON group ($n=24$). During the intervention, 4 participants withdrew from the study: 2 from GET (one due to repeated school absence and one due to loss of

interest) and 2 from CON (one due to relocation and one due to incomplete post-testing). Therefore, a total of 44 participants completed all study procedures and were retained for the final analysis, with 22 participants in the GET group and 22 in the CON group. Mean attendance in the GET group was 88.6% (31.9 ± 2.7 of 36 sessions completed). Attendance exceeded 80% in 19 of the 22 participants (86.4%), indicating excellent adherence to the intervention protocol. No exercise-related injuries or serious adverse events were reported (Figure 1). Baseline characteristics did not differ significantly between participants who completed the study ($n = 44$) and those who withdrew ($n = 4$) for age, sex distribution, BMI, SE, BI, or HRPF (all $p > 0.05$), suggesting a low risk of attrition bias.

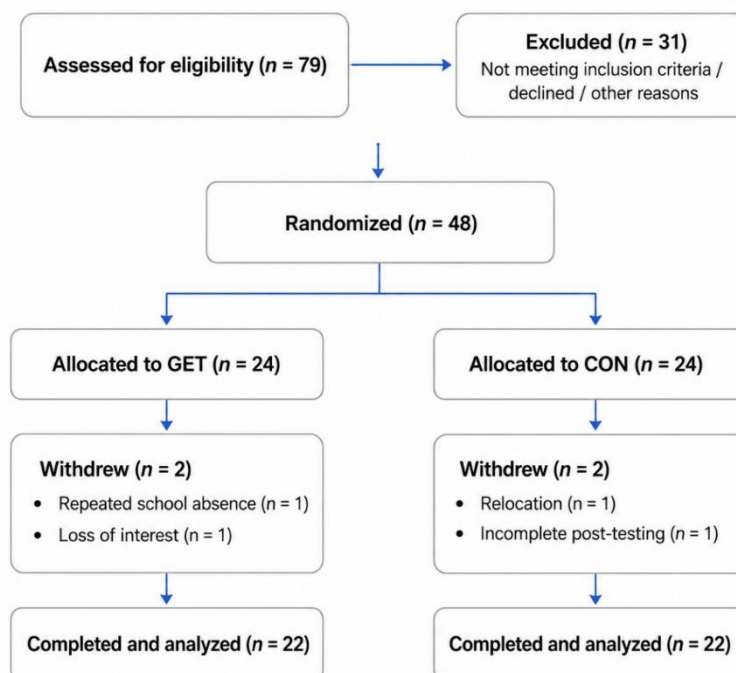


Figure 1. The Flow of Participants.

3.2. Baseline Characteristics

Baseline comparisons revealed no statistically significant between-group differences across the variables presented in Table 1 (all $p > 0.05$), supporting the comparability of the groups following

randomization. After the intervention, the GET group showed modest reductions in body mass and BMI relative to the CON group; however, neither difference remained statistically significant after adjustment for baseline values (both $p > 0.05$).

Table 1. Baseline Characteristics of Participants.

Variable	GET (n = 22)	CON (n = 22)	p
Age (Years)	14.1 $\pm$ 0.8	14.0 $\pm$ 0.7	0.68
Boys/Girls (n)	11 / 11	10 / 12	0.76
Height (cm)	160.8 $\pm$ 8.7	161.5 $\pm$ 8.4	0.79
Body mass (kg)	56.9 $\pm$ 9.8	57.6 $\pm$ 10.1	0.82
BMI (kg/m ²)	22.0 $\pm$ 2.9	22.1 $\pm$ 3.0	0.91
RSES Score	19.8 $\pm$ 3.7	20.1 $\pm$ 3.5	0.77
BSQ Score	82.6 $\pm$ 18.4	80.9 $\pm$ 17.9	0.75
PACER laps	24.7 $\pm$ 7.1	25.3 $\pm$ 7.5	0.79
Curl-up (Repetitions)	20.8 $\pm$ 5.9	21.1 $\pm$ 6.1	0.88
Push-up (Repetitions)	10.6 $\pm$ 3.8	10.9 $\pm$ 4.0	0.81
Sit-and-Reach (cm)	22.9 $\pm$ 5.6	23.2 $\pm$ 5.4	0.86

3.3. Psychological Outcomes

The post-intervention analysis indicated a significant between-group effect for SE ($F_{1,41}=11.02$,

$p=0.002$, $\eta^2=0.21$) and BI ($F_{1,41}=12.98$, $p=0.001$, $\eta^2=0.24$) (Table 2; Figure 2).

Table 2. Changes in Psychological Outcomes.

Variable	GET-Pre	GET-Post	CON-Pre	CON-Post	Adjusted Mean Difference (95% CI)	p	η^2
RSES	19.8±3.7	23.1±3.4	20.1±3.5	20.4±3.6	2.71 (1.10 to 4.32)	0.002	0.21
BSQ	82.6±18.4	70.3±15.9	80.9±17.9	79.5±17.3	-10.6 (-16.9 to -4.3)	0.001	0.24

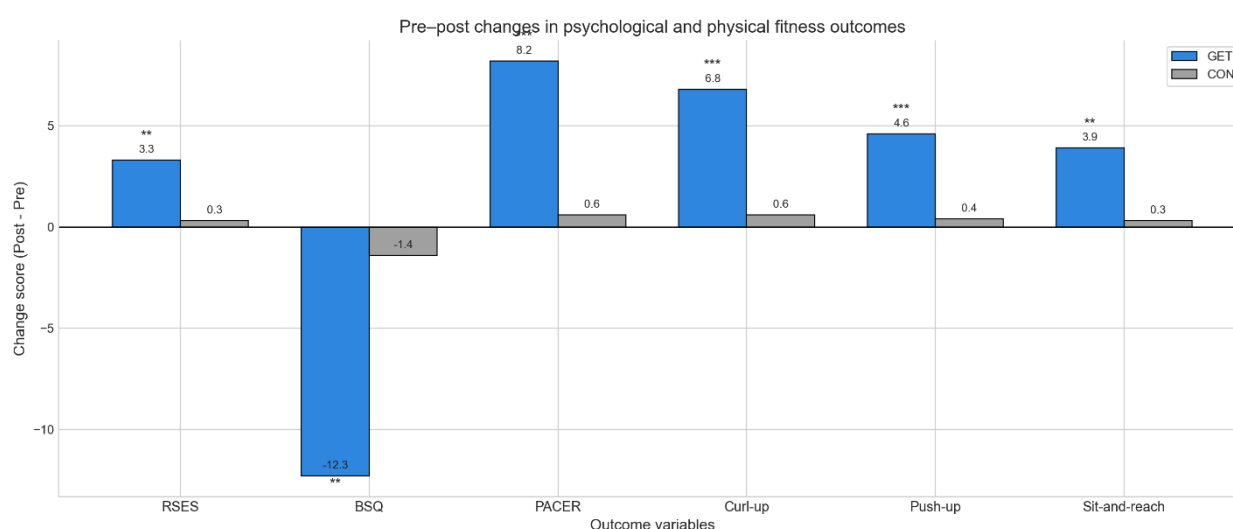
3.4. Health-Related Physical Fitness Outcomes

Significant post-intervention group effects were observed for all four HRPF outcomes (all $p < 0.05$). Overall, the pattern of results favored the GET group for cardiorespiratory fitness, muscular endurance, and flexibility (Table 3; Figure 2). Specifically, PACER performance demonstrated a significant between-group difference at post-intervention ($F_{1,41} = 15.93$, $p < 0.001$, $\eta^2 = 0.33$). Significant group effects were also

found for both measures of muscular endurance. Curl-up performance improved markedly in the GET group, whereas the CON group exhibited only a slight change ($F_{1,41} = 14.48$, $p < 0.001$, $\eta^2 = 0.30$). Likewise, push-up performance increased substantially in the GET group, while the CON group remained relatively stable ($F_{1,41} = 14.18$, $p < 0.001$, $\eta^2 = 0.29$). In addition, flexibility, assessed using the sit-and-reach test, showed a significant post-intervention group effect ($F_{1,41} = 9.06$, $p = 0.004$, $\eta^2 = 0.18$).

Table 3. Changes in Health-Related Physical Fitness Outcomes.

Variable	GET-Pre	GET-Post	CON-Pre	CON-Post	Adjusted Mean Difference (95% CI)	p	η^2
PACER	24.7±7.1	32.9±7.8	25.3±7.5	25.9±7.4	7.6 (4.9 to 10.2)	<0.001	0.33
Curl-up	20.8±5.9	27.6±6.1	21.1±6.1	21.7±6.0	6.1 (3.9 to 8.2)	<0.001	0.30
Push-up	10.6±3.8	15.2±4.1	10.9±4.0	11.3±4.1	4.1 (2.5 to 5.8)	<0.001	0.29
Sit-and-Reach	22.9±5.6	26.8±5.4	23.2±5.4	23.5±5.3	3.3 (1.3 to 5.2)	0.004	0.18

**Figure 2.** Intervention-Induced Changes in Study Variables. Data are Presented as Mean ± SD. Error Bars Represent Standard Deviations.

4. Discussion

The present randomized controlled trial examined the effects of a 12-week school-based group exercise training program on SE, BI, and HRPF in physically inactive adolescents. The main finding was that participants assigned to the exercise intervention demonstrated significant improvements in both psychological and physical outcomes compared with the CON group. The findings support the hypothesis that a structured group exercise program can provide multidimensional benefits for inactive adolescents and suggest that school-based delivery may be an effective and practical approach for promoting both mental and physical health.

One of the most important findings of the study was the improvement in SE observed in the exercise group. Adolescence is a developmental stage in which SE can be particularly sensitive to social comparison, physical changes, and academic or peer-related pressures (34). Physically inactive adolescents may be especially vulnerable to lower SE because they often have fewer opportunities to experience physical

competence, achievement, and positive reinforcement through movement-related activities (10-12). The increase in SE scores following the intervention suggests that participation in regular, supervised group exercise can positively influence how adolescents evaluate themselves more broadly. This effect is likely multifactorial. Repeated successful participation in exercise sessions may enhance feelings of mastery and competence, while the structured nature of the program may help adolescents develop confidence in their ability to complete physical tasks that initially seemed challenging (15). In addition, the group format may foster social inclusion, encouragement, and a sense of belonging, all of which are known to contribute to positive self-worth during adolescence.

The observed improvement in BI is similarly meaningful. BI concerns often intensify during adolescence as body awareness increases and appearance-related social pressures become more pronounced (35). Negative BI can discourage PA participation, creating a cycle in which adolescents become less active, less physically confident, and more

dissatisfied with their bodies (36). In the present study, BI scores decreased significantly in the intervention group, indicating reduced body-related concern after 12 weeks of training. This improvement may reflect several underlying mechanisms. First, participation in exercise may shift adolescents' perceptions of the body from an object evaluated mainly on appearance to one appreciated for its function, strength, and capability (37). Second, improvements in HRPF may enhance physical self-perception and reduce dissatisfaction (38). Third, the supportive non-competitive group environment used in this study may have reduced fear of judgment and promoted more positive body-related experiences (2). Taken together, these factors may explain why adolescents in the exercise group reported more favorable BI at the end of the intervention.

HRPF findings also deserve emphasis. Significant improvements were observed in cardiorespiratory fitness, muscular endurance, and flexibility, demonstrating that the intervention was not only psychologically beneficial but also physiologically effective. The increase in PACER performance suggests enhanced aerobic fitness, an important marker of cardiovascular and metabolic health in youth. Improvements in curl-up and push-up performance indicate gains in muscular endurance, while the increase in sit-and-reach scores suggests better flexibility (39). These findings are consistent with the structure of the intervention, which incorporated aerobic activities, bodyweight circuit exercises, and stretching within each session (25-29). Because the program was performed three times per week over 12 weeks, the frequency and duration were sufficient to induce broad improvements across multiple fitness domains. This is important from a public health perspective, as physically inactive adolescents often present with low HRPF levels that may track into adulthood if not addressed.

An important strength of the present findings is that improvements in psychological well-being and HRPF were observed concurrently. Although these outcomes changed in the same direction, the present study did not examine whether improvements in HRPF mediated the observed changes in SE or BI. Therefore, it cannot be concluded that the HRPF gains directly caused the psychosocial improvements. Rather, both sets of outcomes may have resulted from common features of the intervention, including regular exercise participation, supportive peer interaction, progressive mastery experiences, and increased engagement in PA. Future studies employing mediation analyses are needed to clarify the relationships among these variables.

The group-based nature of the intervention may have been especially important for the outcomes observed. Adolescents are strongly influenced by their social environment, and group exercise provides a setting in which movement is experienced collectively rather than individually. When delivered in a supportive and non-judgmental manner, this format may reduce barriers commonly experienced by inactive youth, such as fear of embarrassment, low confidence, or discomfort in more competitive sports settings. Group sessions may also enhance enjoyment, accountability, and peer encouragement, all of which can promote sustained participation. The high adherence observed in the present study (88.6%

attendance) represents one of the notable strengths of the intervention and suggests that supervised group exercise is both feasible and acceptable for physically inactive adolescents. Although the present study was not designed to examine dose-response relationships, it is possible that consistently attending the exercise sessions contributed to the favorable psychological and physical outcomes. Future studies should investigate whether greater attendance predicts larger improvements in health outcomes. The school setting likely further contributed to adherence by minimizing logistical barriers such as transportation and scheduling constraints. These practical advantages strengthen the relevance of the intervention for real-world implementation.

The present findings are consistent with previous literature suggesting that regular PA can improve psychological well-being and HRPF in young people (10,11,25,27). However, this study extends existing evidence in several ways. First, it focused specifically on physically inactive adolescents, a group that may derive substantial benefit from structured and supportive exercise opportunities. Second, it examined both psychological outcomes and HRPF outcomes within the same randomized design, allowing a more comprehensive understanding of intervention effects. Third, the intervention was designed to be school-based and feasible, which increases its translational value for educators, health professionals, and policymakers seeking scalable youth health strategies. These features make the findings especially relevant to prevention-oriented adolescent health promotion.

Several mechanisms may help explain the benefits observed. From a psychological perspective, exercise may improve mood, reduce stress, and enhance self-perceived competence. Social interaction during group sessions may support relatedness and belonging, while progressive challenge may increase mastery experiences. From a physiological perspective, regular aerobic and bodyweight activity likely improved movement efficiency, endurance, and overall conditioning. These changes may have contributed indirectly to more positive body evaluations and greater confidence in physical performance. Although the present study was not designed to test mediators, the pattern of results suggests that both psychosocial and physiological pathways likely contributed to the overall effect of the intervention.

These findings may also be interpreted within established motivational frameworks. According to SDT, supportive group exercise environments can satisfy adolescents' psychological needs, thereby promoting more positive self-evaluations and sustained participation in PA (13,14). Similarly, CMT suggests that repeated successful movement experiences and positive feedback enhance perceptions of competence, which may contribute to improvements in SE and BI (14,15). Although these theoretical mechanisms were not directly measured in the present study, they provide a plausible framework for interpreting the observed psychosocial benefits.

From a practical perspective, implementing similar programs within routine school settings may require consideration of staff availability, scheduling, facility access, and financial resources. Nevertheless, because the intervention relied primarily on bodyweight exercises, simple equipment, and existing school

facilities, it may represent a relatively practical and scalable approach for school-based health promotion. Future implementation studies should evaluate these real-world considerations across different educational settings.

Despite these strengths, several limitations should be acknowledged. First, the sample size was relatively modest, which may limit the generalizability of the findings. Second, the intervention lasted only 12 weeks, and no follow-up assessments were performed; therefore, the long-term sustainability of the observed improvements remains unknown. Third, SE and BI were assessed using self-report questionnaires and may have been influenced by response bias or social desirability. Fourth, pubertal maturation was not assessed. Because biological maturation may influence SE, BI, HRPF, and responsiveness to exercise during adolescence, this factor could have acted as an unmeasured confounder. Fifth, PA performed outside the intervention was not objectively monitored in either group, making it impossible to completely exclude differences in habitual activity during the study period. Sixth, although anthropometric variables were measured at baseline, post-intervention anthropometric outcomes were not included in the present analysis, limiting interpretation of whether psychosocial improvements occurred alongside measurable physical changes. Finally, participants were recruited from schools within a limited geographic area and represented physically inactive adolescents aged 13–15 years; therefore, caution is warranted when generalizing these findings to other age groups or populations.

Future research should determine whether the observed psychological and physical benefits are maintained over medium- and long-term follow-up. Studies should also investigate potential mediating mechanisms, including exercise enjoyment, physical self-concept, perceived competence, social connectedness, and autonomous motivation. Examining dose-response relationships between intervention attendance and health outcomes, as well as comparing group-based exercise with individual or sport-specific interventions, would further clarify the most effective approaches for promoting adolescent health.

4.1. Conclusion

This study demonstrated that a 12-week school-based group exercise training program performed three times per week significantly improved SE, BI, and HRPF in physically inactive adolescents. The high attendance rate and absence of serious adverse events further suggest that supervised group exercise is a feasible and acceptable strategy for school-based health promotion. Although the intervention produced favorable psychosocial outcomes, these findings should be interpreted specifically in relation to SE and BI rather than broader mental health. Overall, incorporating structured group exercise into school settings may represent a practical approach for promoting both psychological well-being and HRPF among physically inactive adolescents.

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statistical analysis, interpretation of the results, and writing and revision of the manuscript.

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Declaration of Generative AI and AI-Assisted Technologies in the Writing Process: The author declares that no generative artificial intelligence or AI-assisted technology was used in the preparation, writing, editing, or revision of this manuscript. The author takes full responsibility for the accuracy, originality, integrity, and overall content of the published work.

Ethical Considerations: Ethical approval for this study was obtained from the relevant institutional ethics committee (Approval Code: IR.TABRIZU.REC.1402.153). The research was conducted in accordance with the ethical principles of the Declaration of Helsinki, and written informed consent was obtained from the parents or legal guardians of the participating adolescents before enrollment. The adolescents were informed about the study procedures in an age-appropriate manner, and their voluntary participation was ensured throughout the study.

Data Availability: The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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Conflicts of Interest: The author declares that there are no financial, personal, or professional conflicts of interest related to this study.

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