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THE EFFECTIVENESS OF HIGH-INTENSITY INTERVAL TRAINING (HIIT) ON WEIGHT LOSS AND METABOLIC PARAMETERS: A SCOPING REVIEW

Efektivitas High-Intensity Interval Training (HIIT) Terhadap Penurunan Berat Badan Dan Parameter Metabolik: Sebuah Scoping Review

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ABSTRAK

Obesitas merupakan permasalahan kesehatan global yang terus meningkat, dengan prevalensi yang signifikan di Indonesia. High-Intensity Interval Training (HIIT) muncul sebagai metode latihan yang efisien dalam menurunkan berat badan dan memperbaiki kesehatan metabolik. Studi ini merupakan scoping review yang bertujuan untuk mengevaluasi efektivitas HIIT dalam menurunkan berat badan pada individu dengan kelebihan berat badan dan obesitas. Pencarian literatur dilakukan melalui lima basis data utama (PubMed, ScienceDirect, Google Scholar, ProQuest, dan EBSCO), menghasilkan 20 studi intervensi dengan total 1.184 partisipan. Hasil sintesis menunjukkan bahwa HIIT secara signifikan menurunkan massa lemak tubuh, meningkatkan VO_2maks, memperbaiki indeks massa tubuh (BMI), serta meningkatkan komposisi tubuh. Protokol HIIT yang efektif berkisar antara 80–95% VO_2maks, dengan durasi latihan 10–45 menit per sesi dan frekuensi 2–5 kali per minggu. Selain peningkatan efektivitas metabolik, HIIT juga terbukti meningkatkan kepatuhan terhadap latihan melalui durasi yang lebih singkat dan intens. Meski demikian, heterogenitas protokol dan variasi respons individu menjadi keterbatasan dalam generalisasi hasil. HIIT dapat direkomendasikan sebagai strategi latihan non-farmakologis untuk pengelolaan berat badan. Pendekatan ini juga efektif dalam pencegahan penyakit metabolik secara individual maupun populasi.

***Kata kunci**: latihan interval, kesehatan metabolik, komposisi tubuh, obesitas, VO_2maks*

ABSTRACT

Obesity is a growing global health concern, with a significantly increasing prevalence in Indonesia. High-Intensity Interval Training (HIIT) has emerged as an efficient exercise method for weight reduction and the improvement of metabolic health. This scoping review aimed to evaluate the effectiveness of HIIT in reducing body weight among individuals who are overweight or obese. Literature searches were conducted across five major databases (PubMed, ScienceDirect, Google Scholar, ProQuest, and EBSCO), yielding 20 interventional studies involving a total of 1,184 participants. The synthesized findings indicate that HIIT significantly reduces body fat mass, improves VO_2max, enhances body mass index (BMI), and improves the fat-free mass-to-fat ratio. Effective HIIT protocols typically range between 80% and 95% of VO_2max, with session durations of 10–45 minutes, and are performed 2–5 times per week. In addition to its metabolic benefits, HIIT demonstrates higher adherence rates due to its time efficiency and intensity. However, the heterogeneity of protocols, such as differences in frequency, intensity, and sample characteristics, as well as interindividual variability, limits the generalizability of the results. HIIT is recommended as a non-pharmacological exercise strategy for weight management and the prevention of metabolic diseases, with potential for broad application when individualised based on intensity, frequency, and health status.

***Keywords:** body composition, interval training, metabolic health, obesity, VO_2max.*

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INTRODUCTION

According to data from the World Health Organization (WHO), in 2022, there were more than 1 billion people worldwide living with obesity. In Indonesia, the prevalence of obesity among individuals aged over 18 years increased from 15.4% in 2013 to 21.8% in 2018.[1] In addition, obesity can lead to respiratory problems, fatigue, and an increased risk of cardiovascular disease and diabetes mellitus.[2] Excess body weight is generally caused by an increase in body fat mass.[3]

Several health impacts associated with overweight and obesity include insulin resistance. Obesity is a risk factor for the development of insulin resistance, which may manifest in conditions such as hypertension, dyslipidemia, and hyperuricemia.[4] Obesity also affects various bodily functions due to excessive body weight, including the nervous, respiratory, cardiovascular, musculoskeletal, gastrointestinal, endocrine, and reproductive systems. As a non-communicable disease, obesity can contribute to the development of other non-communicable diseases such as coronary heart disease, diabetes mellitus, and others.[5]

In general, the management of excess body weight includes pharmacological therapy, aerobic exercise, and bridging exercises. Bridging exercise is considered a fundamental workout aimed at improving stability and spinal stabilization, as well as enhancing core muscle strength.[6] Several types of diets, such as the Atkins diet—which is based on the principle of very low-calorie intake—have been studied and shown to promote weight loss. One of the most commonly used exercise methods for weight reduction in cases of obesity is aerobic exercise. Aerobic exercise has a significant effect on reducing body weight and body fat percentage in individuals with obesity. Numerous studies have demonstrated that this type of exercise can aid in weight reduction, enhance muscle mass, and improve overall well-being.[7]

In addition to aerobic methods, anaerobic methods can also be used. This approach is often considered the opposite of aerobic exercise. Anaerobic exercise involves high-intensity activities performed over a relatively short duration. One form of training that can improve the anaerobic threshold is High-Intensity Interval Training (HIIT), which consists of sessions involving high-intensity exercises performed at a speed or load above the anaerobic threshold within a short period.[8]

High-Intensity Interval Training (HIIT) is a structured form of physical exercise characterized by repeated, high-intensity movements performed within short durations. Compared to conventional cardio, HIIT is more effective in reducing body fat while simultaneously improving cardiovascular function. Unlike traditional aerobic exercises that primarily target heart rate without significantly impacting fat reduction, HIIT achieves both outcomes efficiently. Additionally, incorporating plyometric exercises within HIIT programs has been demonstrated to support weight loss in overweight adolescents. As an anaerobic modality, HIIT also offers advantages such as reduced injury risk and improved endurance.[7]

However, several potential biases related to HIIT have been identified in existing studies. These include its unsuitability for beginners due to the risk of injury from high intensity, potential joint inflammation, and muscle soreness. Moreover, some studies suggest that highly intense HIIT sessions may reduce the enjoyment of exercise, which could affect long-term adherence. Despite these concerns, High-Intensity Interval Training (HIIT) plays an important role in obesity management, as it efficiently burns calories in a short amount of time and boosts metabolism. Research indicates that HIIT can support weight loss,

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reduce body fat, and improve cardiovascular fitness in individuals who are overweight.[9]

Although individuals with overweight and obesity are generally advised to engage in moderate-intensity exercise, it is important to note that such exercise typically requires a longer duration to be effective. Therefore, this study aims to examine the effects of High-Intensity Interval Training (HIIT) on weight loss in individuals who are overweight or obese.

METHODS

1. Protocol and Registration

The articles were selected using the PRISMA-ScR scoping review method (Figure 1), which follows the reporting guidelines outlined in the PRISMA Extension for Scoping Reviews. This review procedure aims to synthesize the benefits of High-Intensity Interval Training (HIIT) for individuals who are overweight. The study protocol consists of five main steps: (1) formulating the research question, (2) identifying relevant sources, (3) selecting appropriate studies, (4) extracting data, and (5) compiling, summarizing, and reporting the findings.

2. Eligibility Criteria

The article search was conducted across several databases, including PubMed, Google Scholar, and ScienceDirect. Eligible studies were those published between January 2015 and May 2025.

3. Information Source

Full-text articles were accessed through five databases: PubMed, Google Scholar, ScienceDirect, ProQuest, EBSCO, and Grey Literature.

4. Search Terms

In the search terms section of this scoping review, the researchers used a systematic approach to ensure that the literature search covered all relevant terms related to the research topic, namely the benefits of High-Intensity Interval Training (HIIT) for weight loss in individuals who are overweight or obese.

5. Selection of Source of Evidence

Data extraction was carried out by compiling articles in Microsoft Excel format. Information from each article was organized according to specific criteria, including: author, title, type of study (all research involving primary data analysis), year of publication, country, study sample (individuals with overweight or obesity), and findings (the effectiveness of High-Intensity Interval Training based on exercise type, duration, intensity variables, and implementation protocols for overweight individuals). In addition, comparative interventions such as Continuous Moderate-Intensity Training (CMIT) and Low-Intensity Training (LIT) were also documented. The methodology included study design, participants, study location, ethical considerations, measurements/tools, data collection procedures, and data analysis methods used.

6. Inclusion and Exclusion Criteria

This study applied the PICO framework, encompassing Population, Intervention, Comparison, Outcome, and Study Design. The inclusion criteria for the population consisted of individuals with a BMI ≥ 25 kg/m², with body fat percentages >32% in men and >25% in women. Included interventions were aerobic interval training and High-Intensity Interval Training (HIIT), such as stationary cycling, treadmill walking or sprinting, and resistance training, while exercises like jump tests and squat jumps were excluded. The comparisons involved low-intensity training and continuous moderate-intensity training. The expected outcomes included improvements in VO_2max, reductions in body mass, decreases in body fat percentage, and normalization of body mass index (BMI). Accepted study designs included case reports, experimental studies, randomized controlled trials, and pilot studies, with

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meta-analyses and reviews of reviews excluded.

This scoping review followed the PRISMA-ScR guidelines, beginning with the identification of 158,516 articles from various databases. After deduplication (25,500 articles) and automated filtering (110,961 articles), as well as the removal of articles for other reasons (15,852 articles), a total of 39,629 articles remained for title and abstract screening. Of these, 31,703 were excluded, and 7,926 articles proceeded to the eligibility assessment stage. However, only 5,271 articles met the eligibility criteria. From this number, 7,530 articles were inaccessible, 3,953 did not meet the inclusion criteria, and 395 were excluded due to other methodological reasons. In the end, 20 primary studies were selected for analysis, all of which assessed the effectiveness of High-Intensity Interval Training (HIIT) in promoting weight loss and improving fitness in individuals who are overweight or obese. Figure 1 presents information on the journal title, authors, study design, outcome measures, study subjects, type of exercise, training protocol, conclusions, and risk of bias scores. The risk of bias was assessed using the JBI Critical Appraisal Checklist for Randomized Controlled Trials (RCTs). If a clinical trial was still classified as an RCT, the JBI tool was consistently applied.

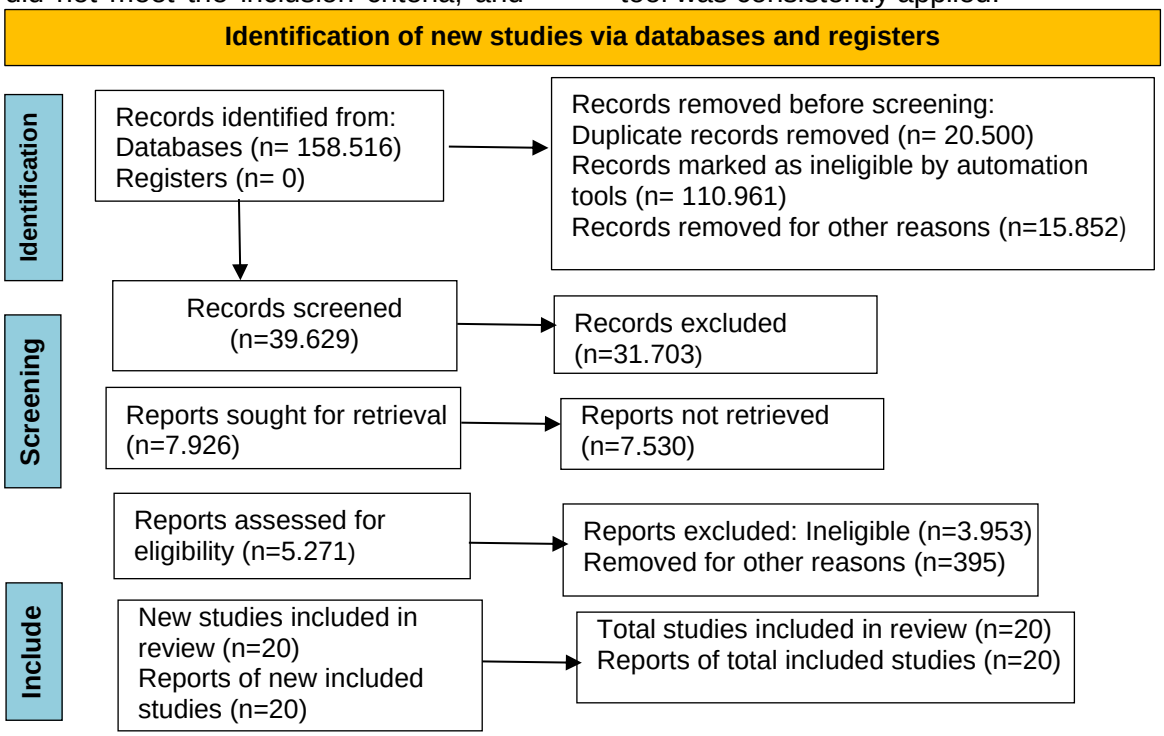

Figure 1. Article Selection Flow Diagram

RESULT

Table 1 Summary of the 20 Journals That Were Included in This Review

No	Author	Design, Subject & Outcome Measure	Protocol	Conclusion of Result	Risk of Bias
1.	Zhu (2024) [21]	RCT, 60 obese young women aged 18–30; *Excl.* Metabolic disorders, training history. **Outcome:** body composition and energy metabolism	SIT: 6s sprint + 9s rest × 40 sets; HIIT: 60s @ 120% VO_2max + 90s rest × 16–21 sets, 12 weeks.	HIIT induced higher energy expenditure (~300 kcal) and fat oxidation than SIT.	8/10

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No	Author	Design, Subject & Outcome Measure	Protocol	Conclusion of Result	Risk of Bias
2.	Khammassi (2020) [25]	RCT, 56 obese adolescents (11–17 yrs, BMI ~35), *Excl.* Not specified. **Outcome:** VO_2max, fat-free mass (FFM), and fat mass.	HIIT: 2x/week strength (bench press, leg press), 1x/week aquatic @ 75–90% VO_2max, duration: 12 weeks.	Combined program significantly increased VO_2max and FFM, and reduced fat mass.	7/10
3.	Xu (2022) [22]	RCT, 60 obese youth aged 18–30 (BMI ≥ 24 or ≥ 28), *Excl.* Not specified. **Outcome:** weight, fat% %, and CRF measured pre/post with trained blinded assistants.	Bike; HIIT: 5x/week, 30 min (5×3 min @ 80% VO_2max + recovery @ 50%), MICT: 3x/week, 50 min @ 60–70%..	HIIT + intermittent/continuous energy restriction reduced weight, fat, and increased CRF..	9/10
4.	Jiang 2024[13]	RCT, 22 men aged 18–25, body fat >20%, *Excl.* Activity 48h prior. **Outcome:** metabolic substrate oxidation and energy expenditure post-exercise	Treadmill; HIIT: 30 min @ 90% VO_2max (1 session), MICT: @ 60% VO_2max.	HIIT showed significantly higher EPOC (~300 kcal) and fat oxidation vs MICT	9/10
5.	Zhang 2017[10]	RCT, 52 women aged 18–22, BMI ≥25, body fat ≥30%, *Excl.* Not specified. **Outcome:** total and regional fat mass changes.	Bike; HIIT: 4 min @ 90% VO_2max + 3 min rest, 3x/week, 12 weeks	HIIT and MICT both significantly reduced fat mass with no significant difference.	10/10
6.	Amuri 2022[26]	RCT, 44 adults (18–50 yrs, BMI 30–55), *Excl.* Prior weight loss programs. **Outcome:** waist/hip circumference changes by gender.	Treadmill; HIIT: 3–7×3 min @ 100% VO_2max + 1.5 min @ 50%; MICT: @ 60%..	Greater waist circumference reduction in men; CRF increased in both groups.	9/10
7.	Hertel 2021[28]	RCT, adults with BMI ≥35–40, *Excl.* Not specified. **Outcome:** body weight, VO_2max, and daily energy expenditure.	Treadmill; HIIT: 4×4 min @ 90–95% HRmax + 3 min recovery, MICT: 35 min @ 70%.	HIIT reduced body weight by ~3 kg more than MICT and improved VO_2max.	10/10
8.	Couvert 2024[19]	Clinical trial, males aged 18–65, BMI 25–35, *Excl.* Unstable weight/diet. **Outcome:** abdominal fat mass.	Bike/treadmill; 12 weeks, 36 sessions. 10×45 sec @ 80–85% HRmax + 90 sec @ 40–45%.	HIIT significantly reduced abdominal fat.	8/10
9.	Putra 2018[15]	Quasi-experimental, 50 obese women aged 50–60, *Excl.* Not specified. **Outcome:** body fat mass.	Bodyweight (wall push-up, knee squat, etc..); 5 exercises × 3 rounds (30s work + 60s rest); 20 min/session, 3×/week, 5 months.	HIIT significantly reduced body fat.	9/9
10.	Darmawati 2015[29]	Quasi, 44 adults; *Excl.* Not specified. **Outcome:** BMI index.	HIIT running: 1.5 min + 3 min active rest × 10 rounds, 50 min/session, 3×/week, 12 sessions.	BMI reduced by 0.42 kg/m² per week.	9/9
11.	Hausswirth 2019[14]	RCT, 23 healthy women aged 20–49, Excl. Hypertension. Outcome: VO_2max and HRmaxz.	Ergometer cycling; 45 min/session @ 90% HRmax; 3×/week for 4 weeks.	Significant weight loss and improved VO_2max.	10/10

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No	Author	Design, Subject & Outcome Measure	Protocol	Conclusion of Result	Risk of Bias
12.	Li 2022[11]	RCT, women aged 18–23, BMI >23, Excl. Men, BMI <23. Outcome: affective response (valence), enjoyment, exertion.	Static cycle, HIIT120: 1 min @ 120% VO_2max + 1.5 min rest, HIIT90: 4 min @ 90% + 3 min rest, Sprint: 6s + 9s rest.	Effective, enjoyable, and time-efficient for body weight control.	10/10
13.	Jiménez 2023[12]	RCT, 83 adults (BMI ≥25 or ≥30), Excl. Weight fluctuation >3kg, diabetes. Outcome: fat-free mass(FFM), energy intake, appetite	Bike; 10×1 min @ 75% HRmax + 1 min @ 50W, 25 min/session.	Preserved lean mass despite calorie deficit, appetite not significantly affected.	8/10
14.	Sun 2021[30]	Clinical, 45 adults aged 18–30, BMI ≥23, Excl. Smokers, alcohol users. Outcome: body weight, BMI, blood pressure, triglycerides, glucose.	HIIT: 10×6s sprint + 9s rest; MICT: 30–60 min @ 50–60% VO_2max.	HIIT + low-carb diet significantly reduced weight, BMI, BP, and improved metabolic profile.	8/10
15.	Herrera 2021[31]	RCT, adults 18–65, post-op recovery, Excl. Complications. Outcome: fat mass, glucose control, HRV, 6MWT, quality of life.	HIIT: 4×60s @ 90% HRmax + 60s rest, + 15 min resistance (50–60% 1RM).	. Improved fat mass, glucose, CRF, and quality of life.	8/10
16.	Bouamra 2022 [32]	RCT, 73 obese sedentary teens (12–14 yrs), Excl. Not specified. Outcome: anaerobic performance, cardiovascular fitness, BMI.	Running: 12×10s @ 80–110% VO_2max + 10s rest, 3–4 sets, 3×/week, 9 weeks.	Reduced fat mass, BMI, improved cardiovascular and anaerobic capacity.	9/10
17.	Reljik 2021[20]	RCT, 163 obese adults (BMI ≥30), Excl. BMI <30, age <18. Outcome: VO_2max, work capacity, psychological well-being.	Bike: 5×1 min @ 80–95% HRmax + 1 min rest; 14 min/session, 2×/week, 12 weeks.	Improved VO_2max and well-being using low-volume HIIT.	10/10
18.	Batittuc 2022[27]	RCT, 36 obese women (BMI 34 ± 3.2); Excl. Diabetes, hypertension, dyslipidemia. Outcome: fat-free mass, fat mass, cardiorespiratory fitness.	Multisport HIIT; 25 min/session, 3×/week, 8 weeks @ 70–85% HRmax.	Increased lean mass and improved body composition.	8/10
19.	Reljik 2020 [18]	RCT, adults (BMI ≥30, high waist circumference); Excl. CVD, cancer, ortho disorders. Outcome: waist circumference, fat-free mass.	Bike: 3×1 min @ 80–95% HRmax + 1 min rest, 14 min/session.	Reduced waist size and preserved lean mass.	9/10
20.	Bnhöof 2022[23]	Clinical, 20 sedentary overweight men aged 30–65, Excl. Insulin use, smoking. Outcome: autonomic cardiac function.	Bike: 4×4 min @ 90% HRmax + 3 min @ 70%, 3×/week, 12 weeks.	Improved cardiac autonomic function without weight loss.	8/10

DISCUSSION

This scoping review (Table 1) indicates that High-Intensity Interval Training (HIIT) is an effective exercise method for reducing body weight, improving Body Mass Index (BMI), and

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enhancing cardiorespiratory fitness in individuals who are overweight or obese. Compared to Moderate-Intensity Continuous Training (MICT) and control groups, HIIT produces more significant improvements in body composition and aerobic capacity.

Types of High Intensity Interval Training.

The types of High-Intensity Interval Training (HIIT) used in the reviewed studies varied in protocol but shared a common principle: alternating periods of high-intensity physical activity with rest or recovery intervals. One study utilized Sprint Interval Training (SIT), involving 6 seconds of activity followed by 9 seconds of rest for 40 sets at an intensity of 120% VO_2max. This protocol was shown to be more effective in reducing body fat compared to Moderate-Intensity Continuous Training (MICT). Based on the findings of this scoping review, several forms and types of exercise were implemented in both HIIT and MICT protocols, including stationary cycling (ergometer), treadmill running, resistance training, and bodyweight exercises.[10]Although the forms of exercise vary, intensity remains the key distinguishing factor between the two approaches. Equipment such as ergometers and treadmills is commonly used due to their ability to precisely control intensity and offer a high level of safety, particularly for individuals with obesity who are at greater risk of musculoskeletal or cardiovascular complications.[11,12, 13, 14]

High-Intensity Interval Training (HIIT) performed at 90–120% of VO_2max has been proven to significantly improve aerobic capacity and fat oxidation.[10,11]Additionally, the combination of resistance and aerobic training, as demonstrated by Khammassi (2020) and Zhang (2017), offers additional benefits such as increased lean body mass and muscle strength, which are particularly relevant for adult and elderly populations.[15],[16] Other studies have also highlighted the effectiveness of bodyweight-based HIIT, such as wall push-ups and chair squats, which can be performed without equipment, making them an affordable and accessible option for community-based interventions.[15,17]

MICT protocols typically involve steady, moderate-intensity exercise performed over a longer duration, such as cycling or walking for 40–60 minutes.[10,18] Overall, these findings suggest that the effectiveness of HIIT does not rely on a specific type of exercise, but rather on the combination of intensity, exercise duration, and recovery periods. This synergy triggers significant physiological adaptations through structured high-intensity intervals and training volume.

Several studies have shown that HIIT enhances the release of lipolytic hormones such as adrenaline and noradrenaline, which play a key role in mobilizing body fat during and after exercise.[18] Furthermore, HIIT induces a greater excess post-exercise oxygen consumption (EPOC) effect compared to moderate-intensity training, leading to prolonged energy expenditure following exercise.[13]

Other observed adaptations include the preservation of fat-free mass during energy deficits.[12] improvements in cardiorespiratory fitness (VO_2max),[19] And positive changes in metabolic parameters such as fasting glucose, triglycerides, and blood pressure.[14,13] These physiological responses demonstrate that HIIT is an effective strategy for weight loss and enhancing metabolic health in individuals who are overweight or obese.

Duration of High-intensity Interval Training

Various studies have demonstrated significant variation in HIIT duration, including session length, weekly frequency, and total intervention period.[20] For example, Zhu applied a Sprint Interval Training (SIT) protocol with a total session duration of approximately 10 minutes, comprising 6 seconds of

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sprinting followed by 9 seconds of rest, repeated 40 times, and conducted over 12 weeks. This protocol proved effective in enhancing the release of lipolytic hormones and reducing fat mass.[21]

Meanwhile, Xu[22] Reported that 30-minute sessions, conducted five times per week over four weeks, significantly reduced body weight and fat mass when combined with an energy-restricted diet. Other studies, such as those by Hausswirth[14] and Bnhöof[23]Implemented longer session durations—ranging from 35 to 45 minutes, three times per week for 4 to 12 weeks—which also showed significant improvements in body composition and cardiovascular function, even without substantial changes in body weight.

A form of HIIT with very short session durations, such as that applied in a study involving 20-minute sessions three times per week over five months, also produced significant reductions in body fat percentage among elderly women with obesity. Based on these findings, it can be concluded that the effective duration of HIIT is flexible, ranging from 10 to 45 minutes per session, with an average session length of approximately 25–26 minutes.

Within this range, HIIT creates a high level of physiological stress, prompting the body to adapt by increasing VO_2max through improvements in the oxygen transport system (heart, blood vessels, mitochondria). It also enhances fat oxidation capacity, primarily through the activation of metabolic enzymes such as CPT-1 and HSL, as well as lipolytic hormones like epinephrine and norepinephrine. These hormones accelerate fat breakdown by stimulating lipolysis, the process by which triglycerides in fat cells are broken down into free fatty acids to be used as energy. Additionally, HIIT increases excess post-exercise oxygen consumption (EPOC), leading to greater oxygen use and elevated fat oxidation even after the exercise session has ended. [24]

Excess post-exercise oxygen consumption (EPOC) refers to a condition in which the body continues to burn calories after exercise. This effect is typically achieved at an intensity range of 80%–90% of VO_2max. However, performing HIIT too frequently (more than five times per week) may disrupt homeostasis, reduce long-term performance, and increase the risk of chronic inflammation or musculoskeletal injury. These outcomes depend on training intensity, program goals, and individual characteristics. This flexibility makes HIIT an efficient and adaptable approach for weight loss in individuals who are overweight or obese (Jiang, 2024).[13]

Exercise Intensity

Exercise intensity is a key variable in High-Intensity Interval Training (HIIT) protocols, with a wide range of applications observed across studies listed in Table 2. Most studies set intensity between 75%–120% of VO_2max or HRmax, tailored to intervention goals and participant characteristics. For instance, Zhu (2024)[21] used an extreme intensity of 120% VO_2max in a Sprint Interval Training (SIT) protocol, while Khammasi (2020)[25] Applied 75–90% VO_2max combined with resistance training. Xu 2022[22] and Reljic 2020[18] Adopted 80–95% HRmax during intervals, with recovery at 50–70% HRmax. Jiang 2024[13] Implemented a single high intensity at 90% VO_2max, whereas Jiménez 2023[12] Used 75% of peak power targeting 85–90% HRmax, preserving muscle mass without significantly reducing VO_2max under caloric deficit. Intensity adjustments were also made via active/recovery interval timing, as seen in Hausswirth 2019[14], which reported significant reductions in body fat and waist circumference, and in Li 2022[11], which applied 90–95% HRmax or VO_2max with variable interval durations, effectively reducing body weight and enhancing exercise enjoyment.

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These studies emphasize that the effectiveness of High-Intensity Interval Training (HIIT) is highly influenced by the regulation of exercise intensity, both absolute and relative, which facilitates optimal physiological adaptations. These include improvements in aerobic capacity, enhanced fat oxidation, and reductions in fat mass, without the need for prolonged exercise durations. Specifically, intensity zones of 85–95% HRmax or >90% VO_2max have been identified as optimal for stimulating favorable physiological responses, such as increased VO_2max, enhanced fat oxidation, improved insulin sensitivity, and better lipid profiles.

Short-duration yet high-intensity HIIT protocols, such as ten 1-minute repetitions, have been shown to elicit substantial metabolic stimulus comparable to longer-duration moderate-intensity continuous training (MICT). The structuring of active intervals and recovery periods also plays a critical role in optimizing adaptive responses through complex physiological mechanisms. These include elevated release of lipolytic hormones (norepinephrine and epinephrine), significant increases in excess post-exercise oxygen consumption (EPOC) at 80%–90% VO_2max intensities, which prolong post-exercise caloric expenditure, and metabolic and mechanical stress that promote muscle tissue repair, mitochondrial biogenesis, and cardiovascular adaptation.

Furthermore, high-intensity exercise provides an anabolic stimulus that contributes to the retention or increase of muscle mass, even under conditions of caloric deficit, enhancing the overall efficacy of HIIT as a weight management and metabolic health strategy.[21,13,14, 26,12]

Implications

This scoping review confirms that High-Intensity Interval Training (HIIT) is an effective and adaptable intervention for improving cardiorespiratory fitness, reducing body fat, and enhancing metabolic health in individuals with overweight and obesity. Despite differences in session duration (10–45 minutes) and frequency (2–5 times/week), HIIT consistently proved effective across studies, highlighting its flexibility for various ages, sexes, clinical conditions, and fitness levels. These findings support its application in fitness programs, rehabilitation, and public health policy as a non-pharmacological strategy for preventing and managing chronic metabolic diseases.

The effectiveness of HIIT, even with short-duration protocols, suggests potential for improving long-term adherence. For instance, several practical protocols include: 5 × 1-minute intervals at 80–95% HRmax with 1-minute rest (total duration: 14 minutes)[20] Jiménez 2023[12]: 10 × 1 minute at 75% peak power with 1-minute active recovery (total: 25 minutes); and Batitucci 2022[27]3 sessions/week, 25 minutes per session at 70–85% HRmax. These examples highlight HIIT's feasibility and structured implementation.

Therefore, HIIT can be recommended as an integral component of evidence-based lifestyle interventions. However, its application must be individualized in terms of intensity, accompanied by proper warm-up and cool-down routines, gradual progression, and professional supervision to ensure safety and effectiveness. Individualized HIIT dosing is essential for optimizing physiological outcomes and minimizing injury risk, particularly in individuals with overweight and obesity. Several reviewed studies support the use of physiological parameters such as VO_2max or HRmax for tailoring intensity. For example, studies[20],[13] Set exercise intensity based on cardiopulmonary test results, gradually increasing up to 95% HRmax or using 90% VO_2max to promote optimal cardiometabolic adaptation.

Limitation

This scoping review has several limitations, notably the heterogeneity of intervention protocols—including

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differences in exercise type, intensity, frequency, and duration—which hinders direct comparisons and limits generalizability. Participant diversity in age, sex, and obesity levels also adds variability to physiological responses. The assessed outcomes also varied widely, ranging from body composition to cardiometabolic and psychological variables related to health-related quality of life (HR-QOL) and affective responses (e.g., valence, enjoyment, and pleasure)[25],[11],[18], making it difficult to draw aggregated conclusions. Most of the included studies were of short duration and did not evaluate long-term effects, with limited reporting on adherence and adverse events, both of which are essential for assessing the safety of the intervention.[11,18,25]

Furthermore, potential publication bias and limited attention to psychosocial and socioeconomic factors weaken the strength of evidence. Future studies should use standardized protocols, longer interventions, and consider contextual variables to better assess HIIT's long-term effectiveness in reducing body fat in overweight and obese individuals.

CONCLUSION

This scoping review shows that High-Intensity Interval Training (HIIT) is an effective and efficient intervention for reducing body fat and improving cardiorespiratory fitness. Analysis of 20 studies highlights that optimal HIIT protocols involve 80–95% VO_2max or HRmax, with 30-second to 4-minute repetitions, interspersed with 1–3 minutes of recovery. Effective training requires 2–4 sessions weekly for 4–12 weeks, with session durations ranging from 14 to 45 minutes. Protocols that resulted in significant reductions in body fat and improvements in body composition often targeted an energy expenditure of approximately ±300 kcal per session, demonstrating elevated excess post-exercise oxygen consumption (EPOC) following 28-minute sessions, and a greater reliance on fat as an energy substrate compared to moderate-intensity continuous training (MICT), these findings may serve as a foundation for clinical practitioners and fitness professionals in designing evidence-based exercise programs tailored to individuals with excess body weight or obesity.

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