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Effects of self-paced high-intensity interval training and moderate-intensity continuous training on the physical performance and psychophysiological responses in recreationally active young adults

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ABSTRACT: This study aimed to compare the effects of 8-week self-paced high-intensity interval training (HIIT) vs. self-paced moderate-intensity continuous training (MICT) on the physical performance and psychophysiological responses of young adults. Twenty-eight recreationally active young adults (age: 21.1 ± 1.6 years) were randomly assigned to either the self-paced HIIT (n = 14) or the MICT (n = 14) group training protocol. The HIIT consisted of two 12–24 x 30 seconds of high-intensity runs interspersed by 30 seconds of recovery. The MICT completed 24–48 minutes of continuous running. Before and after the 8-week interventions the following tests were completed: maximum oxygen consumption ($\dot{V}O_{2max}$) estimated from the Yo-Yo Intermittent Recovery Test level 1 (YYIRTL-1), repeated sprint ability (RSA), 10–30-m sprint test, change of direction test (T-drill), countermovement jump (CMJ) and squat jump (SJ), and triple hop distance test (THD). Training rating of perceived exertion (RPE) and physical activity enjoyment scale (PACES) were assessed during the training programme. The HIIT resulted in greater improvement in YYIRTL-1, $\dot{V}O_{2max}$, RSA and T-drill performances compared to the MICT. Furthermore, RPE and PACES values were higher in the HIIT than the MICT. This study suggested that self-paced HIIT may be a more effective training regime to improve aerobic fitness with greater physical enjoyment in recreationally active young adults.

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INTRODUCTION

Regular physical activity and aerobic exercise are a very important part of the healthy and modern lifestyle [1, 2]. Therefore, important organizations such as the World Health Organization (WHO) and the American College of Sports Medicine (ACSM) generally recommend that adults should perform physical activity comprising at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity in a per week to maintain and improve their health conditions [3]. Notwithstanding, a considerable number of adolescents and adults failed to reach the recommended level of physical activity [4]. Commonly, lack of time and lack of motivation are noted as the primary reasons for sedentary behaviour [5]. Thus, it has been one of the major concerns for exercise scientists to develop interventions that can be performed in less time and include much more enjoyable activities for the general population [6]. Consequently, individuals have performed various training programmes in order to improve their health profiles.

One of the traditional training programmes used is the moderate-intensity continuous training (MICT) (55–70% HR_{max}), which increases by approximately 2–7% maximum oxygen consumption ($\dot{V}O_{2max}$) in young and recreationally active adults [7, 8]. Helgerud et al. [7] demonstrated that the $\dot{V}O_{2max}$ of young adults improved by 1.8% after the MICT programme three times a week for 8 weeks. A recent popular alternative training strategy to the MICT, high-intensity interval training (HIIT), which includes a short burst of high-intensity activities (> 85% HR_{max}) with recovery periods or very light exercise, has been shown to be a more time-efficient and effective training modality to improve aerobic capacity in athletes [9] and the general population, especially young to middle-aged adults [10]. Moreover, the majority of recent studies have compared the effects of HIIT and MICT interventions on exercise responses and health markers in athletic and nonathletic populations [2, 11]. Surprisingly, few studies focus on the effects of self-paced or self-selected

HIIT and MICT training on psychophysiological and performance responses in the literature [12]. However, numerous studies have confirmed that self-paced or self-selected running exercises are effective training methods as imposed or prescribed training in terms of the psychophysiological responses [13, 14, 15], exercise performance [13, 14] and health markers [13] in recreationally active adults.

In the last decade, a growing body of literature has demonstrated the effects of self-paced [12, 16, 17] or self-selected intensity training [14, 15, 18] on the psychophysiological responses [12, 14, 16–18], exercise performance [12, 14–18] and health markers [12] in sedentary, recreational active and active individuals. Connolly et al. [12] performed a self-paced HIIT programme 3 times weekly for 12 weeks compared to the MICT, consisting of 50 minutes of continuous cycling exercise. As a result of this study, both training strategies were similarly effective at improving cardiorespiratory fitness in sedentary middle-aged women. Several recent studies have compared the various duration of training effects of HIIT and MICT interventions on the psychophysiological responses [19], performance responses [7] and cardiorespiratory fitness [20] of adults. However, a few studies have compared the efficiency of self-paced or supervised intensities of HIIT and MICT interventions in active young adults. To our knowledge, no previous study has investigated this topic in recreationally active young adults. Therefore, the purpose of this study was to compare the effects of self-paced HIIT and MICT on the physical performance and psychophysiological responses in recreationally active young adults. We hypothesized that the self-paced HIIT programme would be more effective in improving physical performance with higher physical enjoyment responses than the MICT strategy. Our study results would provide recreationally active young adults with empirical evidence to confirm their selection between self-paced HIIT and MICT strategies..

MATERIALS AND METHODS

Experimental Approach to the Problem

A two-group, parallel study design was used to compare physical performance and psychophysiological responses in recreationally active young adults. Considering the 150 min·wk^{-1} of moderate intensity and 75 min·wk^{-1} of vigorous intensity, the total training time for the MICT group was fixed two-fold according to the HIIT group in the present study (Table 1). The present study design lasted 10 weeks, consisting of 1 week of tests (baseline), 8 weeks of self-pace HIIT and MICT interventions, and 1 week of tests (post-intervention). The participants were classified in- the HIIT or the MICT group according to their aerobic fitness (YYIRTL-1) rankings to avoid having unbalanced groups. All participants completed pre and post-testing, which consisted of Yo-Yo Intermittent Recovery Test level 1 (YYIRTL-1), 10-m, 20-m and 30-m sprinting tests, vertical jumping tests (countermovement jump [CMJ] and squat jump [SJ]), lateral jumping test (triple-hop distance [THD]), change of direction (T-drill), and repeated sprint ability (RSA). Both training regimes were performed three times a week and each training session and tests were separated by at least 2 days in order to avoid any possible effects of physical fatigue. All tests with the same order were performed on an indoor basketball court with a sprung wooden floor at a similar time of the training day (between 3 p.m. and 6 p.m.) for similar chronobiological characteristics [21]. Similar air humidity (40–45%) and temperatures (18–25°C) were measured during the training. The participants were familiar with all performance tests and training methods, and they were instructed to maintain normal dietary intake before and during the study.

Subjects

Thirty-two young adults agreed to participate at the beginning of the present study. A total of 4 participants (2 from the HIIT group and 2 from the MICT group) were excluded (due to injuries, nonattendance at training or drop-out), resulting in a dropout rate of approximately 12.5%. Consequently, 28 young male adults (age: 21.1 ± 1.6; body height: 176.4 ± 6.0 cm; body mass: 68.7 ± 7.6 kg; body fat%: 11.3 ± 1.9) were divided into two groups: the HIIT (n = 14) and MICT (n = 14). All participants, performing team sports such as soccer, basketball and handball, were familiar with the training workload of < 3 training units per week (< 180 min·wk^{-1}), consisting of core strength training, aerobic and group exercise, for at least 2 years. No other inclusion or exclusion criterion was applied in the present study. The participants were notified regarding the research procedures, benefits, risks and requirements and written informed consent was obtained prior to the study. The study was approved by the local university ethics committee (59754796-050.99).

Procedures

Testing Procedure. On the first day, weight (kg) and fat percentage (%) were measured using bioelectrical impedance measurement (BC-418, Tanita, Tokyo, Japan) in the morning before breakfast. After the anthropometric measurements, each participant performed the YYIRTL-1 for the measurement of aerobic capacity. The YYIRTL-1, which is a reliable and acoustically progressive test, was used to evaluate aerobic capacity [22]. After the test, the estimated $\dot{V}O_{2max}$ was calculated using the following formula [23]:

$$\dot{V}O_{2max} = 36.4 + (0.0084 \times \text{covered distance in YYIRTL-1})$$

The remaining performance tests were conducted at 3 to 6 p.m. after a 15-minute standardized warm-up section, consisting of low-intensity running, sprinting and stretching. As fast as possible, each participant performed 10-m, 20-m and 30-m sprinting tests on the third day. After the sprinting tests, the change of direction performance of the participants was evaluated using a T-drill test. The test was performed according to the procedures suggested by Pauole et al. [24]. Each participant covered a total distance of 36.56 m on the T-drill, including forward sprinting, from left to side right shuffling and backpedalling. Test times were measured using a portable wireless photocell system connected to an electronic timer (Witty, Microgate, Bolzano, Italy). Each participant had three attempts separated by 2-3 minutes of passive resting for these tests between consecutive trials.The T-drill tests were separated by 4–5 minutes of passive rest to minimize fatigue accumulation and injury risk.

On the fifth day, the participants performed vertical jumping tests (CMJ and SJ) and the lateral jumping test (THD). The CMJ and SJ were performed with hands kept on the hips to minimize the contribution of the upper limbs. The aim of the THD, which is a valid test for prediction of lower limb strength and power, is to reach a maximum distance with 3 consecutive hops [25]. Each player had 3 trials in all the jumping tests and these trials were separated by 2–3 minutes of passive resting between consecutive trials. To avoid fatigue and injury risk, all jumping tests were separated by 4–5 minutes of passive rest between tests. A portable force plate (Optojump, Microgate, Bolzano, Italy) was used for measuring all the jumping test performances.

On the seventh and the last testing day, all participants performed the RSA test involving 6 repetitions of maximal 2 x 12.5-m shuttle sprints (~6 seconds) departing every 25 seconds [26]. Total sprint times were measured using a portable wireless photocell system connected to an electronic timer (Witty, Microgate, Bolzano, Italy).

Each participant had three attempts separated by 5 minutes of passive resting for these performance tests between except for RSA and the best values in these tests were used for statistical analysis. The performance tests showed high reliability (range 0.90–0.95) according to a previous study [27]. All the participants were familiar with all performances tests used in the present study and were verbally encouraged to perform maximal efforts during the testing.

Training Interventions. The self-paced HIIT and MICT interventions were performed three times a week and each training session was separated by at least 48 hours to minimize physical and psychophysiological fatigue over the 8-week period. A gradual progress plan was performed to reach the maximal final performance for HIIT and MICT interventions. The total training time for the MICT group was fixed two-fold according to the HIIT group (Table 1). Training sessions started with a 15-minute standardized warm-up, consisting of 10 minutes of jogging and 5 minutes of static and dynamic stretching exercises, and then the participants performed self-paced HIIT and MICT on a 400-m standard athletics track. All the participants were familiar with all performance tests and training methods used in the present study. Before the study, participants were given guidance on the description of each training protocol, sessions, and intensities. The HIIT consisted of 2 sets of 12 to 24 repetitions of 30-second work and 30-second passive resting. The HIIT group was divided into 2 groups, including 7 participants who had their own lane, and they were supported with a whistle by a coach to remind the participants to switch exercise and resting period every 30 s. The MICT consisted of running continuously at a self-paced intensity and took a total exercise time of 24–48 minutes. During the MICT, participants were able to check their running time on the timer on the scoreboard. Our participants did not receive any informative feedback regarding their exercise intensity level and they were also asked to freely adjust and maintain their pace throughout each of the training sessions. The psychophysiological responses such as rating of perceived exertion (RPE 6–20) [28] and physical activity enjoyment scale (PACES) [29] were recorded after each training session. The participants answered the RPE and PACES individually to avoid hearing the scores of the colleagues immediately after the completion of each training session. Ten minutes after the training session, participants completed the PACES, which required them to answer 18 items on a 1–7 scale. The participants were familiarized with the questionnaires and scales before the beginning of the study.

Statistical Analyses

Data were represented as mean ± SD. Before using parametric tests, the assumption of normality was confirmed using the Kolmogorov-Smirnov test. The paired sample t-test was used to assess the differences in RPE and PACES responses between HIIT and MICT during the intervention. A mixed ANOVA was used that represents a combination of within and between tests. Effect sizes (Cohen's *d*) were also calculated to provide an estimate of meaningfulness of comparisons between pre-test and post-test results. The thresholds

TABLE 1. Description of the 8-weeks of HIIT and MICT training interventions

		HIIT	MICT
Week	**Sessions**	**Pre-intervention testing**	
1 and 2	1–6	2 x (12 x 30 s), 30 s rest	24 min continuous running
3 and 4	7–12	2 x (16 x 30 s), 30 s rest	32 min continuous running
5 and 6	13–18	2 x (20 x 30 s), 30 s rest	40 min continuous running
7 and 8	19–24	2 x (24 x 30 s), 30 s rest	48 min continuous running
		Post-intervention testing	

for effect size statistics were as follows: < 0.20 = trivial, 0.20–0.59 = small, 0.6–1.19 = moderate, 1.2–1.99 = large, ≥ 2.0 = very large [30]. Reliability of each performance test was assessed by intraclass correlation coefficient (ICC). Statistical analyses were performed with SPSS software version 16.0 (SPSS, Inc., Chicago, IL, USA). The level of statistical significance was set at $p \leq 0.05$.

RESULTS

Responses of RPE to HIIT sessions were higher than those to MICT sessions (17.2 ± 0.6 vs. 13.1 ± 1.1; $p < 0.01$, $d = 4.6$ [very large effect]). In addition, PACES scores from the HIIT were higher than from the MICT over the 24 sessions (101.3 ± 5.3 vs. 80.8 ± 4.6; $p < 0.01$, $d = 4.1$ [very large effect]).

Pre-test values and the effect of training on anthropometric and physical performance of the players are summarized in Table 2 and Figure 1. In terms of within-group comparisons, improvements were observed in anthropometric measurements such as body weight, body fat percentage and BMI following training in both groups ($p \leq 0.05$, d = ranging from 0.15 to 0.99 [trivial to moderate effect]). The YYIRTL-1 performance and $\dot{V}O_{2max}$ responses increased in both groups from pre-test to post-test ($p \leq 0.05$, d = ranging from 2.49 to 3.29 [very large effect]). Sprinting (10-m, 20-m and 30-m) and jumping (CMJ, SJ and THD) performances increased in both groups from pre-testing to post-testing ($p \leq 0.05$, d = ranging from 0.55 to 1.76 [small to large effect]). RSA total test time decreased from pre-test to post-test in the RSA performance (HIIT: -9.2%, $d = 2.93$ [very large effect]; MICT: -6.0%, $d = 1.84$ [large effect]). T-drill test time decreased from pre-test to post-test (HIIT: -9.8%, $d = 2.59$ [very large effect]; MICT: -5.3%, $d = 1.40$ [large effect]).

Between-group comparison demonstrated that the HIIT group showed greater improvement in the YYIRTL-1 performance (HIIT: +44.3%, standardized effect size [d] = -3.29 [very large effect];

TABLE 2. Effect of both training methods on anthropometric and performance responses of the participants

	HIIT (n = 14)					MICT (n = 14)					Training comparison		
	Pre-test	Post-test	%Change	Cohen's d	Descriptor	Pre-test	Post-test	%Change	Cohen's d	Descriptor	F (1,26)	p	η^2
Body weight (kg)	65.9 ± 9.9	64.4 ± 10.0*	-2.4	0.15	trivial	70.8 ± 5.2	68.9 ± 4.7*	-2.7	0.38	small	0.586	0.451	0.022
Body fat (%)	10.6 ± 1.8	8.9 ± 1.6*	-16.2	0.99	moderate	12.0 ± 2.0	10.3 ± 1.7*	-14.6	0.92	moderate	4.167	0.051	0.138
BMI ($kg \cdot m^{-2}$)	21.4 ± 2.8	20.9 ± 3.0*	-2.5	0.17	trivial	22.5 ± 1.6	21.9 ± 1.6*	-2.8	0.37	small	1.474	0.236	0.054
$YYIRTL^{-1}$ (m)	1163 ± 151	1666 ± 154*#	44.3	3.29	very large	1074 ± 131	1389 ± 122*	30.2	2.49	very large	14.005	0.001	0.350
$\dot{V}O_{2max}$ ($ml \cdot min^{-1} \cdot kg^{-1}$)	46.2 ± 1.3	50.4 ± 1.3*#	9.2	3.23	very large	45.4 ± 1.1	48.1 ± 1.0*	5.8	2.57	very large	13.867	0.001	0.348
10-Sprint (s)	1.81 ± 0.13	1.71 ± 0.10*	-5.4	0.86	moderate	1.80 ± 0.09	1.75 ± 0.09*	-2.3	0.55	small	0.110	0.742	0.004
20-Sprint (s)	3.04 ± 0.17	2.89 ± 0.15*	-4.7	0.94	moderate	3.09 ± 0.16	2.94 ± 0.13*	-4.6	1.03	moderate	0.641	0.431	0.024
30-Sprint (s)	4.28 ± 0.23	4.02 ± 0.22*	-6.0	1.15	moderate	4.36 ± 0.23	4.11 ± 0.21*	-5.6	1.13	moderate	0.385	0.540	0.015
CMJ (cm)	32.3 ± 2.6	36.3 ± 2.5*	12.6	1.57	large	31.3 ± 2.3	34.8 ± 2.3*	11.3	1.52	large	0.906	0.350	0.034
SJ (cm)	34.8 ± 2.8	40.2 ± 3.3*	15.5	1.76	large	34.5 ± 2.7	39.3 ± 2.9*	13.8	1.71	large	0.439	0.513	0.017
THD (cm)	418 ± 41	479 ± 43*	14.7	1.45	large	410 ± 43	464 ± 44*	13.4	1.24	large	3.026	0.094	0.104
RSA_{total} (s)	37.5 ± 1.0	34.1 ± 1.3*#	-9.2	2.93	very large	38.2 ± 1.2	35.9 ± 1.3*	-6.0	1.84	large	8.085	0.009	0.237
T-drill (s)	10.74 ± 0.38	9.69 ± 0.43*#	-9.8	2.59	very large	10.82 ± 0.46	10.24 ± 0.36*	-5.3	1.40	large	4.559	0.042	0.149

Data presented as mean ± SD. BMI: body mass index; YYIRTL-1: Yo-Yo Intermittent Recovery Test level 1; $\dot{V}O_{2max}$: maximal oxygen uptake; CMJ: counter-movement jump; SJ: squat jump; THD: Triple-Hop Distance; RSA_{total}: total time during repeated sprint ability test; T-drill: change of direction test. * $p \leq 0.05$ for within-group changes. # $p \leq 0.05$ for between-group changes.

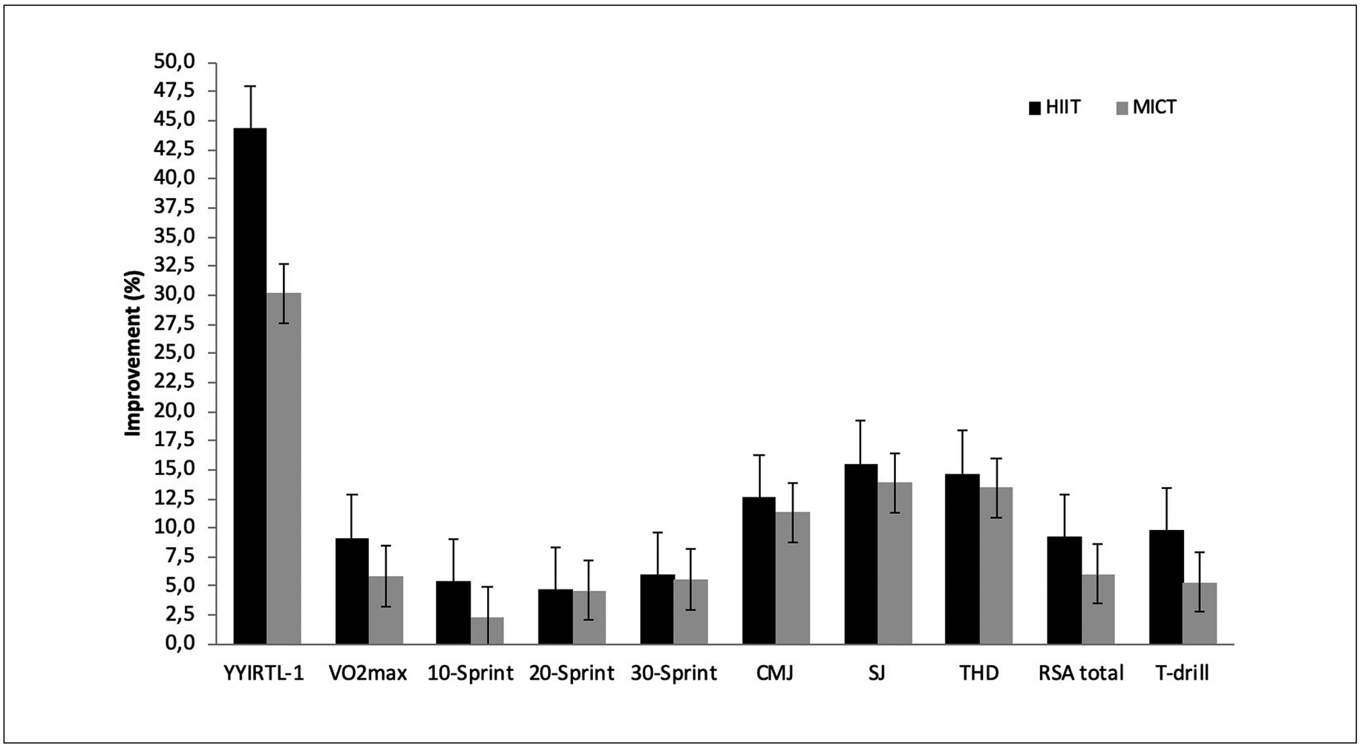

FIG. 1. Improvement in performance responses following the different training interventions

MICT: +30.2%, d = 2.49 [very large effect] and $\dot{V}O_{2max}$ responses (HIIT: +9.2%, d = -3.23 [very large effect]; MICT: +5.8%, d = 2.57 [very large effect]) compared with the MICT group. Furthermore, the HIIT group demonstrated better RSA performance (HIIT: -9.2%, d = 2.93 [very large effect]; MICT: -6.0%, d = 1.84 [large effect]) and T-drill performance (HIIT: -9.8%, d = 2.59 [very large effect]; MICT: -5.3%, d = 1.40 [large effect]) than the MICT group.

DISCUSSION

The present study showed that both training strategies result in similar changes in body composition, sprinting and jumping abilities. Furthermore, self-paced HIIT induced better improvement in speed-based responses such as $\dot{V}O_{2max}$, RSA and T-drill in recreationally active young adults. To the best of our knowledge, the present study is the first to compare the influences of 8-week self-paced HIIT vs. 8-week self-paced MICT on the physical performance and psycho-physiological responses in recreationally active young adults.

Psycho-physiological scales such as RPE and PACES, which are popular, low cost and practical methods for measuring exercise intensity and levels of enjoyment, were used during the study. Studies have shown relationships between RPE responses and PACES scores in active young adults [31, 32]. Our results showed that the HIIT group had higher PACES scores with higher RPE responses than the MICT group. This result is in line with the findings of the previous studies comparing HIIT and MICT conducted on similar adult groups such as recreationally active men [11], healthy active women [33] and recreationally active men and women [34]. Two main potential factors, i.e. the nature of HIIT including intervals, and the monotonous nature of MICT consisting of prolonged exercise, may explain the similarities between the findings of our study and those of previous studies.

One of the important findings of the study was that both HIIT and MICT interventions significantly improved the $\dot{V}O_{2max}$ responses of the young adults, although the $\dot{V}O_{2max}$ improvement was significantly larger in the HIIT group compared to MICT (9.2% and 5.8%, respectively). These findings are in line with previous studies comparing HIIT and MICT, demonstrating that these training programmes, including both imposed and self-paced running, increase the $\dot{V}O_{2max}$ response not only in recreationally active adults [8], but also in different populations such as untrained young adults [35], healthy male university students [7], male [36] and female young adults [37]. In the literature, numerous studies have also shown the changes in the $\dot{V}O_{2max}$ response of young adults after HIIT and MICT programmes with different intervention durations. In a similar study, Hottenrott et al. [8] found that the $\dot{V}O_{2max}$ response increased from 36.8 ± 4.5 $ml \cdot min^{-1} \cdot kg^{-1}$ to 43.6 ± 6.5 $ml \cdot min^{-1} \cdot kg^{-1}$ with an increase of 18.5% after HIIT intervention in recreationally active adults for a period of 12 weeks. They also reported that the $\dot{V}O_{2max}$ values increased by 6.9% after MICT lasting 12 weeks. In another similar study, the $\dot{V}O_{2max}$ responses of female young adults increased from 35.7 ml·min^{-1}·kg^{-1} to 40.1 ml·min^{-1}·kg^{-1} with an increase of 10.9% after an 8-week HIIT programme compared with the MICT strategy [37]. Nybo et al. [35] demonstrated that greater improvement was found following a 12-week HIIT intervention compared with MICT in untrained young adults (14.0% and 7.4%, respectively). In contrast to these supporting study results, in a similar study Connolly et al. [12] recently observed a greater increase in the $\dot{V}O_{2max}$ values of inactive females after 12-week self-paced MICT programmes compared with HIIT (19.7% and 15.7%, respectively). Considering these study results, differences in improvement of the $\dot{V}O_{2max}$ response may be explained by the training type (imposed or self-pace exercise), session and intervention duration (ranging from 6 to 12 weeks) and characteristics of the participants (sex, age and training experiment). From a practical point of view, our results also confirmed that self-paced HIIT and MICT are as effective training methods as imposed HIIT and MICT to improve aerobic fitness in recreationally active adults. Contrary to some previous study results [35, 37, 38], MICT induced larger changes in body composition in terms of body fat percentage compared to the HIIT group in our study. While some studies showed a similar effect on body composition, other researchers reported a larger improvement in body fat percentage, comparing HIIT vs MICT [39, 40]. There is still no consensus on which type of training method is better for body composition, including body fat percentage, body weight and fat-free mass, in the literature.

In accordance with the improvement in $\dot{V}O_{2max}$ results, we found a considerable increase in RSA performance of 9.2% after the 8-week self-paced HIIT intervention. In another study, supporting findings were observed for the RSA that, a 6-week HIIT training intervention induced a decrease by 1.5% their total time of RSA [41]. In another study, Cicioni-Kolsky et al. [42] showed that the RSA test duration decreased from 36.0 ± 1.9 ml·min^{-1}·kg^{-1} to 35.0 ± 1.3 ml·min^{-1}·kg^{-1} with an increase of 3.7% after 6-week HIIT in recreationally and moderately trained young males. In addition to these study results, amateur handball players (aged from 21 to 27 years) also showed improvement in the RSA performances (effect size: 0.72 to 0.38, respectively) after different 6-week HIIT interventions, including short or long interval duration running [43]. Considering these study results, the RSA performance improvement from our study was larger than those of previous studies. Furthermore, the other important performance indicator in team sports such as soccer, basketball and handball, change of direction performance, increased after the 8-week self-paced HIIT intervention compared with MICT (effect size: -2.59 very large vs. -1.40 large effect, respectively). Iacono et al. [44] reported improvement in agility performance in handball players (mean aged 25.6 years) following the HIIT programme twice per week for 8 weeks. In another supporting study, Buchan et al. [45] observed a decrease of 1.5% in the agility test completion time after the 8-week HIIT in healthy adolescents. These differences might be explained by different type of training (imposed or self-pace), shorter intervention duration and individual differences. Considering these study results, from a practical point of view, a running-based HIIT programme might only increase aerobic fitness, but also supporting change of direction performance in team sports. Both self-paced HIIT and MICT showed similar changes in body composition, sprinting and jumping (vertical and lateral) abilities. These results are in line with similar studies, which have shown that 6–12 weeks of HIIT and MICT induces no negative effects on body composition [7, 8, 12, 35], sprinting [44, 45] or jumping performances [44, 45] in physically active and inactive young adults.

The present study has some limitations that need to be acknowledged. The main limitation of this study is that there was a lack of dietary intake control, affecting body composition and weight control. Another limitation is the indirect measurement of aerobic capacity. This measurement method may weaken the interpretation of the results. It should be noted that these results were observed in recreationally active young adults. Therefore, our study results may not generalize to participants of different performance levels, sex, and age groups.

CONCLUSIONS

The present study demonstrated the effect of the self-paced HIIT and MICT on the physical performance and psychophysiological responses of young adults. An 8-week training period, including either self-paced HIIT or self-paced MICT three times a week, was similarly effective in changing body composition, sprinting and jumping performances. Furthermore, the time-efficient, effective and more enjoyable training strategy, HIIT, also showed a considerable increase in speed-based performances in terms of the $\dot{V}O_{2max}$, RSA and T-drill compared with MICT in recreationally active young adults. From a practical point of view, a self-paced training strategy might help to improve desired physical conditioning as an alternative to imposed HIIT, especially in team sports such as soccer, basketball and handball at a recreational level. From a coach's point of view, time-efficient, more effective and more enjoyable training strategies are preferable to improve participants' aerobic fitness and general health conditions.

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Conflict of interest declaration

The authors declare no conflict of interests regarding the publication of this manuscript.

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