



Benefits arising from the practice of High Intensity Interval Training

Benefícios decorrentes da prática do Treinamento Intervalado de Alta Intensidade

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ABSTRACT

High intensity interval training, also known as HIIT (High Intensity Interval Training), is characterized by short duration sessions, with loads and speeds at high intensity, using different pause variables. HIIT, when consistently prescribed, can accelerate metabolism and increase processes of caloric expenditure, aerobic resistance and VO₂max. Thus, this study aimed to carry out a review of the specialized literature on the benefits related to HIIT. For the composition of this research, scientific articles published between the years 1962 until the most current 2023 were consulted. HIIT has been much discussed by specialists in the sports field and physiologists around the world, featuring a practice that has been rapidly gaining prominence among athletes and non-athletes alike, as it is a short-term activity and presents several benefits when compared to continuous long-term aerobic training. duration. It is concluded that HIIT training is a strong ally for promoting health and well-being, as it is an effective, fast method that can be practiced in different ways and in different environments.

Keywords: HIIT benefits, High intensity interval training, HIIT.



1 INTRODUCTION

The HIIT, acronym for High Intensity Interval Training, is a short training with loads and speeds at high intensity containing short or long pauses, whether passive or active (GIBALA, 2016). It has been the focus of studies and is a topic of great relevance for researchers and the entire scientific community, indicating great progress for the health area, especially when it comes to cardiac rehabilitation programs (DEL GIUDICE et al., 2018).

Studies indicate that the application of interval work is capable of presenting similar adaptations to a form of training that has greater volume in its proposed methodology, with an average frequency of two to three times a week, lasting approximately 20 to 30 minutes in its sessions (BARTLETT et al., 2011).

According to Gibala (2012) and João et al (2023) the HIIT presents as main advantages of interval training the acceleration of metabolism and the processes of increasing caloric expenditure, increase of aerobic resistance and increase of VO₂max, besides being present in the prevention and rehabilitation of pathologies and metabolic syndromes. Currently, the lack of time is a major impediment to regular exercise practice, which hinders the rehabilitation and prevention of cardiovascular pathologies (REICHERT et al., 2007; MARTELLI, 2014; DEVECHIO et al., 2017). Based on the presupposed information, HIIT has been standing out for the fact that it can increase the functional reserve of individuals who practice it, allowing an increase in their physical fitness (DEL GIUDICE et al., 2018).

Practitioners seeking quality of life, amateur and professional athletes are adhering more and more and including HIIT in their training routine, because such a method with characteristics of high intensity and low volume results in time savings in the duration of training sessions (GÓES, 2017).

Some authors today are guided in clarifying and identifying some of the real benefits that the practice of the HIIT method can provide to its adepts. Recent studies demonstrate its effectiveness not only in the aesthetic aspect, but also in the treatment and prevention of metabolic syndromes, cardiovascular diseases and improvements in cardiorespiratory condition, among others (LLOYD-JONES et al., 2010).

In view of these points, this review aimed to investigate the benefits related to the practice of high-intensity interval training (HIIT) and show the data in a clear and objective way about this method that addresses fast and efficient workouts where more and more people are adhering to this practice.



2 METHODOLOGY

To compose this review, a bibliographic search was conducted in Scielo, Portal de Periódicos da Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), PubMed, and Google Scholar searching for scientific articles published until 2023 using the following descriptors alone or in combination: Interval training; HIIT; High intensity; Aerobic endurance.

For the selection of the material, three stages were carried out. The first was characterized by the research of the material that comprised the months of March to December 2022, with the selection of 43 works. The second step was reading the titles and abstracts of the papers, aiming at a greater approximation and knowledge, and excluding those that were not related and relevant to the theme. After this selection, the texts that were available in full were searched, totaling 24 works, which were included in the review.

As criteria for eligibility and inclusion of articles, we analyzed the origin of the journal and indexing, studies that presented data related to the benefits related to the practice of high intensity interval training (HIIT) published between 1962, with an approach to the historical aspects of HIIT, until the most current 2022. As exclusion criteria we used incomplete references and information currently discredited, since this research aims to review updated knowledge on the subject.

3 RESULTS AND DISCUSSION

3.1 FUNDAMENTALS OF INTERVAL TRAINING

There are reports that the Greeks used in their training variables that combined work and pause during the sessions. North American trainers in the 1850s, among them Lawson Robertson and Dean Cronwell, already used high speed training sessions with recovery sessions, even without scientific studies showing the effectiveness in athletes (BRANDÃO, 2015). In 1912, the Finnish school already used interval training applied by coach Laurie Pihkala, who developed the Finnish training system. One of the protocols used was 5 shots at maximum speed between 100 and up to 200 meters, with pauses between shots. Historians indicate Pihkala as the creator of interval training. In the 1920s, historians such as Buchheit and Laursen (2013) state that Nobel Prize winner Archibald Vivian Hill (British physiologist) included interval training in his research.

At that same time, the Finnish runner Pavo Nurmi included in his training sessions the interval training method, using a protocol of 6 400-meter shots in 60 seconds, with an average speed of 24 km/h, performing an active (slow) pause of 10 and up to 20 kilometers per hour. Around the year 1930, the cardiologist Herbert Reindell in one of his studies observed in his



patients the development of cardiac hypertrophy and increased cardiac output, as well as an improvement in oxygen consumption (BUCHHEIT and LAURSEN, 2013). In 1936, the German physiologist Woldemar Gerschler proposed the interval method in athletics tracks with alternation of long and short runs with controlled time. And in 1939 in the city of Freiburg, the methodology was applied to the athlete Harbig, where he beat the world record in the 400 and 800-meter races. Historical contexts where Billat (2001) states that the first research article about interval training was in 1959, by Reidell and Roskamm (1959).

The second was in 1962 by Reidell et al., (1962), where they detailed the methodologies of training with pauses not exceeding 1 minute, being passive or active. In 1967 the Swedish physiologist Astrand et al., (2014) researched the oxygen volume of athletes using the HIIT method, the maximum consumption so far recorded in a runner is 82 ml / kg / min. Until the late 1960s, Europe was the only place where research on HIIT was conducted, in this same period the North American Fox El Robinson L, Wiegman DL (1969) conducted several studies on the method in the military context. In 1980, there were already extraordinary marks of runners who used the interval training, such as the Olympic athletes Sebastián Coe and Said Aouita, (BILLAT, 2001).

3.2 CONCEPTS ABOUT HIIT

HIIT training is cyclical and unique exercises with moments of high intensity, interspersed with recovery moments of greater or equal duration, at low intensity or at rest. The vigorous intensity is close to maximum, between 80 and 100% of HRmax (GIBALA, 2012).

Nytroen et al.,(2012) also state the idea that high intensity interval training is characterized by having certain periods of effort, separated by moments of recovery, which can be passive (stopped) or active (at low intensity). This training model can be as effective as endurance training, what differs is the time of work, being able to generate similar evolutions.

HIIT also covers several areas, among them are the volume, which in turn would be a quantitative aspect of training, for example, number of repetitions and sets, training time and weight. The variable intensity is also used, which is related to the qualitative aspect of training, that is, everything that is based on quality, for example, maximum oxygen consumption and percentage of load used (BOSSI, 2016).

In HIIT one cannot allow the recovery of cardiorespiratory parameters during the workout, besides that, the exerciser should do all the exercises/series with the same intensity, so that the workout is effective. The recovery period is extremely important, because it is in this phase that there will be the energy replacement by the aerobic system, restoring the ATP-phosphocreatine,



which in turn will be the main source of energy consumed during the period of effort (PRATA, 2015).

HIIT training provides higher caloric expenditure when compared to traditional workouts, especially in the post-exercise period, because during this period the O₂ uptake is higher and remains elevated for a longer period (JOÃO et al. 2023). The excess post-exercise O₂ consumption (EPOC) can be influenced by several factors, including the high temperature, the O₂ needed to convert lactate into glucose and the high levels of adrenaline and noradrenaline, thus the effect of EPOC increases the caloric expenditure (PRATA, 2015).

3.3 BENEFITS OF HIGH INTENSITY INTERVAL TRAINING

Fernandes et al., (2016) evaluated 8 women aged 23 years, obese, in order to verify the behavior of total body mass and abdominal circumference. HIIT training was applied over a period of eight weeks, with activities from 7 to 20 minutes. The PAR-Q was applied for pre-approval of the candidates, including medical clearance to practice physical activity, anthropometric evaluation composed of total body mass (TBM) and body mass index (BMI) measurements. The stress test was a treadmill protocol with progressive addition of loads (speed), being evaluated pre and post exercise. After the eight-week period, the participants showed a 2% decrease in total body weight.

High intensity interval exercise can currently be considered a good strategy to improve health, besides potentiating lipid oxidation, promoting physiological adaptations, improving metabolic control and cardiorespiratory function (GIBALA, 2012). Racil et al., (2013) conducted a similar study, but with the participation of 34 women, with a mean age of 15.9 years, where they used the HIIT method for 12 weeks. In addition to body weight, they reported a reduction in abdominal circumference (AC) values by 3.5%. According to Prata (2015) HIIT is able to significantly increase circulating catecholamine and growth hormone, which in turn will stimulate lipolysis, thus being more effective in reducing visceral fat.

Coronary heart disease is the leading cause of morbidity and mortality in developed countries, being responsible for one third of deaths of individuals over 35 years (LLOYD-JONES et al., 2010). And this has been directly linked to the development of other diseases such as hypertension, diabetes, and dyslipidemia, which in turn is directly related to mortality (GRAD and ZDRENGHEA, 2014).

However, for some time now, HIIT training has been used by some teams in the treatment of coronary artery disease and metabolic syndrome. In a research published in the International



Journal of Cardiology, HIIT training and moderate continuous aerobic training were tested, where the main objective was to verify if there would be an improvement in post-exercise heart rate recovery in individuals with pathology in rehabilitation phase. The study included seventy-three participants with coronary artery disease, who were divided into two groups: HIIT and moderate continuous aerobic exercise. For the test an ergometric bicycle was used, the VO₂max and heart rate data were monitored during and after the exercise. Both methods showed significant results: HIIT training showed an increase in VO₂max: 4.5 ± 4.46 ml / kg / min, while continuous aerobic training showed 2.46 ± 3.57 ml / kg / min ($p= 0.039$).

In the recovery of heart rate, HIIT training also excelled compared to moderate continuous aerobic training, in the recovery phase, in the first and second minute (15.44 ± 7.04 vs. 21.22 ± 6.62 , $P < 0.0001$ and 23.73 ± 9.64 vs 31.52 ± 8.02 , $p < 0.0001$). The results show that the application of HIIT in patients with low-risk coronary heart disease obtained an improvement in VO₂max, and there was also an improvement in heart rate recovery compared with moderate continuous aerobic training.

Gosselin et al. (2012) compared the continuous method and the interval method to analyze possible metabolic responses such as HR, VO₂max, MSL. The Sprint interval training (SIT) method was evaluated using the Wingate protocol, and to promote significant physiological adaptations the method must be performed at supra-maximal intensity, and is potentially unsafe for sedentary people over 35 years old. Therefore, eight young people were evaluated, two men and six women aged between 20 and 30 years old. The metabolism and cardiovascular responses were evaluated, performing four protocols of high intensity interval training (HIIT) at 90% of VO₂max with similar activity times but with different pause times. A treadmill was used where the speed was increased every 2 minutes of work for three weeks. Protocol 1 consisted of approximately 20 minutes of continuous exercise at 70% of VO₂max, while protocols 2 through 5 were based on intervals with an active pause duration (in seconds) of 30/30, 60/30, 90/30, and 60/60, respectively. Each protocol resulted in approximately 10 minutes of exercise at a workload of approximately 90% of VO₂max, but what differentiated was the interval time. The results showed that the 90/30 protocol resulted in an increase in VO₂max, HR, effort assessment and blood lactate (MLSS), while the 30/30 protocol obtained the lowest rates of these parameters. The total caloric expenditure was lower in the 90/30 and 60/30 protocols which was 150 kcal, while the other 3 protocols were 195 kcal (30/30 60/60 and the 20" protocol) . The immediate post-exercise blood pressure response was similar across all protocols. These findings indicate that HIT



performed at approximately 90% VO₂max does not become more efficient than continuous exercise performed at 70% VO₂max. The HIIT protocol can be used as a time-saving alternative.

Shelle et al, (2001) conducted a study published by the Journal of Strength and Conditioning that examined the effects of active and passive recovery on lactate concentration and performance in 18 men averaging 21 years of age from Division I (NCAA) Ice Hockey. Using a repeated model, the skating test consisted of skating a 7-lap course with direction changes lasting 40 seconds for 90 seconds of rest between laps. Active recovery was performed on a bicycle ergometer, at low intensity, with a speed of 50 to 70 rpm about 12 to 15 minutes, and at the end of the seventh lap the athlete took a 3-minute passive rest for blood collection. The passive recovery followed the same protocol containing the same 15-minute interval (simulating a match) and for data measurement a Polar heart rate monitor and an Accusport lactate analyzer were used. Blood was drawn 3 to 5 minutes before the activity and 12 to 15 minutes after the effort. Results: Passive x Active: Recovery showed no statistically significant differences for distance skated in heart rate or lactate, there was a small difference in the second lap in the active method, but the numbers were not significant (p. 0.05) concluding that active and passive recovery did not increase lactate removal or interfere in the athletes' performance.

Bossi (2016) cites in his book a study that was conducted by Alvarez in 2014, where they used 38 women (9 with hyperglycemia, 10 with hypercholesterol, 9 with hypercholesterol and hyperglycemia and 10 healthy), where for 8 weeks they used a HIIT protocol prepared by 17 to 29 minutes of activities and more 24 minutes of weight training, before this test the results were beneficial in cardiovascular metabolic and anthropometric variables which leads us to conclude that HIIT training should be used as a form of prevention as well.

4 FINAL CONSIDERATIONS

In face of all these concepts, HIIT has become a strong ally for the promotion of health and wellness, where the benefit noted is the economy of time since its effects are similar or superior when compared to long-term work. The fact that society has become so immediacy has made it unfeasible for people to stay for hours in gyms, parks, and clubs, and this is one of the reasons for the great acceptance of the method.

HIIT is not only a practice for professional athletes, amateur athletes also use the same method, in order to achieve a better performance in their respective sports.

The practice of HIIT promotes benefits beyond weight loss such as, for example, the improvement of the cardiorespiratory system, both in rehabilitation and in the prevention of



metabolic syndromes, coronary heart disease, and glycemic control, promoting well-being to its followers. It is worth pointing out that there are several evaluative protocols that must be taken into consideration for the prescription of the protocol, respecting the individuality and possible limitations that the client/patient may present.



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