Health Problems of Civilization
eISSN: 2354-0265, ISSN: 2353-6942

REVIEW PAPER

Effects of HIIT-based training protocols on body composition and physical fitness in overweight and obese adults: a systematic review

Aleksandra Učur[1(A,E,F)], **Bogdan Živanović**[1(F)], **Darinka Korovljev**[1(A)]

[1]Faculty of Sport and Physical Education, University of Novi Sad, Novi Sad, Serbia

Učur A, Živanović B, Korovljev D. Effects of HIIT-based training protocols on body composition and physical fitness in overweight and obese adults: a systematic review. Health Prob Civil. https://doi.org/10.29316/hpc/231677

Tables: 1
Figures: 2
References: 30
Submitted: 2026 Jun 19
Accepted: 2026 Aug 25

Address for correspondence: Aleksandra Učur, Faculty of Sport and Physical Education, University of Novi Sad, Dr Zorana Đinđića 1, 21102 Novi Sad, Serbia, e-mail: ucuraleksandra@gmail.com
ORCID: Aleksandra Učur https://orcid.org/0009-0008-7591-5674, Bogdan Živanović https://orcid.org/0009-0000-6627-8767, Darinka Korovljev https://orcid.org/0000-0002-2510-3044

Abstract

Overweight and obesity are associated with adverse health consequences and unfavorable cardiometabolic outcomes. The objective of this systematic review was to evaluate the effects of different high-intensity interval training (HIIT) protocols on body composition and physical fitness in overweight and obese people. Relevant literature published from 2020 to 2026 was systematically retrieved from the Web of Science, PubMed, and Scopus databases. Eight studies satisfied the inclusion criteria. The results showed that HIIT-based therapies consistently had a positive effect on both body composition and physical fitness. Reductions in body weight, body fat percentage, fat mass, body mass index (BMI), visceral fat, and blood pressure, as well as gains in muscle mass, fat-free mass (FFM), aerobic fitness, maximal oxygen uptake (VO_2max), peak oxygen uptake (VO_2peak), and fat oxidation, were common findings. All methods studied were effective: aquatic HIIT, hybrid HIIT, resistance training mixed with HIIT, running-based HIIT, and low-frequency HIIT. In conclusion, HIIT seems to be an effective and time-efficient intervention for increasing body composition and cardiorespiratory fitness in people with overweight and obesity. However, exercise recommendations should be customized.

Keywords: HIIT, overweight adults, body composition, physical fitness, obesity

Introduction

The prevalence of overweight and obesity has increased worldwide, especially among adults in developing countries [1]. In the last two decades, the number of obese adults has tripled in developed countries [2]. In 2022, more than one billion people were living with obesity, representing 16% of the world's adults. This figure had more than doubled since 1990 and has quadrupled among adolescents [3,4]. Insufficient time available for exercise is often cited as the primary barrier to regular physical activity. At the same time, declining energy expenditure relative to rising energy intake from excess calories contributes to excessive body weight and, if prolonged, to obesity [1].

The World Health Organization (WHO) defines overweight and obesity as abnormal accumulation of body fat that may adversely affect health [5]. Obesity is a complex health condition influenced by physical inactivity, sedentary lifestyles, and poor dietary habits and is associated with a greater risk of chronic disease and disability [6]. Excess fat mass (FM) and metabolic disturbances are linked to a higher prevalence of cardiovascular diseases (CVD), type 2 diabetes, and many types of cancer [7]. Obese subjects exhibit lower cardiorespiratory fitness (CRF) than their lean counterparts [2].

Regular exercise decreases FM and simultaneously increases cardiorespiratory capacity while preserving lean mass [7]. Weight loss in people with overweight or obesity improves vascular endothelial function, thereby reducing cardiovascular risk. Weight management should also be taken seriously in young adults, since health status at this age can affect health outcomes for the rest of one's life [3]. Body composition and CRF are among the most important health outcomes in adults with overweight and obesity, as they are strongly associated with cardiometabolic risk, functional capacity, and long-term health outcomes [8].

Research is still needed to identify the most effective physical activity programs to improve body composition in individuals with overweight or obesity [7]. Growing scientific literature suggests that high-intensity interval training (HIIT) can promote favorable changes in body composition, aerobic fitness, fat oxidation, and cardiometabolic health while requiring less time than traditional exercise programs, thus making it particularly attractive for adults with overweight and obesity [9]. The relatively short time commitment may be one of its key strengths, given findings stating that vigorous-intensity activity yields greater health benefits than moderate-intensity exercise for the same amount of time, particularly for cardiometabolic health and survival outcomes [10].

Evidence from an umbrella review of 24 systematic reviews and meta-analyses showed consistent improvement in CRF in different populations, including overweight and obese people [11]. The American College of Sports Medicine has recommended moderate-intensity continuous training (MICT) for obese patients to lose weight and/or FM [12]. Engaging in moderate-to-vigorous physical activity (MVPA) increases physical fitness and improves health-related measures [13]. Resistance training (RT) may increase fat-free mass (FFM) and contribute to favorable changes in body composition, although its effects on weight loss are generally smaller than those observed with aerobic exercise [14].

During the past decade, HIIT has gained considerable attention as an exercise strategy for the prevention and management of obesity-related conditions [7]. MICT remains the most commonly prescribed exercise modality regarding weight management programs [2]. In contrast, HIIT alternates periods of vigorous exercise with recovery, whereas MICT involves continuous moderate-intensity exercise over a longer duration [15]. Regular aerobic and resistance exercise programs are widely used in overweight and obese populations, mainly because they improve body composition, cardiometabolic health, blood pressure, muscular strength, and aerobic capacity [16]. Growing evidence suggests that both HIIT and MICT can improve aerobic fitness, increase fat oxidation, and improve cardiovascular health [15]. However, differences in exercise intensity, duration, and recovery characteristics may lead to

distinct physiological adaptations; therefore, the comparative effectiveness of various HIIT-based approaches remains poorly understood [17]. Exercise performed at higher intensities may lead to greater aerobic fitness and, indirectly, to improved strength and body composition. In addition, interval training, which combines endurance and resistance training, represents a more optimal approach than concentrating on a single exercise modality [1]. Land-based exercise is widely recommended for its demonstrated non-pharmacological effects on improving body composition and cardiovascular health in the population with overweight and obesity [3]. According to recommendations of the European Association for the Study of Obesity (EASO), HIIT can be considered an effective strategy for improving CRF in overweight or obese individuals when appropriately prescribed and supervised [8].

Several systematic reviews and meta-analyses have investigated the effects of HIIT on obesity-related outcomes, but few have compared different HIIT-based training modalities and their effects on body composition and physical fitness [15]. In addition, differences in exercise modality, training frequency, and program design make direct comparisons difficult. Further synthesis of the available evidence is therefore needed to better understand the effectiveness of different HIIT-based approaches [11,18].

Aim of the work

This systematic review aimed to compare the effects of different HIIT protocols on body composition and physical fitness in overweight and obese adults. Specifically, the review focused on changes in body weight, body fat percentage, FM, FFM, muscle mass, waist circumference, and aerobic fitness indicators, including VO_2max and VO_2peak.

Methods

This systematic review was conducted in accordance with the PRISMA 2020 guidelines.

Search strategy

A systematic literature search was conducted in the Web of Science, PubMed, and Scopus databases on April 15th, 2026. The search terms used were:

("obese adults" OR "overweight adults") AND (HIIT OR "high-intensity interval training") AND ("body composition" OR "fat mass" OR "body fat" OR "muscle mass") AND ("physical fitness" OR "cardiorespiratory fitness").

Eligibility criteria

Studies were included if they: (1) involved adults with overweight and/or obesity; (2) used HIIT or HIIT-based training as the primary intervention; (3) included a comparison group; (4) reported on outcomes related to body composition and/or physical fitness; and (5) were randomized controlled trials published in English. Studies involving children, adolescents, non-obese populations, nutritional interventions alone, or studies without relevant outcomes were excluded. The search was restricted to English-language, free-full-text articles published between 2020 and 2026. Studies of overweight and/or obese adults that evaluated HIIT or similar training protocols and reported on body composition and/or physical fitness outcomes were included. Randomized controlled trials were eligible study designs.

Study selection

Two reviewers independently screened all titles and abstracts identified through the database search according to the predefined eligibility criteria. Full-text articles considered potentially eligible were subsequently assessed for inclusion. Any disagreements regarding study eligibility were resolved through discussion until consensus was reached.

Data extraction

Data extraction was performed independently by two reviewers using a standardized data extraction form. The extracted data included the first author, year of publication, study design, participant characteristics (sample size, age, and body mass index (BMI)), exercise modality, intervention characteristics (frequency, intensity, session duration, and intervention duration), outcome measures, and the main findings related to body composition and physical fitness. Any discrepancies in the extracted data were resolved through discussion until consensus was reached.

Data synthesis

A quantitative meta-analysis was not performed due to the high heterogeneity of the included randomized controlled trials in terms of exercise modality (e.g. HIIT, resistance training, combined training), intervention duration, training intensity, participant characteristics, and reported outcome measures. The degree of clinical and methodological heterogeneity precluded meaningful statistical pooling of the results. Studies were grouped by exercise modality, and a narrative synthesis of findings was undertaken, summarizing the impact on body composition and physical fitness outcomes.

Risk of bias

The methodological quality and risk of bias of the included studies were not formally assessed. This review was designed as a narrative synthesis focusing on the characteristics and reported outcomes of exercise interventions rather than on quantitative evidence synthesis. The absence of a formal risk-of-bias assessment represents a limitation of this review and should be considered when interpreting the findings.

Literature review results

A total of 324 records were identified through database searching. Prior to screening, 12 duplicate records were removed, while 149 records were excluded using automation tools. Title and abstract screening of 163 records was performed. Of these, 135 records were excluded because of inappropriate population (n=15), outcome measures (n=45), interventions (n=40), or study protocols (n=35). Following the screening process, 28 of these were retrieved as full-text reports. Seven reports were unavailable, leaving 21 studies for full-text screening assessment. Thirteen studies were subsequently excluded because of inappropriate interventions (n=9), irrelevant outcomes (n=2), or the absence of a control group (n=2). Finally, eight studies fulfilled all eligibility criteria and were included in the final review. The included studies investigated the effect of different HIIT-based training protocols on body composition and physical fitness outcomes in adults with overweight or obesity. Figure 1 shows the flow diagram of study selection.

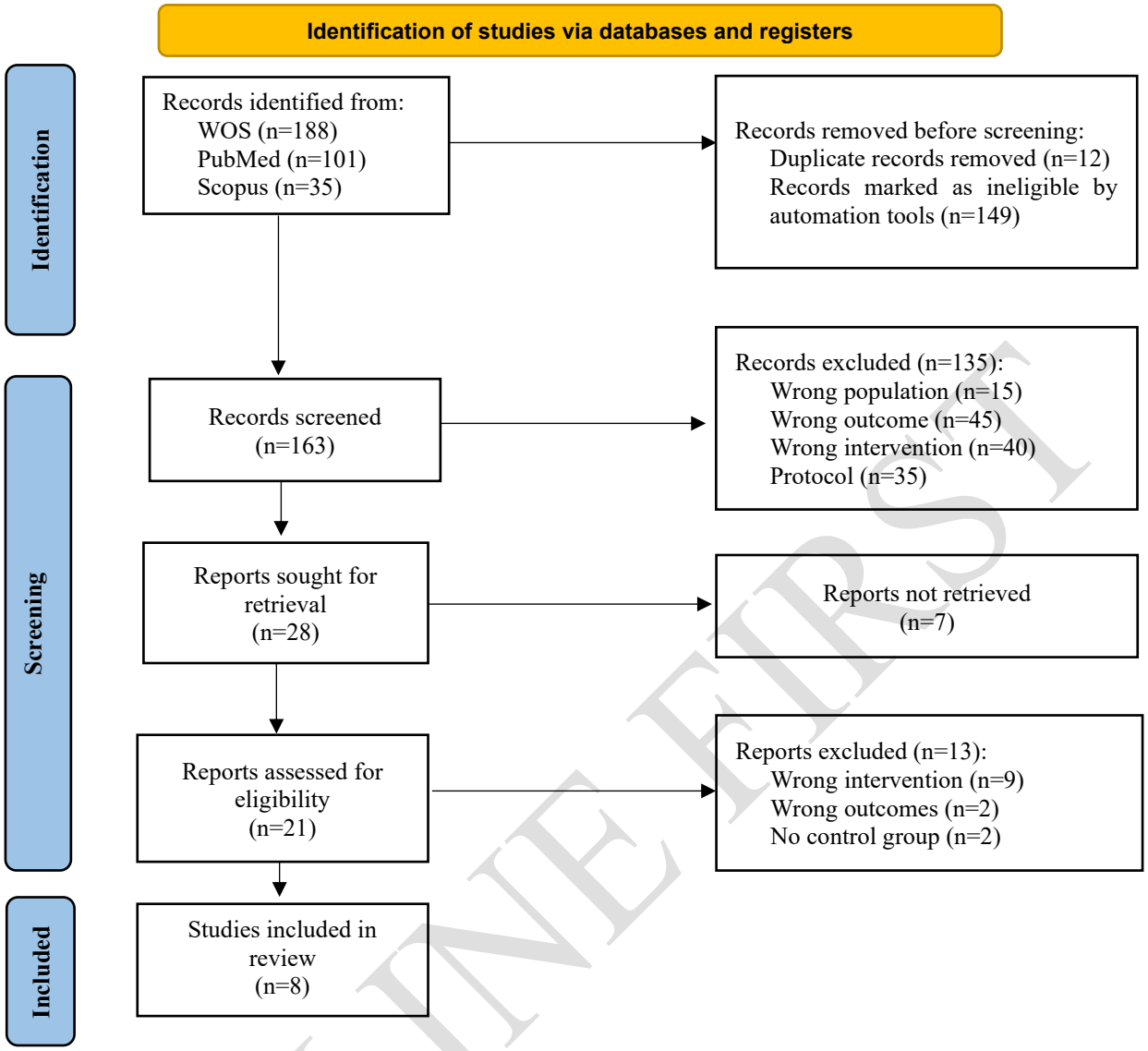

Figure 1. PRISMA flowchart of the study selection process

Table 1 presents the characteristics and the main results of the included studies. Most of the included studies were published within the last five years and examined the effects of HIIT-based interventions on body composition and physical fitness outcomes in overweight and obese adults.

Table 1. Characteristics and main findings of included studies

Authors (Year)	Subjects	Interventions	Main outcomes
Yu et al. (2025) [3]	(n=61; 23.4±5.1 y; M/F) Overweight/obese young adults	8-week aHIIT vs aMICT; RCT	↓BW and BF%; ↑VO_2max; ↑MM; ↑vascular function
Song et al. (2024) [19]	(n=40; 18-25 y; M/F) Obese young adults	8-week HIIT vs MICT; RCT	↓FM; ↓BMI and BF%; ↓WC
Wang et al. (2024) [17]	(n=38; 22±2 y; F) Young women with overweight/obesity	8-week combined HIIT+RT vs HIIT; RCT	↓BW, BMI, BF%, WC, WHR; ↑VO_2peak, VC, VO_2/HR; ↑MM
Couvert et al. (2024) [7]	(n=16; 54.2±9.6 y; M) Men with overweight/obesity	12-week cycling HIIT vs running HIIT; RCT crossover	↓BW; ↓Visceral FM; ↓Abdominal FM (greater effect with running HIIT)
D'Alleva et al. (2023) [2]	(n=34; 39.4±7.0 y; M) Obese men	12-week HIIT vs COMB training; RCT	↓BW and FM; ↑VO_2peak; ↑Fat oxidation
Tsirigkakis et al. (2021) [21]	(n=16; 38.9±7.3 y; M) Obese men	8-week two workload-matched HIIT protocols; RCT	↓Total and trunk FM; ↑Leg lean mass; ↑Fat oxidation; ↑VO_2peak
Chin et al. (2020) [9]	(n=56; 22.8±3.1 y; M) Overweight/obese men	8-week low-frequency HIIT vs MICT; RCT	↓FM and BF%; ↑FFM; ↑VO_2max; ↓SBP;
Vaccari et al. (2020) [20]	(n=32; 18-50 y; M/F) Obese males and female	12-week HIIT vs MICT; RCT	↓BW; ↓BMI; ↓FM; ↑VO_2peak

Notes: n – sample size; y – years; M – male; F – female; M/F – male/female; HIIT – high-intensity interval training; HIRT – high-intensity resistance training; RT – resistance training; COMB – combined training; aHIIT – aquatic high-intensity interval training; aMICT – aquatic moderate-intensity continuous training; BW – body weight; BF% – body fat percentage; FM – fat mass; FFM – fat-free mass; BMI – body mass index; MM – muscle mass; WC – waist circumference; WHR – waist-to-hip ratio; VO_2max – maximal oxygen uptake; VO_2peak – peak oxygen uptake; VC – vital capacity; VO_2/HR – oxygen pulse; SBP – systolic blood pressure; RCT – randomized controlled trial.

Discussion of the review results

Eight studies were eligible and included in this systematic review. Table 1 summarizes the characteristics of the included studies, including participant characteristics, intervention protocols, and main findings on body composition and physical fitness. The studies reported favorable effects of various HIIT-based training protocols on body composition and physical fitness in adults with overweight and obesity.

Several studies included in this review have reported significant improvements in body weight and body composition following HIIT-based interventions. Overweight young adults have experienced a significant reduction in body weight and body fat percentage following aquatic high-intensity interval training (aHIIT) and aquatic moderate-intensity continuous

training (aMICT) [3]. However, only the aHIIT group showed a significant increase in muscle mass, suggesting that higher-intensity aquatic exercise may offer additional benefits for body composition, even in water-based environments. Given the reduced mechanical stress associated with water-based HIIT, it could be a feasible and accessible training option for individuals with obesity who experience discomfort during weight-bearing activities [8]. Clinically, these results suggest that aHIIT is a safe and effective training protocol for this population, serving as a viable alternative for individuals who may experience discomfort or limitations with land-based exercises [3,22].

Similar findings show significant improvements in body composition after both HIIT and MICT, with reductions in FM, BMI, body fat percentage, and waist circumference [19]. Importantly, HIIT led to greater reductions in body fat and anthropometric measurements, particularly in women. The superior effects observed following HIIT could be, at least, partly explained by increased post-exercise energy expenditure and enhanced fat oxidation compared with continuous exercise. HIIT appears to offer a more time-efficient and effective approach to improving body composition, particularly among women aiming to reduce regional fat accumulation [19].

Further evidence comes from studies comparing HIIT with combined HIIT and strength training [17]. Both interventions led to favorable changes in body composition and CRF, including decreases in body mass, BMI, and body fat percentage. However, the combined intervention produced greater increases in muscle mass and VO_2peak than HIIT alone [17,23]. These findings suggest that integrating RT with HIIT may optimize body composition by promoting fat loss while preserving or increasing lean body mass [17].

Taken together, these results indicate that HIIT-based interventions are effective for improving body composition in adults with overweight and obesity. In addition, adaptations may be influenced by exercise modality and program design, with aquatic HIIT and combined HIIT-strength training appearing notably beneficial for preserving or increasing muscle mass while reducing adiposity.

The findings of the present review are consistent with previous systematic reviews and meta-analyses. HIIT is effective in decreasing FM and body fat percentage in overweight and obese adults, and similarly effective as MICT [15]. Similarly, according to other authors, HIIT is effective at lowering abdominal and visceral adiposity, suggesting its potential to lower cardiometabolic disease risk [24]. Collectively, the data support the effectiveness of HIIT as a time-efficient strategy for improving body composition in this population. Other studies looking at different HIIT modalities and programming strategies also found similar results.

Both cycle ergometer (BIKE) and treadmill (RUN) modes demonstrated significant reductions in body mass using HIIT protocols [7,25]. The differential impact on abdominal fat may be explained by variations in muscle involvement patterns and energy expenditure between running and cycling, with running potentially engaging a greater muscle mass and eliciting a higher metabolic demand. Given the close association between abdominal adiposity and cardiometabolic disease risk, reductions in visceral and trunk fat may have important clinical relevance for adults with obesity [7].

Decreases in body weight and FM and increases in VO_2peak and fat oxidation suggest that increased aerobic fitness and metabolic flexibility may contribute to beneficial changes in body composition [2,26]. Enhanced fat oxidation and post-exercise energy expenditure have been proposed as important physiological mechanisms underlying fat loss in response to high-intensity exercise [2]. Similar results were also obtained by Tsirigkakis et al., who examined significantly lower levels in total and abdominal FM, along with increases in lean leg mass, fat oxidation, and VO_2peak following two HIIT protocols with different interval durations [21]. These data are consistent with the hypothesis that HIIT induces positive metabolic adaptations that improve body composition and physical fitness concomitantly in adults with obesity [15,21].

The practical value of HIIT lies in showing improvements in FM, FFM, aerobic fitness, and blood pressure while requiring relatively little training time [9]. Limited time availability is often reported as one of the main barriers to physical activity, and therefore HIIT may be considered a practical and sustainable strategy for adults with overweight and obesity [9,18]. Likewise, other authors identified that HIIT and MICT produced considerable improvements in body composition, including reductions in body weight, BMI, FM, and anthropometric measures, while FFM remained unchanged, with no group differences [20]. These findings suggest that although HIIT and MICT may rely on individual preferences, commitment, and specific goals, either can yield significant health benefits [20].

The findings of the present review are also supported by earlier research on the effects of HIIT on obesity-related outcomes. Comparable loss in total body fat and visceral fat in overweight and obese adults occurs as a result of HIIT and MICT training [27]. Some authors also report that HIIT is a more effective method for reducing FM with significantly less training time than traditional continuous exercise [28]. The reductions in abdominal and trunk fat observed in several studies included in the present review are particularly relevant, as central adiposity is strongly associated with insulin resistance, cardiovascular disease, and metabolic dysfunction.

In addition to improvements in body composition, several studies included in the present review reported meaningful enhancements in physical fitness outcomes. An increase in VO_2peak has been shown to improve aerobic fitness despite relatively low training volume [2,9,17,21]. These data are clinically relevant, as low CRF is recognized as a strong predictor of cardiovascular disease, metabolic dysfunction, and all-cause mortality in adults with overweight and obesity. Therefore, the observed improvements in aerobic fitness suggest that HIIT may offer health benefits beyond reductions in body weight and adiposity.

The positive changes in body composition may be due to a range of physiological adaptations associated with high-intensity exercise. Previous reviews have suggested that HIIT improves mitochondrial adaptations, increases fat oxidation capacity, and improves insulin sensitivity, all of which may contribute to reductions in adiposity and improvements in metabolic health [29,30]. These mechanisms may partially explain the consistent drops in body weight, FM, and body fat percentage seen across the included studies.

In conclusion, the evidence presented in this review indicates that HIIT-based interventions consistently optimize body composition and physical fitness in overweight or obese adults. Despite heterogeneity in exercise modality, interval structure, and program length, studies reported significant improvements in body weight, adiposity, aerobic fitness, and cardiometabolic health. Importantly, HIIT appears to provide these benefits in a time-efficient manner, which may improve exercise adherence in populations where time constraints are a major barrier to participation in physical activity. However, no single HIIT protocol can currently be recommended for all individuals with obesity, and exercise recommendations should be individualized according to age, gender, physical capacity, health status, and personal preferences.

The principal outcomes and potential physiological mechanisms identified in the reviewed studies are summarized in Figure 2.

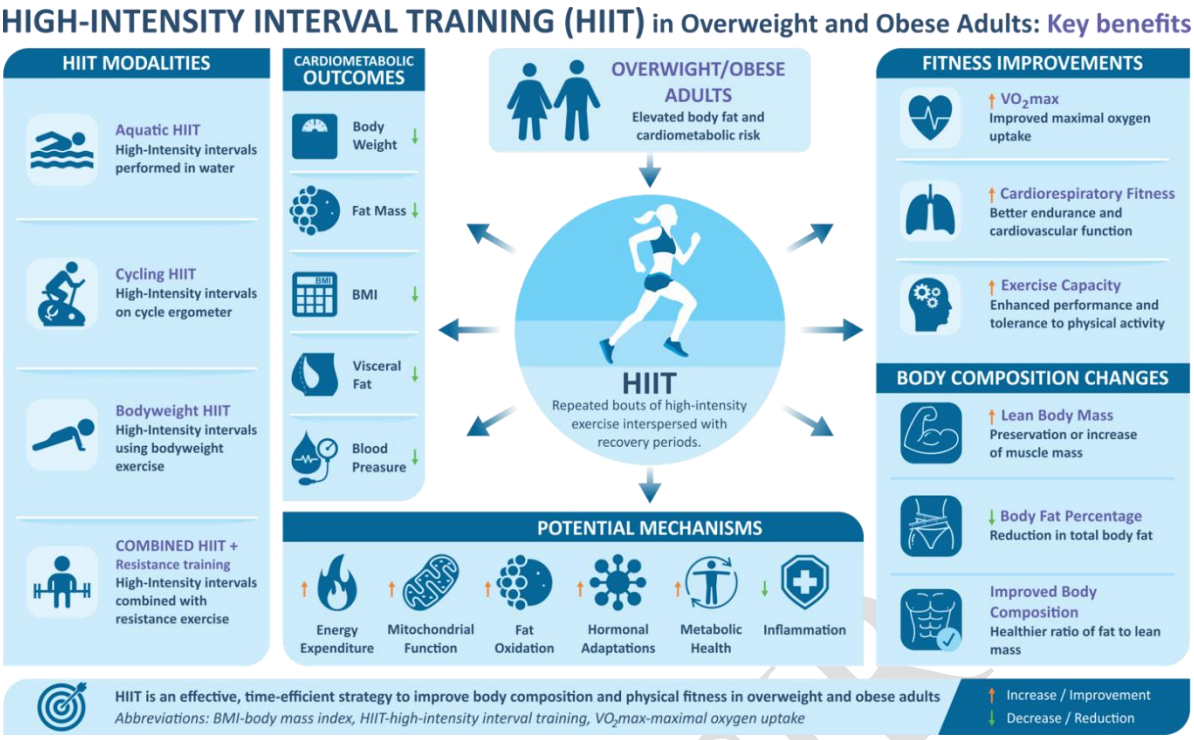

Figure 2. Summary of the effects of HIIT interventions on body composition, cardiometabolic health, and physical fitness in overweight and obese adults

Notes: the figure prepared by the authors.

Practical implications

The findings of this review suggest that HIIT may be a feasible, time-efficient exercise strategy for improving body composition and physical fitness in overweight and obese adults. Exercise professionals and healthcare providers may consider incorporating protocols into weight-management programs, taking into account the participants' health status, fitness level, and potential comorbidities.

Conclusions

In conclusion, obesity is a disease of the modern era, with a continuing upward trend. The included studies indicate that HIIT-based interventions can improve body weight, body composition, aerobic fitness, and cardiometabolic health in adults with overweight and obesity. Different training protocols have varying effects on body weight, body composition, and other components of physical fitness. To date, there is still no universal training protocol applicable

to all individuals with obesity, and the most practical approach is to individualize exercise recommendations according to the individual's abilities, health status, and preferences.

Future studies should focus on long-term, well-controlled interventions with standardized training protocols to improve comparability and assess the sustainability of effects. Greater attention should be given to individual characteristics, gender-specific responses, and low-impact exercise modalities, as well as to behavioral and adherence-related outcomes.

Strengths and limitations

This review was performed following the PRISMA 2020 guidelines. The literature search included studies available in the PubMed database that met predefined eligibility criteria. The review comprises experimental studies that provide specific data on different types of training and their effects on various components of physical fitness, contributing not only to theoretical knowledge but also to practical applications when working with adults with overweight and obesity.

There are a number of limitations to consider. Firstly, the number of included studies was relatively low. Second, there was considerable heterogeneity among studies in participants' characteristics, intervention duration, exercise modalities, outcome measures, and study design, which limited direct comparisons and prevented firm conclusions about the superiority of specific training protocols. A formal assessment of methodological quality or risk of bias was not performed. Therefore, the findings of this review should be interpreted with caution, particularly considering the relatively small number of included studies and their methodological heterogeneity.

Disclosures and acknowledgments

The authors declare no conflicts of interest with respect to the research, authorship, and/or publication of this article.

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Figure 2 was created with the assistance of OpenAI ChatGPT, based on the authors' concepts and scientific content, and subsequently edited and refined using CorelDRAW X8. The authors reviewed and approved the final figure and take responsibility for its scientific content.

References:

1. Jitwil A, Pitil PP, Wahed WJE. High-intensity interval training and high-intensity resistance training on body fat percentage and aerobic fitness among female overweight adults. Malays J Sport Sci Recreat. 2019; 15(2): 25-34.
2. D'Alleva M, Vaccari F, Graniero F, Giovanelli N, Floreani M, Fiori F, et al. Effects of 12-week combined training versus high intensity interval training on cardiorespiratory fitness, body composition and fat metabolism in obese male adults. J Exerc Sci Fitness. 2023; 21(2): 193-201. https://doi.org/10.1016/j.jesf.2023.01.004
3. Yu Z, Tang S, Hu M, Peng J, Fan Q, Leng L, et al. Aquatic high-intensity interval training improves vascular function, whereas aquatic moderate-intensity continuous training lowers resting heart rate in overweight and obese young adults: a randomized controlled trial. J Sports Sci Med. 2025; 24: 666-675. https://doi.org/10.52082/jssm.2025.666
4. Guo L, Chen J, Yuan W. The effect of HIIT on body composition, cardiovascular fitness, psychological well-being, and executive function of overweight/obese female young adults. Front Psychol. 2023; 13: 1095328. https://doi.org/10.3389/fpsyg.2022.1095328
5. World Health Organization. Obesity and overweight [Internet]. Geneva: World Health Organization; 2025 Dec 8 [access 2026 Jul 12]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
6. Baj-Korpak J, Zaworski K, Wochna M, Chmara S, Stelmach MJ. Physical fitness and body build parameters of children and adolescents participating in the physical activity promotion programme "Athletics for all!". Arch Public Health. 2024; 82: 206. https://doi.org/10.1186/s13690-024-01436-9
7. Couvert A, Goumy L, Maillard F, Esbra A, Lanchais K, Saugrain C, et al. Effects of a Cycling versus running HIIT program on fat mass loss and gut microbiota composition in men with overweight/obesity. Med Sci Sports Exerc. 2024; 56(5): 839-850. https://doi.org/10.1249/MSS.0000000000003376
8. Oppert JM, Bellicha A, van Baak MA, Battista F, Beaulieu K, Blundell JE, et al. Exercise training in the management of overweight and obesity in adults: synthesis of the evidence and recommendations from the European Association for the Study of Obesity Physical Activity Working Group. Obes Rev. 2021; 22(Suppl. 4): e13273. https://doi.org/10.1111/obr.13273

9. Chin EC, Yu AP, Lai CW, Fong DY, Chan DK, Wong SH, et al. Low-frequency HIIT improves body composition and aerobic capacity in overweight men. Med Sci Sports Exerc. 2020; 52(1): 56-66. https://doi.org/10.1249/MSS.0000000000002097
10. Biswas RK, Ahmadi MN, Bauman A, Milton K, Koemel NA, Stamatakis E. Wearable device-based health equivalence of different physical activity intensities against mortality, cardiometabolic disease, and cancer. Nat Commun. 2025; 16: 8315. https://doi.org/10.1038/s41467-025-63475-2
11. Poon ETC, Li HY, Gibala MJ, Wong SHS, Ho RST. High-intensity interval training and cardiorespiratory fitness in adults: an umbrella review of systematic reviews and meta-analyses. Scand J Med Sci Sports. 2024; 34(5): e14652. https://doi.org/10.1111/sms.14652
12. Dupuit M, Rance M, Morel C, Bouillon P, Pereira B, Bonnet A, et al. Moderate-intensity continuous training or high-intensity interval training with or without resistance training for altering body composition in postmenopausal women. Med Sci Sports Exerc. 2020; 52(3): 736-745. https://doi.org/10.1249/MSS.0000000000002162
13. Baj-Korpak J, Stelmach MJ, Zaworski K, Lichograj P, Wochna M. Assessment of motor abilities and physical fitness in youth in the context of talent identification—OSF test. Int J Environ Res Public Health. 2022; 19(21): 14303. https://doi.org/10.3390/ijerph192114303
14. Dupuit M, Maillard F, Pereira B, Marquezi ML Jr, Lancha Jr AH, Boisseau N. Effect of high intensity interval training on body composition in women before and after menopause: a meta-analysis. Exp Physiol. 2020; 105(9): 1470-1490. https://doi.org/10.1113/EP088654
15. Wewege M, van den Berg R, Ward RE, Keech A. The effects of high-intensity interval training vs. moderate-intensity continuous training on body composition in overweight and obese adults: a systematic review and meta-analysis. Obes Rev. 2017; 18(6): 635-646. https://doi.org/10.1111/obr.12532
16. Costa EC, Hay JL, Kehler DS, Boreskie KF, Arora RC, Umpierre D, et al. Effects of high-intensity interval training versus moderate-intensity continuous training on blood pressure in adults with pre- to established hypertension: a systematic review and meta-analysis of randomized trials. Sports Med. 2018; 48: 2127-2142. https://doi.org/10.1007/s40279-018-0944-y
17. Wang Y, Yang X, Deng J, Wang Z, Yang D, Han Y, et al. Combined high-intensity interval and resistance training improves cardiorespiratory fitness more than high-

intensity interval training in young women with overweight/obesity: a randomized controlled trial. Frontiers in Endocrinology. 2024; 15: 1450944. https://doi.org/10.3389/fendo.2024.1450944

18. Guo Z, Li M, Cai J, Gong W, Liu Y, Liu Z. Effect of high-intensity interval training vs. moderate-intensity continuous training on fat loss and cardiorespiratory fitness in the young and middle-aged: a systematic review and meta-analysis. Int J Environ Res Public Health. 2023; 20(6): 4741. https://doi.org/10.3390/ijerph20064741
19. Song X, Cui X, Su W, Shang X, Tao M, Wang J, et al. Comparative effects of high-intensity interval training and moderate-intensity continuous training on weight and metabolic health in college students with obesity: a randomized controlled trial. Sci Rep. 2024; 14: 16558. https://doi.org/10.1038/s41598-024-67331-z
20. Vaccari F, Passaro A, D'Amuri A, Sanz JM, Di Vece F, Capatti E, et al. Effects of 3-month high-intensity interval training vs. moderate endurance training and 4-month follow-up on fat metabolism, cardiorespiratory function and mitochondrial respiration in obese adults. Eur J Appl Physiol. 2020; 120: 1787-1803. https://doi.org/10.1007/s00421-020-04409-2
21. Tsirigkakis S, Mastorakos G, Koutedakis Y, Mougios V, Nevill AM, Pafili Z, et al. Effects of two workload-matched high-intensity interval training protocols on regional body composition and fat oxidation in obese men. Nutrients. 2021; 13(4): 1096. https://doi.org/10.3390/nu13041096
22. Liao T, Zheng C, Xue J, Wang YT. Effects of aquatic and land high-intensity interval trainings on selected bio- and physiological variables among obese adolescents. Frontiers in Endocrinology. 2024; 15: 1381925. https://doi.org/10.3389/fendo.2024.1381925
23. Bouamra M, Zouhal H, Ratel S, Makhlouf I, Bezrati I, Chtara M, et al. Concurrent training promotes greater gains on body composition and components of physical fitness than single-mode training (endurance or resistance) in youth with obesity. Front Physiol. 2022; 13: 869063. https://doi.org/10.3389/fphys.2022.869063
24. Batacan RB Jr, Duncan MJ, Dalbo VJ, Tucker PS, Fenning AS. Effects of high-intensity interval training on cardiometabolic health: a systematic review and meta-analysis of intervention studies. Br J Sports Med. 2017; 51: 494-503. https://doi.org/10.1136/bjsports-2015-095841
25. Khodadadi F, Bagheri R, Negaresh R, Moradi S, Nordvall M, Camera DM, et al. The effect of high-intensity interval training type on body fat percentage, fat and fat-free

mass: a systematic review and meta-analysis of randomized clinical trials. J Clin Med. 2023; 12(6): 2291. https://doi.org/10.3390/jcm12062291

26. Atakan MM, Guzel Y, Shrestha N, Kosar SN, Grgic J, Astorino TA, et al. Effects of high-intensity interval training (HIIT) and sprint interval training (SIT) on fat oxidation during exercise: a systematic review and meta-analysis. Br J Sports Med. 2022; 56: 988-996. https://doi.org/10.1136/bjsports-2021-105181
27. Keating SE, Johnson NA, Mielke GI, Coombes JS. A systematic review and meta-analysis of interval training versus moderate-intensity continuous training on body adiposity. Obes Rev. 2017; 18(8): 943-964. https://doi.org/10.1111/obr.12536
28. Andreato LV, Esteves JV, Coimbra DR, Moraes AJP, de Carvalho T. The influence of high-intensity interval training on anthropometric variables of adults with overweight or obesity: a systematic review and network meta-analysis. Obes Rev. 2019; 20(1): 142-155. https://doi.org/10.1111/obr.12766
29. Jelleyman C, Yates T, O'Donovan G, Gray LJ, King JA, Khunti K, et al. The effects of high-intensity interval training on glucose regulation and insulin resistance: a meta-analysis. Obes Rev. 2015; 16(11): 942-961. https://doi.org/10.1111/obr.12317
30. MacInnis MJ, Gibala MJ. Physiological adaptations to interval training and the role of exercise intensity. J Physiol. 2017; 595(9): 2915-2930. https://doi.org/10.1113/JP273196