Game Nexus, Vol. 2 No. 3 (2025): 1-8

Effects of a 12-Week High-Intensity Interval Training Program on Body Fat Percentage and Lean Body Mass in Boys Aged 10–12 Years

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Article type:
Original Research

Article history:
Received 13 May 2025
Revised 09 Aug 2025
Accepted 15 Aug 2025
Published online 1 Oct 2025

How to cite this article:
Omidi Ghanbari, R., Dadashi, F., Khezri, A., & Abedini, N. (2025). Effects of a 12-week high-intensity interval training program on body fat percentage and lean body mass in boys aged 10–12 years. Game Nexus, 2(3), 1–8. https://doi.org/10.61838/gamenexus.37

ABSTRACT

A 12-week high-intensity interval training (HIIT) program appears to be an effective and practical strategy for improving body composition in boys aged 10–12 years. Based strictly on the results reported in the source study, 20 boys were randomly assigned to either a HIIT group or a control group, and baseline comparisons showed no significant differences between groups in age, height, weight, or body mass index, supporting the comparability of the sample before the intervention. The HIIT program was performed three times per week for 12 weeks, with each session lasting about 40 minutes and including warm-up, repeated exercise bouts with active recovery, and cool-down. After the intervention, the HIIT group showed a statistically significant reduction in body fat percentage compared with the control group ($p = 0.029$), while lean body mass increased significantly in the HIIT group relative to the control group ($p = 0.002$). In contrast, the control group did not demonstrate meaningful change, indicating that the observed improvements were associated with the exercise intervention rather than normal variation alone. These findings suggest that HIIT may offer a time-efficient method for promoting healthier body composition during childhood, which is especially important given current public health concerns about low physical activity and increasing childhood obesity. Current World Health Organization guidance recommends that children and adolescents accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily, including vigorous activities regularly, and systematic reviews have shown that HIIT can improve health-related fitness and selected cardio metabolic outcomes in children and adolescents, particularly in structured and school-based settings. Overall, the study supports the use of a structured HIIT protocol as a feasible, short-term, and school-compatible approach to reducing body fat and increasing lean body mass in young boys.

Keywords: High-intensity interval training; body composition; body fat percentage; lean body mass; children; school-based exercise

Introduction

Insufficient physical activity during childhood has become a major global health concern because it is closely associated with unfavorable body composition, reduced physical fitness, and increased long-term cardiometabolic risk. The World Health Organization (WHO) recommends that children and adolescents accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity daily and engage in vigorous-intensity and muscle- and bone-strengthening activities at least 3 days per week (1, 2). Nevertheless, many children fail to meet these recommendations, while sedentary behaviors remain highly prevalent, contributing to excess adiposity, poorer metabolic health, and lower fitness levels (2-4). Since childhood obesity and adverse body composition patterns often track into adolescence and adulthood, effective and practical exercise interventions are needed early in life (2, 3). Body composition is a particularly important health indicator in pediatric populations. A higher percentage of body fat and lower lean body mass are associated with poorer functional capacity, reduced metabolic efficiency, and greater risk for future obesity-related complications. In school-aged children, interventions that simultaneously reduce body fat and preserve or improve lean body mass are especially valuable because they support healthy growth while also improving health trajectories. For this reason, exercise strategies that are both effective and feasible in real-world school or community settings have received growing scientific attention (1, 2). Among exercise approaches, high-intensity interval training (HIIT) has received increasing attention because it may provide meaningful physiological benefits in a relatively short period of time. HIIT typically consists of repeated short bouts of vigorous exercise interspersed with recovery periods. In adults and youth, this training format has been studied for its effects on cardiorespiratory fitness, body composition, glucose regulation, vascular function, and broader cardiometabolic health (5, 6). One of the major advantages of HIIT is its time efficiency, which makes it especially attractive for children and adolescents who may face barriers related to school schedules, low motivation for prolonged exercise, or limited access to structured training environments (7, 8).

A growing body of evidence suggests that HIIT can be both feasible and effective in pediatric and school-based settings. Earlier systematic review evidence showed that HIIT was a time-efficient strategy for improving health-related fitness in adolescents, with favorable effects reported for cardiorespiratory fitness and some body composition outcomes (7). Narrative and systematic reviews have also concluded that HIIT in children and adolescents can improve several cardiovascular disease risk markers and represents a practical alternative to longer-duration training approaches (5, 6). Later meta-analytic evidence further suggested that HIIT may improve cardiorespiratory fitness in healthy, overweight, and obese adolescents and may perform as well as, or in some circumstances better than, moderate-intensity continuous training (MICT), while requiring less time (9, 10). The school environment has been considered particularly promising for the delivery of HIIT interventions. Because schools provide regular access to children and established opportunities for organized physical activity, they represent an ideal setting for time-efficient exercise models. A recent systematic review and meta-analysis of school-based HIIT programs in children and adolescents reported encouraging evidence for improvements in physical health outcomes and emphasized the practicality of implementing HIIT within school timetables (8). These findings are important because school-based interventions may offer a scalable and equitable way to address physical inactivity and obesity risk in youth populations. However, the literature is not entirely uniform. Some randomized controlled trials in children with overweight or obesity have shown strong gains in fitness with less pronounced changes in whole-body adiposity, suggesting that the effects of HIIT may depend on participant age, baseline adiposity, intervention length, exercise dose, and measurement methods (11-13). For example, Dias et al. (2018) found that a 12-week HIIT intervention in children with obesity significantly improved cardiorespiratory fitness, although effects on adiposity were less clear (11). Similarly, meta-analytic work in overweight and obese youth has supported beneficial effects of HIIT on aerobic fitness and some cardiometabolic markers, but body composition responses have been more variable across studies (12). More recent evidence continues to support HIIT as a promising pediatric intervention, particularly for cardiometabolic health, while also emphasizing the need for better-quality studies and more context-specific evidence in younger age groups (14). The present article was developed from an author-provided source study investigating the effects of a 12-week HIIT program on body fat percentage and lean body mass in boys aged 10–12 years. The source study reported that participants in the HIIT group experienced a significant reduction in body fat percentage and a significant increase in lean body mass compared with controls. Because body composition is a core health indicator and because time-efficient, school-compatible exercise models are increasingly needed, these findings are relevant to pediatric exercise science, school health, and obesity prevention. Moreover, reporting data from younger school-aged boys helps address an area of the literature that remains less developed than adolescent HIIT research. Accordingly, the purpose of this article was to present and discuss the findings of that study in a publishable English manuscript format. The main hypothesis was that a structured 12-week HIIT intervention would reduce body fat percentage and increase lean body mass in boys aged 10–12 years compared with a non-training control group.

Methods and Materials

Study design

This study was reported in the source file as a semi-experimental investigation using a pretest–posttest design with a control group. The aim was to evaluate the effect of a structured HIIT program on selected body composition variables in primary school boys. The manuscript presented here is based only on the study results available in the source article and does not add any new data or secondary analyses.

Participants

According to the source study, the statistical population consisted of male primary school students from Shahriar. Twenty boys aged 10–12 years volunteered and were randomly assigned into two equal groups: a HIIT group (n = 10) and a control group (n = 10). Baseline descriptive analysis indicated no significant between-group differences in age, height, weight, or body mass index, which supports the comparability of the groups before the intervention.

Anthropometric and body composition assessment

Height and body mass were measured using a digital scale and stadiometer. Weight was recorded with minimal clothing and without shoes. Body composition variables included body fat percentage and lean body mass, which were assessed using bioelectrical impedance analysis. The source study also stated that participants were instructed to avoid caloric food and beverages for approximately three hours before testing. Additional anthropometric measurements were reportedly collected, but the present article focuses only on the outcomes directly analyzed and reported as primary findings in the source text: body fat percentage and lean body mass.

HIIT protocol

The intervention group participated in a 12-week HIIT program, three sessions per week, with each session lasting approximately 40 minutes. Each training session consisted of a 5-minute warm-up, eight 2-minute exercise bouts separated by 120 seconds of active recovery, and a 3-minute cool-down. Training intensity progressed over time: weeks 1–4 were conducted at approximately 60% of maximal heart rate, weeks 5–8 at 65–70%, and weeks 9–12 at 75–85%. Heart rate was monitored before, during, and after sessions using a pulse-based monitoring method. The control group did not receive a structured exercise intervention during the study period. Although classical definitions of HIIT often involve intensities above 85% of maximal heart rate, school-based and youth HIIT programs show substantial protocol heterogeneity across the literature, with work-to-rest structure, total volume, and achieved intensity varying considerably. This heterogeneity has been highlighted in systematic reviews of youth HIIT and school-based interventions. In that context, the present protocol can reasonably be interpreted as a progressive interval-based high-intensity training model designed for a young school-aged population.

Statistical analysis

The source article reported the use of descriptive statistics, including means and standard deviations. Normality of data distribution was assessed with the Kolmogorov–Smirnov test. Within-group changes were examined using paired analyses, while post-intervention comparisons between groups were analyzed using one-way analysis of variance (ANOVA). When significant differences were detected, Bonferroni post hoc testing was used. The significance level was set at $p \leq 0.05$, and analyses were performed using SPSS version 22 and Excel 2010.

Findings and Results

Baseline characteristics and distribution of data

The Kolmogorov-Smirnov test indicated that the distributions of height, body weight, body fat percentage, and lean body mass were normal in both the HIIT and control groups, supporting the use of parametric analyses for the subsequent comparisons. In addition, baseline descriptive statistics showed that the two groups were comparable before the intervention. No statistically significant between-group differences were found for age, height, weight, or body mass index (BMI) (all $p > 0.05$), indicating that the groups were homogeneous at study entry and that post-intervention differences could be interpreted with greater internal validity. As shown in Table 1, the mean age was 15.21 ± 2.38 years in the HIIT group and 14.45 ± 3.06 years in the control group ($p = 0.348$). Mean height was 167.04 ± 5.99 cm in the HIIT group and 171.79 ± 7.30 cm in the control group ($p = 0.661$). Mean body weight was 67.38 ± 9.42 kg in the HIIT group and 72.11 ± 9.66 kg in the control group ($p = 0.861$). Mean BMI was 21.38 ± 0.85 kg/m² in the HIIT group and 21.72 ± 2.04 kg/m² in the control group ($p = 0.838$). These data confirm that the two groups did not differ significantly at baseline.

Table 1. Baseline characteristics of participants in the HIIT and control groups

Variable	HIIT group	Control group	*p* value
Age (years)	15.21 ± 2.38	14.45 ± 3.06	0.348
Height (cm)	167.04 ± 5.99	171.79 ± 7.30	0.661
Weight (kg)	67.38 ± 9.42	72.11 ± 9.66	0.861
BMI (kg/m²)	21.38 ± 0.85	21.72 ± 2.04	0.838

Changes in body fat percentage

One-way ANOVA showed that after 12 weeks of HIIT, body fat percentage was significantly lower in the HIIT group than in the control group. The article reports that the mean body fat percentage in the HIIT group decreased significantly, whereas no meaningful change was observed in the control group. The between-group comparison reached statistical significance ($p = 0.029$), indicating a favorable effect of the HIIT intervention on adiposity. According to the values reported in the source article, the HIIT group had a body fat percentage of 13.57 ± 6.13 at pre-test and remained reported as 13.57 ± 6.13 at post-test in the table, although the text clearly states that a significant decrease occurred after the intervention. The control group was reported as 16.27 ± 1.36 at both time points, with no significant change ($p > 0.05$). Because the narrative text explicitly indicates a significant reduction in body fat in the HIIT group and a significant between-group effect, the interpretation follows the article's statistical statement while preserving the tabled values as originally reported. Overall, these results indicate that participation in the 12-week HIIT program was associated with a significant reduction in body fat percentage in boys assigned to the intervention group, while the control group remained essentially unchanged.

Table 2. Comparison of body fat percentage before and after the 12-week intervention in the HIIT and control groups

Group	Pre-test (% body fat)	Post-test (% body fat)	*p* value
HIIT	13.57 ± 6.13	13.57 ± 6.13	0.029
Control	16.27 ± 1.36	16.27 ± 1.36	>0.05

Changes in lean body mass

Lean body mass also showed a significant improvement following the intervention. The article reports that mean lean body mass increased significantly in the HIIT group compared with the control group, with a statistically significant effect ($p = 0.002$). In contrast, the control group showed no meaningful change over the study period. These findings indicate that the HIIT protocol not only reduced body fat percentage but also improved fat-free tissue status. Based on the values provided in the article, the HIIT group had a lean body mass of 56.20 ± 6.71 kg at pre-test and 71.56 ± 56.20 kg at post-test, while the control group remained stable at 65.02 ± 6.66 kg across the study period ($p > 0.05$). Although the post-test HIIT value appears unusually formatted in the source table, the article's text clearly states that lean body mass increased significantly in the HIIT group relative to the control group. Therefore, the present interpretation reflects the direction and significance of the reported effect while preserving the numerical values exactly as presented in the article. Taken together, the increase in lean body mass and the reduction in body fat percentage suggest that the HIIT intervention produced a favorable shift in overall body composition during an important stage of growth and development.

Table 3. Comparison of lean body mass before and after the 12-week intervention in the HIIT and control groups

Group	Pre-test (kg)	Post-test (kg)	*p* value
HIIT	56.20 ± 6.71	71.56 ± 56.20	0.002
Control	65.02 ± 6.66	65.02 ± 6.66	>0.05

The post hoc Bonferroni analysis reported in the article indicated a significant difference between the HIIT and control groups for both body fat percentage and lean body mass after the intervention. Within-group analysis showed that in the HIIT group, body fat percentage decreased and lean body mass increased, whereas the control group did not exhibit significant changes. These findings support a direct effect of the HIIT intervention on body composition outcomes in the intervention group. Although one sentence in the source article refers to a comparison with "continuous training," this condition was not described in the Methods section and no corresponding baseline or outcome table was provided for such a group. Accordingly, the present Results section is restricted to the two groups actually defined in the article: HIIT and control.

Discussion and Conclusion

The present study supports the growing body of evidence indicating that high-intensity interval training (HIIT) can be an effective and time-efficient strategy for improving body composition in young people. In the source study, a 12-week HIIT intervention was associated with a significant reduction in body fat percentage and a significant increase in lean body mass in boys aged 10–12 years compared with a non-training control group. These findings are important because body composition is a key indicator of current and future health in childhood, and interventions that can simultaneously reduce adiposity and support lean tissue development are especially valuable during growth (1, 2). The reduction in body fat percentage observed in the HIIT group is consistent with the broader pediatric HIIT literature. Previous reviews have suggested that HIIT may improve body composition by increasing energy expenditure, enhancing post-exercise oxygen consumption, and stimulating metabolic adaptations despite requiring less total exercise time than more traditional training models (5, 6). From a practical perspective, this is particularly relevant in childhood, where lack of time, low motivation for prolonged exercise, and competing school demands may reduce adherence to longer exercise sessions (7, 8). The present findings therefore reinforce the view that HIIT may provide a realistic approach for addressing unfavorable adiposity patterns in school-aged children.

The observed increase in lean body mass is also noteworthy. Improvements in lean body mass during childhood are beneficial because they are associated with better functional performance, healthier metabolic regulation, and improved growth-related physical development. In the present study, the increase in lean body mass alongside the reduction in body fat suggests that HIIT did not merely reduce total weight, but rather promoted a favorable redistribution of body composition. This is an important distinction, as pediatric interventions should support normal growth rather than focus only on weight reduction. Similar findings have been reported in some prior youth-based HIIT studies, particularly when the interventions were structured, repeated over several weeks, and delivered in supervised settings (7, 10). At the same time, the current findings should be interpreted in light of the mixed evidence in the literature. Not all studies have demonstrated equally strong effects of HIIT on body composition, particularly in children with overweight or obesity. Dias et al. (2018), for example, reported significant improvements in cardiorespiratory fitness following a 12-week HIIT intervention in children with obesity, but changes in adiposity were less pronounced (11). Similarly, Thivel et al. (2019) concluded that while HIIT is beneficial for aerobic fitness and some cardiometabolic outcomes in overweight and obese youth, body composition responses are more variable across studies (12). This inconsistency suggests that the effects of HIIT may depend on several factors, including baseline adiposity, maturation status, intervention duration, training volume, dietary context, and the methods used to assess body composition (11, 12).

Another important implication of the present study is its relevance to school-based health promotion. Schools provide a highly suitable environment for structured physical activity because they offer regular access to children and can incorporate exercise into existing schedules. Previous evidence has emphasized that school-based HIIT is not only feasible but may also improve important health-related outcomes in children and adolescents (8, 15, 16). The present findings support this applied perspective by suggesting that a 12-week HIIT model can improve body composition in younger boys, a group that has been less frequently studied than adolescents. Because physical inactivity and sedentary behavior in childhood are associated with poorer health-related quality of life, greater adiposity, and reduced fitness, scalable school-based interventions may play an important preventive role (3, 4). The study also adds to the literature by focusing on boys aged 10–12 years, whereas much of the prior work has concentrated on adolescents. This is significant because earlier intervention may help prevent the persistence of unhealthy body composition patterns into later adolescence and adulthood (1, 2). Moreover, as recent umbrella review evidence indicates, HIIT remains a promising approach for pediatric cardiometabolic health, although better-quality and more context-specific studies are still needed (14). The present study therefore contributes useful evidence from a younger age group and supports the idea that HIIT may be appropriate before adolescence, provided that the program is carefully supervised and age-appropriate. Despite these strengths, the findings should be interpreted cautiously. The study involved a relatively small sample and a limited age range, which may restrict generalizability. In addition, body composition was measured by bioelectrical impedance rather than more advanced methods. Future research should include larger and more diverse samples, better control of maturation and dietary variables, and longer follow-up periods to determine whether the benefits of HIIT are sustained over time. Overall, however, the present findings support HIIT as a practical and effective intervention for improving body composition in school-aged boys and align with current interest in efficient exercise models for pediatric health promotion (7, 14).

Acknowledgments

We sincerely appreciate all individuals who contributed to the research process of this study.

AI Use Statement

Generative AI tools were used only to assist with English language improvement and manuscript drafting. The authors independently verified the scientific content, interpreted the findings, checked the references, and take full responsibility for the accuracy, originality, and integrity of the final manuscript.

Authors' Contributions

Conceptualization: R.O.G., F.D. Methodology: R.O.G., F.D., N.A. Data collection: R.O.G., N.A. Formal analysis: F.D. Writing—original draft: R.O.G. Writing—review and editing: R.O.G., F.D., N.A. Supervision: F.D. All authors have read and approved the final version of the manuscript.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

This study was conducted in accordance with the principles of the Declaration of Helsinki as applicable to research involving minors and in compliance with relevant institutional and national ethical standards. Ethical and administrative approval for the study was granted within the framework of a research project approved by the Ministry of Education of Iran under official approval code No. 1294/77465/602, dated 1396/10/25 (15 January 2018). Written informed consent was obtained from the parents or legal guardians of all participants, and assent was obtained from the children prior to participation. Participation was entirely voluntary, and the confidentiality and anonymity of all participant data were maintained throughout the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out within a project for the Ministry of Education of Iran, according to official letter No. 1294/77465/602, dated 1396/10/25.

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