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Journal of Education, Health and Sport. eISSN 2391-8306.

Journal Home Page

<https://apcz.umk.pl/JEHS/index>

BOLEK, Oliwia, GRZELAK, Oliwia, KUŚMIERCZYK, Weronika, SORDYL, Katarzyna, SZCZEPAŃSKI, Piotr, ROGULSKI, Krzysztof, MAJKOWSKA, Magdalena, FENGIER, Maria, KAĆIKOWSKA, Justyna, and TRZASKOWSKI, Jakub. High-Intensity Interval Training and Its Effects on Cardiorespiratory Fitness and Body Mass Index in Children and Adolescents with Overweight or Obesity: A Narrative Review. Journal of Education, Health and Sport. 2026;89:69806. eISSN 2391-8306. <https://doi.org/10.12775/JEHS.2026.89.69806>

The journal has had 40 points in Minister of Science and Higher Education of Poland parametric evaluation. Annex to the announcement of the Minister of Education and Science of 05.01.2024 No. 32318. Has a Journal's Unique Identifier: 201159. Scientific disciplines assigned: Physical culture sciences (Field of medical and health sciences); Health Sciences (Field of medical and health sciences). Punkty Ministerialne 40 punktów. Załącznik do komunikatu Ministra Nauki i Szkolnictwa Wyższego z dnia 05.01.2024 Lp. 32318. Posiada Unikatowy Identyfikator Czasopisma: 201159. Przypisane dyscypliny naukowe: Nauki o kulturze fizycznej (Dziedzina nauk medycznych i nauk o zdrowiu); Nauki o zdrowiu (Dziedzina nauk medycznych i nauk o zdrowiu). © The Authors 2026. This article is published with open access at License Open Journal Systems of Nicolaus Copernicus University in Toruń, Poland. Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author (s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non commercial license Share alike. (<http://creativecommons.org/licenses/by-nc-sa/4.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited. The authors declare that there is no conflict of interests regarding the publication of this paper. Received: 13.03.2026. Revised: 17.03.2026. Accepted: 18.03.2026. Published: 23.03.2026.

High-Intensity Interval Training and Its Effects on Cardiorespiratory Fitness and Body Mass Index in Children and Adolescents with Overweight or Obesity: A Narrative Review

Oliwia Bolek – OB. – Corresponding Author

(email: oliwia.bolek99@gmail.com)

Centralny Szpital Kliniczny WUM, Stefana Banacha 1A, 02-097 Warsaw, Poland

ORCID: 0009-0006-2399-9808

Oliwia Grzelak - OG

(email: ogrzalak@protonmail.com)

Mazowiecki Szpital Bródnowski, ul. Kondratowicza 8, 03-242 Warsaw, Poland

ORCID: 0009-0001-3649-1134

Weronika Kuśmierczyk - WK

(email: weronika.kusmierczyk51@gmail.com)

Samodzielny Publiczny Szpital Kliniczny im. prof. W. Orłowskiego CMKP, Warsaw, Poland

ORCID: 0009-0000-5704-1485

Katarzyna Sordyl - KS

(email: kasordyl@gmail.com)

Samodzielny Publiczny Zespół Zakładów Opieki Zdrowotnej w Wyszku, Komisji Edukacji

Narodowej 1, 07-200 Wyszki, Poland

ORCID: 0009-0005-1438-154X

Piotr Szczepański - PS

(email: Piotr.szczepanski.med@gmail.com)

University Clinical Centre of the Medical University of Warsaw, The Infant Jesus Clinical Hospital, Lindleya 4, 02-005 Warsaw, Poland

ORCID ID: 0009-0007-1064-6947

Krzysztof Rogulski - KR

(email: krogul12@gmail.com)

National Medical Institute of the Ministry of Interior and Administration: Warsaw, Poland

ORCID: 0009-0006-7091-0546

Magdalena Majkowska - MM

(email: magdalenamajkowska3@gmail.com)

Medical University of Warsaw, Poland

ORCID: 0009-0001-7472-9537

Maria Fengier - MF

(email: maria.fengier@op.pl)

Medical University of Warsaw, Poland

ORCID: 0009-0002-9201-5703

Justyna Kącikowska - JK

(email: kacikowskajustyna@gmail.com)

Dr. Anna Gostyńska Wolski Hospital Marcina Kasprzaka 17, 01-211, Warsaw, Poland

ORCID: 0009-0007-1399-9553

Jakub Trzaskowski - JT

(email: trzaskowski.jakub@gmail.com)

Gajda-Med District Hospital in Pułtusk, Teofila Kwiatkowskiego 19, 06-100 Pułtusk

ORCID: 0009-0001-1517-0948

ABSTRACT

Background. The global prevalence of overweight and obesity among children and adolescents has increased markedly in recent decades and represents a major public health concern. High-intensity interval training (HIIT) has emerged as a time-efficient exercise strategy that may improve cardiorespiratory fitness (CRF) and cardiometabolic health. However, its effectiveness in youth with overweight or obesity is still not fully understood.

Methods. A narrative literature review was conducted to examine the effects of HIIT on CRF and body mass index (BMI) in children and adolescents with overweight or obesity. PubMed, Embase, Google Scholar, and Web of Science were searched for studies published between June 2016 and March 2026. Eligible studies included structured multi-session HIIT interventions lasting at least four weeks in participants aged 6–18 years. Primary outcomes were CRF and BMI. Due to heterogeneity in study design and protocols, findings were synthesized narratively.

Results. Nine intervention studies met the inclusion criteria. Most studies (7 of 9) reported improvements in cardiorespiratory fitness, including increases in VO_{2max} , VO_{2peak} , maximal aerobic speed, or shuttle-run performance after 8–12 weeks of HIIT. Effects on BMI and body composition were less consistent. Approximately half of the studies observed reductions in BMI or BMI z-score, though not consistently greater than those seen with moderate-intensity continuous training or lifestyle interventions. Some studies also reported improvements in cardiometabolic markers such as blood pressure and metabolic parameters.

Conclusion. HIIT appears to be an effective and time-efficient strategy for improving cardiorespiratory fitness in children and adolescents with overweight or obesity. Although its impact on BMI is less consistent, HIIT may still contribute to improved cardiometabolic health and promote physical activity in youth.

Keywords: High-intensity interval training, cardiorespiratory fitness, body mass index, childhood obesity, adolescents, pediatric exercise, cardiometabolic health

1. Introduction

Overweight and obesity represent major global health challenges affecting millions of people worldwide, particularly children and adolescents¹. According to the World Health Organization (WHO), the prevalence of pediatric overweight and obesity has increased substantially over recent decades². In 2022, more than 390 million children and adolescents aged 5–19 years were overweight, with the global prevalence rising from 8% in 1990 to 20% in 2022³. This alarming trend is associated with significant long-term health consequences, including an increased risk of cardiovascular disease, type 2 diabetes, and other cardiometabolic disorders later in life^{4,5}. Structured exercise programs have been shown to improve physical fitness and cardiorespiratory function in adolescents, highlighting the importance of regular physical activity for youth health.⁶

Cardiorespiratory fitness (CRF) is a key indicator of cardiovascular health and an important predictor of future morbidity and mortality. In pediatric populations, low CRF and elevated body mass index (BMI) are strongly associated with adverse cardiometabolic profiles and reduced quality of life. Consequently, improving CRF and reducing excess body weight have become important targets in interventions addressing pediatric overweight and obesity⁷.

Physical activity is widely recognized as a fundamental component of obesity management^{8–10}. However, traditional moderate-intensity continuous training (MICT) may present practical limitations in youth populations, including time constraints and reduced motivation^{11,12}. High-intensity interval training (HIIT), which involves repeated short bouts of vigorous exercise interspersed with recovery periods, has emerged as a time-efficient and potentially engaging alternative^{13–15}.

Evidence from adult populations suggests that HIIT can elicit significant improvements in CRF and cardiometabolic health, sometimes comparable to or greater than those observed with MICT^{16–18}. In recent years, an increasing number of randomized controlled trials have examined the effects of HIIT in children and adolescents with overweight or obesity across school, clinical, and lifestyle intervention settings^{14,19,20}. Although several meta-analyses have reported beneficial effects of HIIT on CRF in pediatric populations, findings regarding its impact on BMI and other metabolic outcomes remain inconsistent^{21,22}.

Therefore, the aim of this review is to summarize and critically evaluate current evidence on the effects of high-intensity interval training on cardiorespiratory fitness and body mass index in children and adolescents with overweight or obesity, with additional consideration of selected metabolic outcomes.

2. Methods

Search Strategy

A literature search was conducted to identify studies examining the effects of high-intensity interval training (HIIT) on cardiorespiratory fitness (CRF) and body mass index (BMI) in children and adolescents with overweight or obesity. The PubMed, Embase, Google Scholar, and Web of Science databases were searched for articles published between June 2016 and March 2026.

Search terms included combinations of the following keywords and their synonyms: “high-intensity interval training,” “HIIT,” “children,” “adolescents,” “youth,” “overweight,” “obesity,” “body mass index,” “BMI,” “cardiorespiratory fitness,” “CRF,” “cardiometabolic health,” and “randomized controlled trial.” Reference lists of relevant articles, including meta-analyses and randomized controlled trials, were also screened to identify additional studies.

Eligibility Criteria

Studies were eligible if they included children or adolescents aged 6–18 years with overweight or obesity and evaluated structured multi-session HIIT interventions lasting at least four weeks. Acceptable comparators included no-exercise control, observation, lifestyle intervention without HIIT, moderate-intensity continuous training (MICT), moderate-intensity interval training (MIIT), sprint interval training (SIT), or other active exercise interventions.

Primary outcomes of interest were CRF and BMI or BMI z-score. Studies reporting closely related anthropometric, cardiovascular, endothelial, or metabolic outcomes were also considered when they contributed to the interpretation of HIIT efficacy. Only articles published in English were included. Studies were excluded if they lacked a comparative group, involved only acute exercise protocols, or did not include repeated HIIT sessions.

Study Selection

Titles and abstracts were screened for relevance, and potentially eligible full-text articles were reviewed according to predefined inclusion criteria. Studies were categorized into three groups: primary effectiveness evidence, supportive evidence, and contextual evidence.

Primary effectiveness evidence consisted of intervention studies, predominantly randomized controlled trials, directly evaluating HIIT in children and adolescents with overweight or obesity. Supportive evidence included studies focusing on related outcomes such as vascular function, bone outcomes, liver fat, enjoyment, or feasibility. Contextual evidence consisted of systematic reviews and meta-analyses used to support interpretation of the primary findings. The study selection process is presented in the PRISMA flow diagram (Figure 1).

Data Extraction

Data extracted from the included studies comprised participant characteristics, intervention duration, HIIT protocol characteristics, comparator conditions, and outcomes related to CRF, BMI, body composition, and selected cardiometabolic markers.

Due to substantial heterogeneity in participant age, sex distribution, training modality, comparator conditions, and outcome assessment, findings were synthesized narratively rather than pooled in a new meta-analysis.

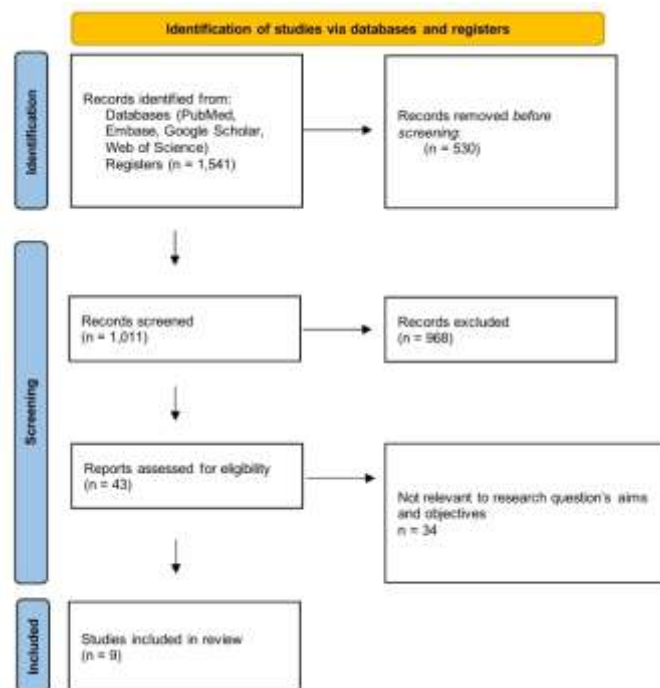


Figure 1. PRISMA flow diagram illustrating the study selection process for the included studies.

3. Results

Study Characteristics:

The database search identified **1,541 records**. After removing duplicates and screening titles and abstracts, **43 full-text articles** were assessed for eligibility. A total of **nine studies** met the inclusion criteria^{19,23-30}.

The primary evidence base consisted of nine intervention studies evaluating HIIT in children and adolescents with overweight or obesity. Most studies employed randomized controlled designs and were conducted in school-based, clinical, or community settings. Sample sizes ranged from approximately **30 participants in tightly controlled trials to more than 170**

participants in pragmatic intervention studies. Intervention duration typically ranged from **6 to 12 weeks**, although some studies lasted up to **16 weeks**^{19,23–30}.

Detailed characteristics of the included studies, including participant demographics, HIIT protocol features, comparator interventions, and reported outcomes, are summarized in **Table 1**.

Table 1. Characteristics of included HIIT intervention studies in children and adolescents with overweight or obesity.

Study	Country	Participants	Study Design	HIIT Protocol	Comparator	Duration	Main Outcomes
Racil et al.	Tunisia	Adolescent girls with obesity (n≈33)	RCT	Running-based HIIT intervals	MIIT	9 weeks	↑ MAS, ↓ BMI, ↓ body fat
Racil et al.	Tunisia	Overweight/obese adolescent females (n≈38)	RCT	HIIT intervals at high intensity	MIIT + control	12 weeks	↓ BMI z-score, ↓ waist circumference, ↑ MAS
HIIT vs MICT vascular study	China	Adolescent boys with obesity	RCT	HIIT running intervals	MICT	8 weeks	↑ VO ₂ peak, ↑ endothelial function
HIIT in PE classes	School setting	Overweight adolescents	RCT	HIIT integrated into PE sessions	SIT / control	8 weeks	↑ VO ₂ max, ↓ fat mass
Cycling HIIT study	Clinical setting	Adolescents with obesity	RCT	HIIT cycling intervals	MICT	16 weeks	↓ BMI, ↓ fat mass
Diet-supported HIIT trial	China	Adolescents with overweight/obesity	RCT	HIIT + dietary guidance	Control	9 weeks	↓ BMI, ↓ body fat

Study	Country	Participants	Study Design	HIIT Protocol	Comparator	Duration	Main Outcomes
Small-sided games HIIT	School/ community	Adolescents	Controlled trial	HIIT + small-sided soccer games	HIIT alone	6 weeks	↑ CRF, ↓ cardiometabolic risk markers
Danish pragmatic trial	Denmark	Children with obesity (n≈173)	RCT	HIIT added to lifestyle program	Lifestyle treatment	12 weeks	No additional BMI reduction
Liver-focused HIIT trial	Clinical setting	Adolescents with obesity	Controlled trial	Short-term HIIT protocol	Control	4 weeks	Improvements in metabolic markers

Effects of HIIT on Cardiorespiratory Fitness (CRF):

Across the included studies, improvements in cardiorespiratory fitness were reported in the majority of intervention trials (7 of 9 studies) evaluating HIIT in children and adolescents with overweight or obesity. Most interventions lasting **8–12 weeks** reported significant improvements in aerobic capacity measured by VO₂max, VO₂peak, maximal aerobic speed (MAS), or shuttle-run performance.

In several trials, HIIT produced improvements in CRF that were comparable to or greater than those observed with traditional moderate-intensity continuous training. These findings suggest that HIIT may represent an effective and time-efficient strategy for improving aerobic fitness in youth populations with excess body weight^{15,19,24,26,28–30}.

Effects of HIIT on BMI and Body Composition

The impact of HIIT on BMI and related anthropometric outcomes was less consistent than its effect on CRF. Reductions in BMI or BMI z-score were reported in approximately half of the included studies, although these effects were not consistently greater than those observed with moderate-intensity continuous training or lifestyle interventions.

However, superiority of HIIT over comparator exercise interventions was not consistently observed. In some randomized trials, HIIT and MICT produced similar reductions in body weight and BMI. Likewise, pragmatic intervention studies integrating HIIT within

multidisciplinary lifestyle treatment did not demonstrate significantly greater reductions in BMI z-score compared with standard lifestyle treatment alone.

These findings suggest that although HIIT may contribute to improvements in body composition, its isolated impact on BMI appears modest and variable^{19,24,28,29,31}.

Additional Cardiometabolic and Vascular Outcomes

Beyond CRF and BMI, several studies reported improvements in additional cardiometabolic indicators following HIIT interventions. These included reductions in waist circumference, improvements in body fat percentage, favorable changes in systolic blood pressure, and improvements in vascular function and endothelial markers.

Some studies also reported improvements in metabolic parameters, including lipid profile, fasting glucose, insulin resistance indices, and inflammatory markers. Interventions combining HIIT with dietary modification or lifestyle counseling tended to demonstrate broader metabolic benefits compared with exercise-only protocols^{23–25,29,30}.

Supportive and Contextual Evidence

Evidence from systematic reviews and meta-analyses further supports the effectiveness of HIIT in youth populations with overweight or obesity. These syntheses consistently report **significant improvements in cardiorespiratory fitness**, with **moderate effects on body composition and cardiometabolic risk markers**. Across studies, the most consistent improvements were observed in **aerobic capacity**, whereas changes in **BMI and other anthropometric outcomes** were generally smaller and more heterogeneous^{14,21,32}.

Overall Evidence Synthesis

Taken together, the available literature suggests that HIIT is a feasible and effective strategy for improving cardiorespiratory fitness in children and adolescents with overweight or obesity. Improvements in BMI and body composition are also reported but appear less consistent and may depend on intervention duration, comparator conditions, and whether HIIT is combined with broader lifestyle interventions.^{19,22,24,26,28–30}

4. Discussion

The present narrative review summarized current evidence on the effects of high-intensity interval training on cardiorespiratory fitness and body mass index in children and adolescents with overweight or obesity. The findings suggest that HIIT represents a feasible and effective strategy for improving aerobic fitness in this population.

Across the included intervention studies, HIIT consistently resulted in improvements in CRF, whereas its effects on BMI and other anthropometric outcomes were less consistent.

Improvements in aerobic capacity were reported in most studies and were measured using indicators such as VO₂max, VO₂peak, or maximal aerobic speed.

Several physiological mechanisms may explain the positive effects of HIIT on cardiorespiratory fitness. High-intensity exercise stimulates central and peripheral cardiovascular adaptations, including increased stroke volume, improved mitochondrial function, enhanced oxidative enzyme activity, and greater capillary density in skeletal muscle. These adaptations contribute to improved oxygen delivery and utilization during exercise, which may explain the consistent improvements in CRF observed across HIIT interventions in youth populations.

The variability in BMI-related outcomes may be explained by differences in intervention duration, training protocols, dietary control, and participant characteristics. Interventions combining HIIT with dietary or lifestyle modifications tended to demonstrate more pronounced improvements in anthropometric outcomes.

Beyond CRF and BMI, several studies reported improvements in cardiometabolic health indicators, including blood pressure, vascular function, lipid profile, insulin sensitivity, and inflammatory markers. These findings highlight the potential of HIIT to improve multiple aspects of cardiometabolic health even in the absence of large reductions in body weight.

From a public health perspective, HIIT may represent a practical strategy to address low levels of physical activity among children and adolescents. The relatively short duration of HIIT sessions may improve adherence compared with traditional endurance training. In addition, HIIT protocols can be easily implemented in school settings, making them a potentially valuable component of school-based physical activity programs targeting pediatric overweight and obesity.

Limitations

Several limitations of the present review should be acknowledged. First, the number of available randomized controlled trials investigating HIIT in children and adolescents with overweight or obesity remains relatively limited. Second, substantial heterogeneity was observed in intervention protocols, participant characteristics, and outcome measures across studies. Third, the duration of most interventions was relatively short, typically ranging from 6 to 12 weeks, which may limit conclusions regarding the long-term effects of HIIT. Finally, the narrative review design does not allow for quantitative synthesis of results, which may limit the ability to estimate pooled effect sizes.

5. Conclusion

In conclusion, current evidence suggests that high-intensity interval training is an effective and time-efficient strategy for improving cardiorespiratory fitness in children and adolescents with overweight or obesity. Although improvements in BMI and body composition are less consistent, HIIT may still contribute to meaningful improvements in cardiometabolic health. Given its relatively short duration and adaptability to school or community settings, HIIT may therefore represent a promising strategy for promoting physical activity and improving cardiometabolic health outcomes in youth populations with excess body weight.

Author's Contribution:

Conceptualisation: OB, WK, OG, PS, MM, JT, KS, KR, JK, MF

Methodology: OB., OG, PS

Software: JT, MM

Check: KS, KR

Formal analysis: OG, OB, JK

Investigation: OG, OB

Resources: MF, PS

Data curation: JK, MM

Writing - rough preparation: OB, OG, WK

Writing - review and editing: OB, KR, JT

Supervision: MF, KS

All authors have read and agreed with the published version of the manuscript.

Founding statement: The study did not receive founding

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflict of Interest Statement: Authors declare no conflicts of interest.

Conflict of Interest Statement: The authors declare no conflicts of interest.

Acknowledgements: Not applicable.

Declaration of the use of generative AI and AI-assisted technologies in the writing process.

In preparing this work, the authors used ChatGPT for the purpose of enhancing language

clarity, improve readability, text formatting and basic data analysis. After using this tool/service, the authors have reviewed and edited the content as needed and accept full responsibility for the substantive content of the publication.

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