

HIGH-INTENSITY INTERVAL TRAINING AND ITS IMPACT ON HEALTH – A REVIEW

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ABSTRACT High-intensity interval training (HIIT) consists of alternating periods of intensive aerobic exercise with periods of passive or active moderate/mild intensity recovery. The purpose of the present study is to motivate other researchers to conduct a study on High-intensity interval training (HIIT) and spread knowledge about this training. this article was compiled through previous studies which are available on the internet, in theses, and in books. Search through Electronic databases to identify all related articles on HIIT and its impact or effect on the human body. Through this research or investigation, we have found that HIIT has lots of benefits like burning calories, improving muscle mass, improving endurance, maintaining a healthy heart, helping in maintaining diabetes, improving aerobic capacity and anaerobic capacity, and improving explosive strength. From this study, it was concluded that High-intensity interval training (HIIT) is very beneficial to maintaining good health, and it's recommended to perform any kind of High-intensity interval training (HIIT) at least twice a week.

Keywords- High-intensity interval training, HIIT, Exercise, Training program

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Introduction

High-intensity interval training (HIIT) consists of alternating periods of

intensive aerobic exercise with periods of passive or active moderate/mild intensity recovery (Fox et al., 1973). The principal

interest lies in the fact that it offers the possibility to maintain high-intensity exercise for far longer periods than during continuous exercise. Therefore, HIIT elicits a greater training stimulus, which further improves maximal aerobic capacity. The central and peripheral adaptations induced by HIIT have been clearly shown in healthy subjects. In addition, HIIT appears to be of particular interest since high-intensity exercise (85–100%) of peak oxygen uptake [VO_{2peak}], apart from its greater ability to improve the limiting factors. VO_{2peak} , and. VO_{2peak} itself, is also more effective than moderate-intensity continuous exercise (MICE) in improving cardiovascular risk factors. The clinical implications appear to be major since. (i) VO_{2peak} is a strong independent predictor of morbimortality in patients with coronary artery disease (CAD) and heart failure (HF); and (ii) the control of risk factors such as diabetes, dyslipidaemia, being overweight and hypertension is a fundamental component of secondary prevention in these patients (Guiraud et al., 2012). Early development of cardiometabolic risk factors in youth has been associated with an increased risk of premature mortality. Insufficient physical activity, overweight, and obesity, poor diet, low cardiorespiratory fitness, hypertension, chronic inflammation, and

dyslipidaemia are evident in youth and can track into adulthood. Adolescence, in particular, is a key stage in the development of healthy behaviour. According to a systematic review of 26 cross-sectional studies by Dumith et al., physical activity decreases by 65 % (on average) during the adolescent years. Given the rising burden of chronic disease, it is essential to implement strategies to improve cardiometabolic health in youth (Logan et al., 2014). As an alternative to continuous aerobic exercise, high-intensity interval training (HIIT) has recently gained popularity. These intense sprint bouts of short duration with recovery intervals at low-to-moderate intensity have been espoused as a time-efficient method to achieve the health benefits of exercise since lack of time has often been cited as a key barrier to exercise participation. Furthermore, HIIT has been shown to improve the cardiometabolic risk profile to a greater extent than continuous aerobic exercise in healthy, obese, type 2 diabetic individuals, as well as being implemented as a more effective method in restoring vascular function in heart disease patients. Emerging research is uncovering the benefits of vigorous-intensity physical activity in the regulation of healthy metabolic profiles regardless of weight loss and energy expenditure, indicating

underlying metabolic mechanisms sensitive to high intensity body movement (Logan et al., 2014).

Methods

Electronic databases were searched to identify all related articles on HIIT and fat mass. Stratified analysis was performed using the nature of HIIT (cycling versus running, target intensity), sex and/or body weight, and the methods of measuring body composition. Heterogeneity was also determined.

Importance of HIIT

Interval training can be defined simply as discontinuous, periodic (demanding) exercise loads separated by periods of recovery. However, the intensity level which defines an exercise as “high intensity” varies in different research publications. There is no accurate consensus threshold from which point the training load is categorized as ‘close to the maximal effort’. In the literature the terms “high intensity” or “vigorous” are used in a fairly diverse manner ranging from an effort as low as 65% of the peak power output up to 170% of the measured power at $V\cdot O_{2max}$. Even the dimension of reference intensity can be different in publications since peak power output percentage (PPO%), power ($PV\cdot O_{2max}\%$) or velocity ($vV\cdot O_{2max}\%$) percentage of

the $V\cdot O_{2max}$, maximal heart rate percentage (HRmax%) and critical/maximal velocity percentage (Vmax%) are all commonly used, but, vary greatly. Using different reference dimensions can be problematic because the same numerical values may indicate a different metabolic demand with a different dimension. Most frequently, intensity levels are referred to the work load corresponding to the $\geq 90\%$ of maximal aerobic capacity (or 90–95% of the peak HR) or maximal effort. Buchheit and Laursen noted nine characteristics which can precisely describe HIT exercise including interval intensity and duration, relief interval intensity and duration, exercise modality, number of reps and series, and finally between series recovery duration and intensity.

Benefits of HIIT

HIIT is a time-efficient strategy to decrease fat-mass deposits, including those of abdominal and visceral fat mass (Maillard et al., 2018)

1. HIIT Can Burn a Lot of Calories in A Short Amount of Time

You can burn calories quickly using HIIT (Falcone et al., 2015; Wood et al., 2016). One study compared the calories burned during 30 minutes each of HIIT, weight training, running, and biking. The researchers found that HIIT burned 25–30% more calories than the other forms

of exercise (Falcone et al., 2015) In this study, a HIIT repetition consisted of 20 seconds of maximal effort followed by 40 seconds of rest. This means the participants were actually exercising for only one-third of the time that the running and biking groups were. Although each workout session was 30 minutes long in this study, it is common for HIIT workouts to be much shorter than traditional exercise sessions. This is because HIIT allows you to burn about the same number of calories but spend less time exercising. HIIT may help you burn more calories than traditional exercise or burn the same number of calories in a shorter amount of time.

2. Increases Metabolic Function

One of the ways HIIT helps you burn calories actually comes after you're done exercising. Several studies have demonstrated HIIT's impressive ability to increase your metabolic rate for hours after exercise (Panissa et al., 2021; Schubert et al., 2017; Wingfield et al., 2015) Some researchers have even found that HIIT increases your metabolism after exercise more so than jogging or weight training (Panissa et al., 2021) The same study also found that HIIT could shift the body's metabolism toward using fat for energy rather than carbs. Due to the

intensity of the workout, HIIT can elevate your metabolism for hours after exercise. This results in burning additional calories even after you have finished exercising.

3. HIIT Reduce Body Fat

Studies have shown that HIIT can help you lose fat. One review looked at 13 experiments and 424 adults with overweight or obesity. Interestingly, it found that both HIIT and traditional moderate-intensity exercise can reduce body fat and waist circumference (Wewege et al., 2017) A range of other studies also indicate that HIIT can reduce body fat despite the relatively short time commitment (Atakan et al., 2021; Fisher et al., 2015). However, like other forms of exercise, HIIT may be most effective for fat loss in people with overweight or obesity (Batacan et al., 2017; Martins et al., 2016) .High intensity intervals can produce similar fat loss to traditional endurance exercise, even with a much smaller time commitment. They can also reduce waist circumference.

4. HIIT Improve Muscle Mass

In addition to helping with fat loss, HIIT could help increase muscle mass in certain people (Callahan et al., 2021; Martins et al., 2016; Naimo et al., 2014) However, the gain in muscle mass is

primarily in the muscles being used the most, often those in the trunk and legs (Martins et al., 2016). Additionally, increases in muscle mass are more likely to occur in people who were less active to begin with (Damas et al., 2015) Some research in active people has failed to show higher muscle mass after HIIT programs (Forbes et al., 2017) Weight training continues to be the gold standard form of exercise to increase muscle mass, but high intensity intervals could support a small amount of muscle growth (Damas et al., 2015)If you are not very active, you may gain some muscle by starting HIIT, but not as much as you would if you engaged in weight training. Increased in muscle mass improve strength and muscle strength help to perform any specific task (Das & Jhaharia, 2022).

5. HIIT Improve Endurance Capability

Oxygen consumption is your muscles' ability to use oxygen. Endurance training is typically used to improve your oxygen consumption. Traditionally, this consists of long sessions of continuous running or cycling at a steady rate. However, it appears that HIIT can produce the same benefits in a shorter amount of time(Batacan et al., 2017; Hwang et al., 2016; Martins et al., 2016). One study found that participants who performed 20-

minute HIIT workouts 4 days per week for 5 weeks improved their oxygen consumption by 9%(Kong, Fan, et al., 2016).This was almost identical to the improvement in oxygen consumption in the other group in the study, who cycled continuously for 40 minutes per day, 4 days per week. Another study found that 8 weeks of exercising on the stationary bike using traditional exercise or HIIT increased oxygen consumption by about 25% (Skutnik et al., 2016).Once again, the total time spent exercising was much different between groups: 120 minutes per week of traditional exercise versus only 60 minutes per week of HIIT. Additional studies also demonstrate that HIIT can improve oxygen consumption (Forbes et al., 2017; Smith et al., 2009). High intensity interval training can improve oxygen consumption as much as traditional endurance training, even if you exercise only about half as long.

6. HIIT Helps to Maintain Healthy Heart and Reduce Hypertension

HIIT may have important health benefits as well. A large amount of research indicates that it can reduce heart rate and blood pressure in people with overweight and obesity, populations in which high blood pressure is common (Batacan et al., 2017).One study found that

8 weeks of HIIT on a stationary bike decreased blood pressure as much as traditional, continuous endurance training in adults with high blood pressure (Skutnik et al., 2016). In this study, the endurance training group exercised 4 days per week for 30 minutes per day, and the HIIT group exercised only 3 times per week for 20 minutes per day. Some researchers have found that HIIT may even reduce blood pressure more than the frequently recommended moderate-intensity exercise (Clark et al., 2020). However, it appears that high intensity exercise does not typically change blood pressure in people in the “normal” BMI range who have normal blood pressure (Batacan et al., 2017). HIIT can reduce blood pressure and heart rate, primarily in people with overweight or obesity who also have high blood pressure.

7. HIIT Can Help in Maintaining Blood Glucose Level

HIIT programs lasting less than 12 weeks can reduce blood sugar (Kong, Sun, et al., 2016). A summary of 50 studies found that HIIT not only reduces blood sugar but also improves insulin resistance more than traditional continuous exercise (Jelleyman et al., 2015). Based on this information, it is possible that high intensity exercise is particularly beneficial for those at risk for type 2 diabetes. In fact,

some experiments specifically in people with type 2 diabetes have demonstrated the effectiveness of HIIT for improving blood sugar (Alkhatib et al., 2017). However, research in healthy people indicates that HIIT may be able to improve insulin resistance even more than traditional continuous exercise (Hwang et al., 2016). High intensity interval training may be especially beneficial for those needing to reduce blood sugar and insulin resistance. Research has found these improvements in people with and without diabetes.

8. HIIT Enhances Aerobic and Anaerobic Capacity

While its health benefits are very important, HIIT also improves performance in both anaerobic and aerobic activities (Ouerghi et al., 2017). Whether you're an athlete or a weekend warrior or you just enjoy running around with your kids, HIIT training will improve your performance during these tasks with just a few short sessions per week. Disadvantages of HIIT Potential disadvantages of HIIT Injuries are often a concern when beginning any exercise program (particularly one such as HIIT), especially in elderly and sedentary patients. While musculoskeletal injuries may occur, they are not more common in groups performing HIIT50 versus other

forms of exercise and can be minimised with careful selection of exercise equipment, for example cycling instead of walking. A recent systematic review demonstrated no cardiac or other potentially lethal events across seven HIIT studies in patients with coronary artery disease,⁵¹ suggesting HIIT is very safe when performed in a controlled environment, although prescription of such exercise must be considered on an individual patient basis. Due to the extreme energy expenditure required in the interval phases of HIIT, high levels of motivation are required. While effective in controlled trials, and perhaps associated with higher adherence levels (as discussed above), studies to assess long term adherence rates to HIIT are still needed. Importantly, as some types of exercise are contraindicated in certain patient populations⁵² and because HIIT is a complex concept for those unfamiliar to exercise, some patients may require specific assessment or instruction in HIIT from an exercise physiologist or physiotherapist.

Discussion

The aim of the current review was to synthesise previous literature that examined HIIT and establish its potential effect on body composition,

cardiometabolic health, blood glucose, fat reduction, aerobic & anaerobic capacity, hypertension, endurance capacity and cardiovascular health. In addition, this review aimed to identify an optimal HIIT protocol with regard to session structure, intensity, frequency and duration. In accord with this aim, some studies were evaluated providing evidence suggesting that HIIT can significantly improve certain health parameters in children and adolescents. These studies have revealed that HIIT can significantly improve cardiorespiratory fitness, BMI and body fat percentage, in comparison to moderate intensity training. HIIT is a feasible and time efficient approach for improving cardiorespiratory fitness and body composition in adolescents.

Conclusion

High-intensity interval training is a time-effective method of improving health in children and adolescents. This review suggests that running-based sessions, at an intensity of >90% maximum heart rate/100–130% maximal aerobic velocity, two to three times a week and with a minimum intervention duration lasting >7 weeks, elicit improvements in health markers; HIIT has lots of benefits like burning calories, improving muscle mass, improving endurance, maintaining a

healthy heart, helping in maintaining diabetes, improving aerobic capacity and anaerobic capacity, and improving explosive strength. From this study, it was concluded that High-intensity interval training (HIIT) is very beneficial to maintaining good health, and it's recommended to perform any kind of High-intensity interval training (HIIT) at least twice a week.

Conflicts of interest

Authors have no conflict of interest to disclosed.

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