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The effects of high intensity interval training (HIIT) on insulin sensitivity and metabolic health in adults with prediabetes.

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Abstract

Background. Prediabetes elevates lifetime risk of type 2 diabetes and cardiovascular disease. Moderate-intensity continuous training (MICT) improves metabolic health but is limited by time demands. High-intensity interval training (HIIT) is a time-efficient alternative that can match or exceed MICT benefits for insulin sensitivity and glycemic control, yet optimal protocols remain unclear.

Aim. To evaluate the effects of HIIT on insulin sensitivity and metabolic health in adults with prediabetes.

Material and methods. PubMed, Scopus and Google Scholar were searched for English-language peer-reviewed studies (2015–2026) on HIIT and insulin sensitivity or metabolic outcomes in adults with prediabetes. Eligible randomised controlled trials, controlled trials, observational studies and reviews were screened by title/abstract and full text after duplicate removal; reference lists were also hand-searched.

Results. HIIT improved muscle and whole-body insulin sensitivity, reduced fasting glucose and HbA1c, and increased VO_2max, often comparably to MICT despite lower time commitment. Higher-volume protocols yielded greater HbA1c reductions; greater volume also strengthened benefits for fasting glucose, insulin and HOMA-IR. Combined HIIT plus diet produced the best BMI outcomes, while clamp-derived insulin sensitivity improvements partly depended on ≥3 % weight loss. Superiority over MICT varied by outcome and protocol.

Conclusions. HIIT delivers meaningful gains in insulin sensitivity and metabolic health that are frequently comparable to MICT with substantially less time. Larger standardised trials are needed to define optimal, individualised prescriptions for type 2 diabetes prevention.

Key words: high-intensity interval training, HIIT, prediabetes, pre-diabetes, impaired glucose tolerance, insulin sensitivity, insulin resistance.

1. Introduction

Prediabetes is defined by blood-glucose concentrations that are elevated above the normal range yet remain below the formal diagnostic thresholds for type 2 diabetes (T2D). It occupies a pivotal intermediate position on the continuum of progressive metabolic dysfunction and is characterised by the presence of impaired fasting glucose, impaired glucose tolerance, or an intermediate elevation of glycated haemoglobin (HbA1c). These glycaemic abnormalities are tightly linked to both peripheral and hepatic insulin resistance, creating a physiological milieu that accelerates further metabolic deterioration. Individuals who meet diagnostic criteria for prediabetes confront a markedly elevated lifetime probability of converting to overt T2D; they also experience substantially higher rates of atherosclerotic cardiovascular disease, microvascular complications (retinopathy, nephropathy and neuropathy) and all-cause mortality. Parallel secular trends of rising overweight, obesity and habitual physical inactivity have driven a continuous upward trajectory in the global prevalence of prediabetes, imposing an escalating public-health and economic burden. In this context there is an urgent requirement for interventions that are simultaneously effective, scalable and sustainable, and that are capable of restoring insulin sensitivity and improving broader metabolic health before the transition to irreversible diabetes becomes established.

Lifestyle modification continues to constitute the foundational pillar of prediabetes management. Within the spectrum of lifestyle strategies, structured physical exercise has repeatedly demonstrated its capacity to enhance insulin sensitivity, optimise glycaemic control, promote favourable shifts in body composition and attenuate overall cardiometabolic risk. The traditional exercise prescription—moderate-intensity continuous training (MICT)—typically comprises prolonged bouts of steady-state aerobic activity performed at a constant sub-maximal intensity. Robust evidence confirms that MICT yields clinically meaningful reductions in fasting glucose, post-prandial glycaemia, HbA1c and surrogate indices of insulin resistance. Nevertheless, the considerable time investment demanded by conventional MICT programmes frequently undermines long-term adherence, particularly among working-age adults and among those who identify lack of time as the principal barrier to regular physical activity.

High-intensity interval training (HIIT) has consequently emerged as a compelling time-efficient alternative. HIIT is characterised by brief, repeated efforts performed at vigorous or near-maximal intensity, interspersed with periods of low-intensity active recovery or complete rest.

Because the cumulative volume of high-intensity work can be concentrated into substantially shorter session durations than those required for volume-matched continuous exercise, HIIT directly addresses the principal practical limitation of traditional training while still delivering a potent physiological stimulus. A growing body of experimental and observational evidence indicates that HIIT can elicit adaptations in cardiorespiratory fitness, insulin sensitivity and overall metabolic health that are at least comparable—and in selected outcomes superior—to those produced by MICT (Mensberg et al., 2025).

Quantitative syntheses reinforce these observations. Meta-analyses have established that HIIT reduces insulin resistance and improves multiple markers of glucose regulation, with the largest effect sizes observed in populations already exhibiting impaired metabolic control (Jelleyman et al., 2015; Cassidy et al., 2017). More recent systematic reviews and meta-analyses that focus specifically on prediabetes or on low-volume HIIT protocols further confirm beneficial effects on fasting glucose, HbA1c, insulin-sensitivity indices and related cardiometabolic risk factors (De Nardi et al., 2018; Lu et al., 2025; Li et al., 2026). Randomised controlled trials conducted exclusively in adults with prediabetes provide additional mechanistic and clinical support. Low-volume HIIT has been shown to augment peripheral insulin sensitivity and to induce favourable molecular adaptations within skeletal muscle (Mensberg et al., 2025). Head-to-head comparisons of differing HIIT dosages and modalities against continuous training have demonstrated improvements in glycaemic control, insulin-resistance indices and circulating hormonal mediators such as irisin and preptin (RezkAllah et al., 2019; Safarimosavi et al., 2021). Complementary trials have documented favourable changes in body composition, glycolipid metabolism, cardiorespiratory fitness and composite diabetes-risk scores, with certain protocols revealing additive benefits when HIIT is combined with concurrent dietary intervention (Chen et al., 2025; Tene et al., 2026).

Despite this expanding evidence base, important knowledge gaps persist. Existing studies exhibit marked heterogeneity with respect to HIIT protocol architecture (interval duration, relative intensity, work-to-rest ratio and weekly training volume), total intervention length, the laboratory methods employed to quantify insulin sensitivity (HOMA-IR, Matsuda index, Cederholm index or gold-standard clamp techniques), and the presence or absence of concomitant dietary restriction. As a result, the precise magnitude of benefit attributable to HIIT, the optimal exercise prescription for adults with prediabetes, and the relative contribution of distinct molecular pathways remain incompletely defined. A focused narrative synthesis is

therefore warranted to integrate the findings of recent randomised trials and systematic reviews, to evaluate specifically the effects of HIIT on insulin sensitivity and metabolic health in adults with prediabetes, and to derive practical implications that can inform both clinical decision-making and public-health recommendations.

Aim of the study.

This narrative review aims to critically examine the effects of high-intensity interval training on insulin sensitivity and key metabolic health outcomes in adults with prediabetes. By synthesizing evidence from both primary trials and higher-level reviews, the review seeks to clarify the strength and consistency of current findings, highlight underlying mechanisms, and outline directions for future research and implementation.

2. Research materials and methods

A systematic literature search was conducted to identify relevant studies examining the effects of high-intensity interval training (HIIT) on insulin sensitivity and metabolic health outcomes in adults with prediabetes. The electronic databases PubMed, Scopus, and Google Scholar were systematically searched using a combination of terms including: “high-intensity interval training”, “HIIT”, “prediabetes”, “pre-diabetes”, “impaired glucose tolerance”, “insulin sensitivity”, and “insulin resistance”. These terms were combined using Boolean operators (AND/OR) to optimise search sensitivity and specificity.

The search was limited to peer-reviewed articles published in the English language between 2015-2026, with particular emphasis placed on more recent publications (2020–2026) to capture the most current evidence. Eligible study designs comprised randomised controlled trials (RCTs), controlled trials, prospective and retrospective observational studies, as well as systematic reviews and narrative reviews. Studies were required to investigate HIIT interventions (or closely related high-intensity intermittent exercise protocols) and report outcomes related to insulin sensitivity, glycemic control, or broader metabolic health parameters in adult populations with prediabetes or closely related metabolic risk states.

Following the initial database search, automatic removal of duplicate records was performed. The remaining titles and abstracts were independently screened by the authors against the predefined inclusion and exclusion criteria. Full-text articles of potentially eligible studies were subsequently retrieved and assessed for final inclusion. Reference lists of included

articles and relevant reviews were also manually examined to identify any additional studies that may have been missed during the electronic search.

3. Research results

3.1 Overview of representative studies

Table 1 summarizes six representative studies illustrating the range of HIIT protocols and outcomes examined in this review, one for each of the topics addressed in the following subsections.

Table 1. Summary of representative studies examining the effects of HIIT on insulin sensitivity and metabolic health in adults with prediabetes.

Study	**Design and population**	**Intervention or Comparator**	**Key findings**
Mensberg et al., 2025	12-week RCT; 70 adults with prediabetes	LV-HIIT vs walking vs HIIT+walking vs control	↑muscle SI (HIIT, HIIT+walk); ↑whole-body SI (walk, HIIT+walk)
RezkAllah & Takla, 2019	12-week RCT; 60 young, overweight adults with prediabetes	LV-HIIT vs HV-HIIT vs control	↓FBG, HbA1c both vs control; HV-HIIT > LV-HIIT for HbA1c
Chen et al., 2025	12-week RCT; 71 adults with prediabetes	HIIT vs MICT	BMI ↓ both; MICT > visceral fat, body fat%, TG loss; HIIT > lean mass loss
Lu et al., 2025	Meta-regression; LV-HIIT protocols	Dose-response (sessions/interval duration)	↑volume → more benefit for FBG, FPI, HOMA-IR, less benefit for HbA1c

Tene et al., 2026	13-week RCT; 68 adults with prediabetes	HIIT vs diet vs HIIT+diet	HIIT+diet: best BMI outcome; VO_2max ↑ (HIIT, HIIT+diet)
Mora-Rodriguez et al., 2020	16-week RCT; 96 adults with MetS, prediabetes, abdominal obesity	Aerobic interval training vs sedentary counseling	HOMA2 ↓ only with exercise; CSI ↑ only with weight loss ≥3%

Abbreviations: CSI, clamp-derived insulin sensitivity index; FBG, fasting blood glucose; FPI, fasting plasma insulin; HIIT, high-intensity interval training; HOMA-IR, homeostatic model assessment of insulin resistance; HOMA2, updated computer-based homeostatic model assessment; HV, high-volume; LV, low-volume; MetS, metabolic syndrome; MICT, moderate-intensity continuous training; RCT, randomized controlled trial; SI, insulin sensitivity; TG, triglycerides; VO_2max, maximal oxygen consumption

3.2 Effects of HIIT on insulin sensitivity in prediabetes

In a 12-week randomized controlled trial, 70 adults with prediabetes were allocated to one of four arms: low-volume high-intensity interval training (LV-HIIT) consisting of three 20-second cycle sprints performed three times per week, a walking intervention targeting more than 10 000 steps per day, a combined HIIT-plus-walking programme, or a no-exercise control group (Table 1). Relative to the control condition, both the HIIT-alone and the combined HIIT-plus-walking interventions produced statistically significant improvements in skeletal-muscle insulin sensitivity (18.5 % and 15.7 %, respectively), whereas the walking-only arm did not elicit a comparable change. In contrast, whole-body insulin sensitivity increased significantly with walking alone (42.3 %) and with the combined HIIT-plus-walking protocol (28.0 %), but not with HIIT performed in isolation (Mensberg et al., 2025).

These clinical observations are reinforced by molecular-level evidence from complementary investigations. High-intensity exercise has been linked to a reduction in skeletal-muscle inositol hexakisphosphate kinase 1 (IP6K1) protein content, elevated Akt phosphorylation, and suppressed hepatic glucose production, resulting in a more pronounced improvement in insulin sensitivity than that achieved by continuous moderate-intensity exercise (Naufahu et al., 2018). Parallel work has shown that as little as two weeks of sprint-interval training (SIT) can decrease

pancreatic fat accumulation and enhance beta-cell function irrespective of baseline glucose-tolerance status, producing outcomes comparable to those of longer MICT programmes (Heiskanen et al., 2018). The influence of SIT on intramyocellular lipid content, however, remains incompletely characterized (Sjöros et al., 2019). In a separate trial examining HIIT with or without berberine supplementation, both exercise arms lowered circulating high-sensitivity C-reactive protein (hs-CRP), interleukin-1β, insulin, fasting glucose, and HOMA-IR. Low-compression HIIT alone additionally reduced the non-coding RNA H19 relative to baseline, while the combination of low-compression HIIT plus berberine uniquely produced significant reductions in absolute fat mass and body-fat percentage (Nikseresht et al., 2024).

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3.3. Effects on glycemic control and glucose regulation

A 12-week randomized controlled trial conducted in 60 young, overweight adults with prediabetes directly compared two distinct HIIT protocols against a no-exercise control, with all participants adhering to a low-calorie diet. The low-volume HIIT (LV-HIIT) arm performed 10 × 1-minute intervals at 90 % of maximal heart rate (approximately 25 minutes per session), whereas the high-volume HIIT (HV-HIIT) arm completed 4 × 4-minute intervals at the same relative intensity (approximately 40 minutes per session); both protocols were delivered three times weekly (Table 1). Relative to the control condition, both HIIT interventions produced statistically significant reductions in HbA1c and fasting blood glucose (FBG). The magnitude of HbA1c improvement was substantially greater with HV-HIIT than with LV-HIIT (26.07 % versus 14.50 %), although the corresponding between-protocol difference for FBG (17.80 % versus 13.22 %) did not reach statistical significance (RezkAllah & Takla, 2019).

Broader quantitative syntheses corroborate these findings. Meta-analyses of HIIT interventions have consistently demonstrated meaningful reductions in both FBG and HbA1c when compared with non-exercise control conditions, with the largest effect sizes observed among individuals who are overweight or obese or who already have type 2 diabetes (Jelleyman et al., 2015; Lu et al., 2025). A narrative review reached congruent conclusions regarding glucose regulation: a single bout of HIIT attenuated postprandial glucose excursions relative to seated rest and produced a modestly greater acute effect than an energy-matched bout of moderate-intensity continuous training (MICT). Over multi-week training periods, HIIT yielded an average absolute reduction of 0.47 percentage points in HbA1c versus control, an improvement that was

comparable in size to that typically reported with MICT (Cassidy et al., 2017). In contrast, a more recent systematic review focused specifically on adults with prediabetes found that the relative efficacy of HIIT versus MICT varied by outcome. MICT conferred a small advantage for fasting glucose, HIIT was superior for 2-hour postprandial glucose and cardiorespiratory fitness, and no significant differences emerged between the two modalities for HbA1c or body-mass index (Li et al., 2026).

3.4. HIIT vs. MICT

The effects of high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) on body composition, glycolipid metabolism, and cardiopulmonary function were directly compared in a 12-week randomized controlled trial involving 71 middle-aged adults (45–59 years) with prediabetes. Participants were assigned either to a HIIT protocol consisting of 10 × 1-minute intervals performed at 75–90 % of peak heart rate or to a MICT protocol of 50 minutes of continuous exercise at 55–70 % of peak heart rate. Both interventions produced significant reductions in body-mass index. However, only the MICT group achieved a statistically significant improvement in waist-to-hip ratio and demonstrated more pronounced decreases in visceral adipose tissue, total body-fat percentage, and circulating triglycerides. In contrast, the HIIT group experienced a greater loss of lean tissue and skeletal-muscle mass. Markers of glycemic control—including fasting blood glucose, 2-hour post-load glucose, and HbA1c—as well as peak oxygen uptake improved to a similar extent in both arms, with no statistically significant between-group differences observed (Chen et al., 2025).

Complementary evidence from additional studies indicates that HIIT and MICT (or traditional continuous aerobic exercise) generally elicit comparable improvements in insulin sensitivity or reductions in insulin resistance among individuals with prediabetes or obesity, with most trials reporting no significant superiority of one modality over the other (Safarimosavi et al., 2021; Ryan et al., 2020; Badaam & Zingade, 2021). A meta-analysis restricted to trials conducted in populations with prediabetes or type 2 diabetes further supports this pattern: while HIIT produced a significantly greater increase in maximal oxygen uptake (VO_2max) relative to MICT, no meaningful differences emerged between the two training approaches for other cardiometabolic endpoints (De Nardi et al., 2018).

3.5. Dose-response: protocol, intensity and volume

Evidence from controlled trials indicates that high-volume high-intensity interval training (HV-HIIT) produces a significantly greater reduction in HbA1c than low-volume HIIT (LV-HIIT) when both are performed over comparable intervention periods (RezkAllah & Takla, 2019). Complementary dose–response insights have been obtained through meta-regression analyses focused exclusively on LV-HIIT protocols (Table 1). These analyses demonstrate that higher weekly training volumes are associated with more pronounced improvements in fasting blood glucose (FBG), fasting plasma insulin (FPI), and the homeostatic model assessment of insulin resistance (HOMA-IR). Paradoxically, the same increase in volume is linked to a comparatively smaller improvement in HbA1c (Lu et al., 2025), suggesting that the relationship between exercise dose and glycemic outcomes is not uniform across all markers of glucose regulation.

Further support for the efficacy of low-volume approaches comes from direct comparisons of sprint-interval training (SIT) with traditional moderate-intensity continuous training (MICT). In one study, both modalities elicited identical 19 % increases in peak oxygen uptake (VO_2peak) and comparable enhancements in insulin sensitivity, even though the SIT protocol required only one-fifth of the total exercise volume and time commitment of MICT (Gillen et al., 2016). Likewise, a ten-week programme of low-volume high-intensity interval walking—an accessible modality particularly well suited to older adults—produced significant reductions in fasting glucose and insulin, improved overall glycemic control and insulin sensitivity, and raised VO_2peak in older individuals with prediabetes (Bartlett et al., 2020). Collectively, these findings underscore that meaningful metabolic benefits can be achieved with relatively modest training volumes, provided the intensity of the work intervals is sufficiently high.

3.6. Body composition and cardiorespiratory fitness

The independent and combined effects of high-intensity interval training (HIIT) and a hypocaloric dietary intervention on body composition and cardiorespiratory fitness were systematically examined in a 13-week randomized controlled trial that enrolled 68 adults diagnosed with prediabetes. Study participants were randomly allocated to one of three parallel intervention arms: a HIIT-only programme, a hypocaloric-diet-only programme, or a combined regimen that integrated both HIIT and caloric restriction. Maximal oxygen uptake (VO_2max), a key index of cardiorespiratory fitness, increased substantially in the two groups that performed

HIIT. In the HIIT-only arm, mean VO_2max rose from 21.30 to 23.56 $mL \cdot kg^{-1} \cdot min^{-1}$, while the combined HIIT-plus-diet arm showed a comparable rise from 21.27 to 24.02 $mL \cdot kg^{-1} \cdot min^{-1}$. By contrast, the diet-only group exhibited virtually no change, with values remaining essentially stable (21.65 to 21.76 $mL \cdot kg^{-1} \cdot min^{-1}$). Importantly, the addition of dietary restriction to the HIIT protocol conferred no incremental benefit for aerobic capacity beyond that already achieved by HIIT performed in isolation.

Body-composition outcomes, however, followed a different pattern. Improvements in body-mass-index (BMI) category were most pronounced under the combined intervention. Although the three groups began the trial with statistically similar baseline BMI distributions, 60.8 % of participants assigned to HIIT plus diet achieved a normal BMI classification by the end of the 13-week period. This proportion was markedly higher than the 34.8 % observed in the HIIT-only arm and the 31.8 % recorded in the diet-only arm (Tene et al., 2026).

These results are consistent with earlier comparative work that directly contrasted HIIT with moderate-intensity continuous training (MICT). In that trial, both exercise modalities produced similar absolute gains in peak oxygen uptake. Nevertheless, the continuous-training protocol elicited greater reductions in visceral adipose tissue volume and in overall body-fat percentage, whereas the interval-training protocol was associated with a more pronounced decline in lean tissue mass and skeletal-muscle mass (Chen et al., 2025). Taken together, the available evidence indicates that HIIT is a potent stimulus for improving aerobic fitness, yet the most favourable shifts in body-composition phenotype appear to require the concurrent application of caloric restriction.

3.7. Is the insulin-sensitivity benefit weight-loss dependent?

In a 16-week randomized controlled trial involving 96 adults who concurrently presented with metabolic syndrome, prediabetes and abdominal obesity, participants were assigned either to an aerobic-interval-training programme (EXER) or to a sedentary lifestyle-counseling control condition (CONT) (Table 1). Despite a measurable reduction in trunk fat mass and a significant improvement in the updated homeostatic model assessment of insulin resistance (HOMA2) within the exercise arm relative to control, the gold-standard, clamp-derived insulin-sensitivity index (CSI) showed no overall improvement with training. Both groups experienced only modest and statistically comparable weight loss of 1–2 %. Critically, participants who

succeeded in losing at least 3 % of their initial body weight—regardless of whether they had been assigned to exercise or to counseling—exhibited clear improvements in CSI, whereas those whose weight reduction remained below this threshold did not. Parallel analyses further demonstrated that the magnitude of trunk-fat reduction was closely correlated with favourable changes in both CSI and HOMA-IR (Mora-Rodriguez et al., 2020).

Complementary evidence from an energy-expenditure-matched comparison of moderate-intensity continuous training (MICT) and high-intensity interval training (HIIT) in adults with prediabetes reinforces the notion that absolute weight loss need not differ substantially for insulin-sensitivity gains to occur. In that trial both exercise intensities produced essentially equivalent improvements in insulin sensitivity, accompanied by only a trivial between-group difference in body-mass reduction of approximately 0.8 kg (Heiston et al., 2020). An alternative conceptual framework proposes that the insulin-sensitizing effect of exercise may be less dependent on lasting structural adaptations and more attributable to the repeated, transient physiological stimulus of each training session. Acute improvements in insulin action following a single bout of exercise can persist for up to 72 hours, and the magnitude of this residual benefit is greatest among previously untrained individuals and those who begin with the lowest baseline insulin sensitivity (DiMenna & Arad, 2020). Collectively, these observations suggest that while meaningful weight loss amplifies the improvement in clamp-derived insulin sensitivity, regular exercise itself retains an independent, albeit shorter-lived, capacity to enhance metabolic control.

4. Discussion

Overall, the reviewed evidence supports HIIT as an effective, time-efficient way to improve insulin sensitivity and metabolic health in adults with prediabetes, although the size and consistency of this benefit vary by outcome, protocol, and how insulin sensitivity is measured. Whole-body and muscle-specific measures did not always improve together, and combining HIIT with continuous low-intensity activity sometimes worked better than either alone (Mensberg et al., 2025). Training volume also mattered, though not consistently, since higher volumes strengthened some outcomes while weakening others (RezkAllah & Takla, 2019; Lu et al., 2025). Even low-volume, less demanding protocols produced meaningful benefit,

suggesting that a high training volume may not be necessary to achieve metabolic benefits (Bartlett et al., 2020).

HIIT does not appear to be uniformly superior to moderate-intensity continuous training: for several outcomes, particularly cardiorespiratory fitness and postprandial glucose control, HIIT held a clear advantage, whereas MICT retained an edge for fasting glycemia and for reductions in visceral fat and triglycerides, and was associated with smaller reductions in lean mass and muscle mass than HIIT in one trial (Chen et al., 2025; Li et al., 2026; Cassidy et al., 2017). HIIT is therefore best understood as a time-efficient alternative to MICT rather than a wholesale replacement, with the preferred approach depending on which outcome matters most for a given patient.

These effects are biologically plausible, with proposed mechanisms including improved skeletal muscle insulin signaling, reduced pancreatic fat, better beta-cell function, and reduced low-grade inflammation (Naufahu et al., 2018; Heiskanen et al., 2018; Nikseresht et al., 2024). Weight loss appears to explain only part of the benefit, since some insulin sensitivity measures improved only alongside meaningful weight loss while others improved with exercise regardless, and comparable gains were seen even when HIIT and MICT were matched for energy expenditure (Mora-Rodriguez et al., 2020; Heiston et al., 2020). These benefits also appear to fade within days of stopping training, underlining the importance of regular, sustained activity for maintaining metabolic improvements (DiMenna & Arad, 2020).

These conclusions are tempered by considerable heterogeneity across the underlying studies, including differences in protocol design, in the methods used to quantify insulin sensitivity, and in sample size and composition, along with a continued lack of long-term data on adherence outside supervised settings. Much of the meta-analytic evidence is also drawn from populations that include individuals with established type 2 diabetes or overweight/obesity rather than focusing specifically on prediabetes, with larger benefits reported in these groups (Jelleyman et al., 2015; Lu et al., 2025). Some trials directly comparing HIIT and MICT likewise included participants with both prediabetes and type 2 diabetes (De Nardi et al., 2018), making it difficult to determine how much of the reported benefit applies specifically to earlier-stage, prediabetic populations.

5. Conclusions

High-intensity interval training (HIIT) consistently produces meaningful improvements in insulin sensitivity and broader metabolic health among adults with prediabetes. These benefits are frequently comparable in magnitude to those achieved with moderate-intensity continuous training (MICT), yet they are obtained with substantially lower total exercise time—an important practical advantage for long-term adherence. The relative superiority of HIIT over MICT is not uniform across all outcomes; rather, it depends on the specific endpoint under consideration, with some parameters (such as cardiorespiratory fitness) favouring HIIT and others showing equivalence or modest advantages for continuous training. Mechanistic evidence suggests that the observed benefits arise from adaptations in skeletal muscle (including enhanced insulin signalling and mitochondrial function), favourable changes in pancreatic fat and beta-cell function, and reductions in systemic inflammation. Collectively, these findings underscore the value of sustained, regular HIIT participation. Nevertheless, substantial heterogeneity in protocol design, training volume, and outcome assessment across existing studies means that larger, more rigorously standardized trials are still required before an optimal, individualized HIIT prescription can be confidently recommended for the prevention of type 2 diabetes in this high-risk population.

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