Dissimilar Physiological and Perceptual Responses Between Sprint Interval Training and High-Intensity Interval Training

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Abstract

Wood, KM, Olive, B, LaValle, K, Thompson, H, Greer, K, and Astorino, TA. Dissimilar physiological and perceptual responses between sprint interval training and high-intensity interval training. *J Strength Cond Res* 30(1): 244–250, 2016—High-intensity interval training (HIIT) and sprint interval training (SIT) elicit similar cardiovascular and metabolic adaptations vs. endurance training. No study, however, has investigated acute physiological changes during HIIT vs. SIT. This study compared acute changes in heart rate (HR), blood lactate concentration (BLa), oxygen uptake ($\dot{V}O_2$), affect, and rating of perceived exertion (RPE) during HIIT and SIT. Active adults (4 women and 8 men, age = 24.2 ± 6.2 years) initially performed a $\dot{V}O_2$max test to determine workload for both sessions on the cycle ergometer, whose order was randomized. Sprint interval training consisted of 8 bouts of 30 seconds of all-out cycling at 130% of maximum Watts (Wmax). High-intensity interval training consisted of eight 60-second bouts at 85% Wmax. Heart rate, $\dot{V}O_2$, BLa, affect, and RPE were continuously assessed throughout exercise. Repeated-measures analysis of variance revealed a significant difference between HIIT and SIT for $\dot{V}O_2$ ($p < 0.001$), HR ($p < 0.001$), RPE ($p = 0.03$), and BLa ($p = 0.049$). Conversely, there was no significant difference between regimens for affect ($p = 0.12$). Energy expenditure was significantly higher ($p = 0.02$) in HIIT (209.3 ± 40.3 kcal) vs. SIT (193.5 ± 39.6 kcal). During HIIT, subjects burned significantly more calories and reported lower perceived exertion than SIT. The higher $\dot{V}O_2$ and lower BLa in HIIT vs. SIT reflected dissimilar metabolic perturbation between regimens, which may elicit unique long-term adaptations. If an individual is seeking to burn slightly more calories, maintain a higher oxygen uptake, and perceive less exertion during exercise, HIIT is the recommended routine.

Key Words $\dot{V}O_2$, blood lactate, perceived exertion, affect, caloric expenditure, cycle ergometry

Introduction

Recent reports from the Centers for Disease Control (9) document marked prevalence of inactivity among adults, in that only 51% of adults meet the guidelines for 150 min·wk^{-1} of moderate exercise or 75 min·wk^{-1} of vigorous exercise and 25% report no leisure time activity. This is an important public health problem because of the direct relationship between inactivity and morbidity/mortality from chronic disease (1). This has prompted interest by modern-day exercise scientists to identify the most effective exercise modality to modify health risks. Current recommendations (13) are designed to improve health status, yet may not be feasible for many individuals who cite lack of time as the greatest obstacle to regular exercise participation (37). As a result, alternative modes of exercise are needed to improve health status yet be time-efficient to appeal to individuals who do not perform the recommended levels of physical activity.

High-intensity interval training (HIIT) has been shown to be a time-efficient and robust approach to promote physiological adaptations including increases in $\dot{V}O_2$max (3,18), cycling performance (18), fat oxidation (4,35), insulin sensitivity (36), and, in some cases, beneficial changes in body composition (19). This training modality is characterized by repeated completion of brief but intense bursts of activity (5–150 seconds at near-maximal to supramaximal intensities) separated by passive or active recovery, with the typical session time approximating 20 minutes. Nomenclature describing interval training has evolved to denote sprint interval training (SIT) as 5–30 seconds of effort at supramaximal intensities such as repeated Wingate-like tests performed at 170–300% of maximum Watts (Wmax) (14,18), whereas HIIT encompasses bouts of longer duration (1–2.5 minutes) at workloads slightly lower than or equal to $\dot{V}O_2$max (4,21,35). Despite many studies examining chronic adaptations to each

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of these regimens, no study to our knowledge has compared acute responses between regimens, which may highlight unique physiological responses incurred and in the long run may help identify the optimal prescription for interval training.

Existing studies describing acute responses to HIIT or SIT tended to manipulate factors including rest interval and bout duration rather than intensity, which is identified (29) as the most important factor affecting the magnitude of training response. Gosselin et al. (16) examined the metabolic responses to different treadmill HIIT routines (work/rest ratios of 30/30, 60/30, 90/30, and 60/60 seconds at 90% $\dot{V}O_2$max for 10 minutes) and compared the results to 20 minutes of continuous exercise at 70% $\dot{V}O_2$max. Across all routines, the 90/30 regimen elicited the greatest increase in $\dot{V}O_2$, heart rate (HR), rating of perceived exertion (RPE), and blood lactate concentration (BLa) but the lowest energy expenditure (16). This shows that duration of work and rest periods during acute interval training may affect physiological responses. In addition, the acute adaptations were comparable between the 60/30 routine and the continuous exercise regimen. Higher $\dot{V}O_2$ and BLa were also shown in trained cyclists in response to a 40:20 vs. 30:30 s cycling regimen performed at 135% Wmax (28), although time to exhaustion and total work were diminished with the 40:20 regimen. Intense calisthenics consisting of repeated burpees revealed similar cardiac (~85% HRmax) and metabolic (~80% $\dot{V}O_2$max) responses to Wingate-based SIT, suggesting similar cardiorespiratory demand across regimens (15). Hazell et al. (20) demonstrated that SIT consisting of 4 Wingate tests acutely increases $\dot{V}O_2$ to values approaching $\dot{V}O_2$max, which was also revealed by Freese et al. (11). These data reveal that brief intense bouts of HIIT or SIT elicit near-maximal cardiorespiratory and metabolic responses and that long-term bouts may promote health-related adaptations in various populations, as previously shown (4,36,38).

Recent studies have also investigated perceptual responses during HIIT and SIT. Kilpatrick et al. (24) examined changes in RPE before, during, and after HIIT exercise compared with continuous exercise. In an early study, Kilpatrick and Greeley (23) showed higher RPE in 60 s vs. 30 s intervals matched for total work. The HIIT routines required 1:1 work:rest ratios (30/30, 60/60, and 120/120 seconds) over a duration of 24 minutes. Across all 3 regimens, intensity was equal to 60% of distance between ventilatory threshold and $\dot{V}O_2$max. The continuous regimen was 20 minutes in duration at an intensity between ventilatory threshold and $\dot{V}O_2$max. Results showed lower RPE throughout and postexercise in 30/30 vs. the longer-duration intervals (60/60 and 120/120) and heavy continuous exercise. Similarly, Price and Moss (31) reported higher RPE in response to long (24:36 s) versus short (6:9 s) work:rest ratios during interval running. Therefore, the specific duration of HIIT bout of identical intensity may uniquely affect RPE. In another study (30), data showed less positive affect during HIIT vs. continuous exercise matched for total work; however, this was explained by the relatively brief recovery periods used during the interval training session. In contrast, a previous study by Bartlett et al. (6) demonstrated higher RPE yet greater perceived enjoyment during interval running (six 3-minute bouts at 90% $\dot{V}O_2$max) compared with continuous exercise in active men. As affect may be related to long-term adherence to exercise (39), elucidating perceptual responses to different interval training regimens may help identify individuals willing to continue regular physical activity.

To our knowledge, no study has compared physiological and perceptual responses between various intensities of interval training. Moreover, there are equivocal data regarding perceptual responses to interval training. Despite numerous studies highlighting chronic adaptations to various interval training regimes, less attention has been paid to exploring the acute responses to interval training (30), which may reveal the efficacy and practicality of specific types of interval training.

The aim of this study was to compare acute changes in cardiorespiratory, metabolic, and perceptual indices between HIIT and SIT in active men and women. It was hypothesized that acute changes in HR, BLa, $\dot{V}O_2$, and perceived exertion would be greater in SIT compared with HIIT, energy expenditure would be lower in SIT, and that HIIT would elicit more positive affect compared with SIT.

Methods

Experimental Approach to the Problem

In this study, participants completed 3 visits to the laboratory (temperature = 21–23° C, relative humidity = 40–60%) at the same time of day within subjects. All trials were preceded by a 3-hour fast and abstention from exercise for 24 hours. On day 1, participants completed a $\dot{V}O_2$max test that was used to establish workloads for the 2 subsequent visits, during which participants completed a single session of HIIT or SIT whose order was randomized. At least 48 hours was allotted between sessions. During exercise, gas exchange data, BLa, and perceptual measures were obtained.

Subjects

Twelve recreationally active men ($n = 8$) and women ($n = 4$) (mean age, mass, height, and frequency of physical activity = 24.2 ± 6.3 years, 74.3 ± 8.5 kg, 175.9 ± 8.7 cm, and >3 $h \cdot wk^{-1}$, respectively) participated in this study. Subjects habitually completed exercise including noncompetitive sport, resistance training, aerobic exercise, etc; yet, none was considered athletic. Subjects filled out a health-history questionnaire to verify their eligibility for the study and provided written informed consent, and all procedures were approved by the University institutional review board.

Familiarization Trial

Initially, height and body mass were measured. Then, an HR monitor (Polar Electro, Woodbury, NY, USA) was placed on the trunk, and participants were prepared for incremental exercise to fatigue on an electrically braked cycle ergometer (Velotron Dynafit Pro; Racermate, Seattle, WA, USA).

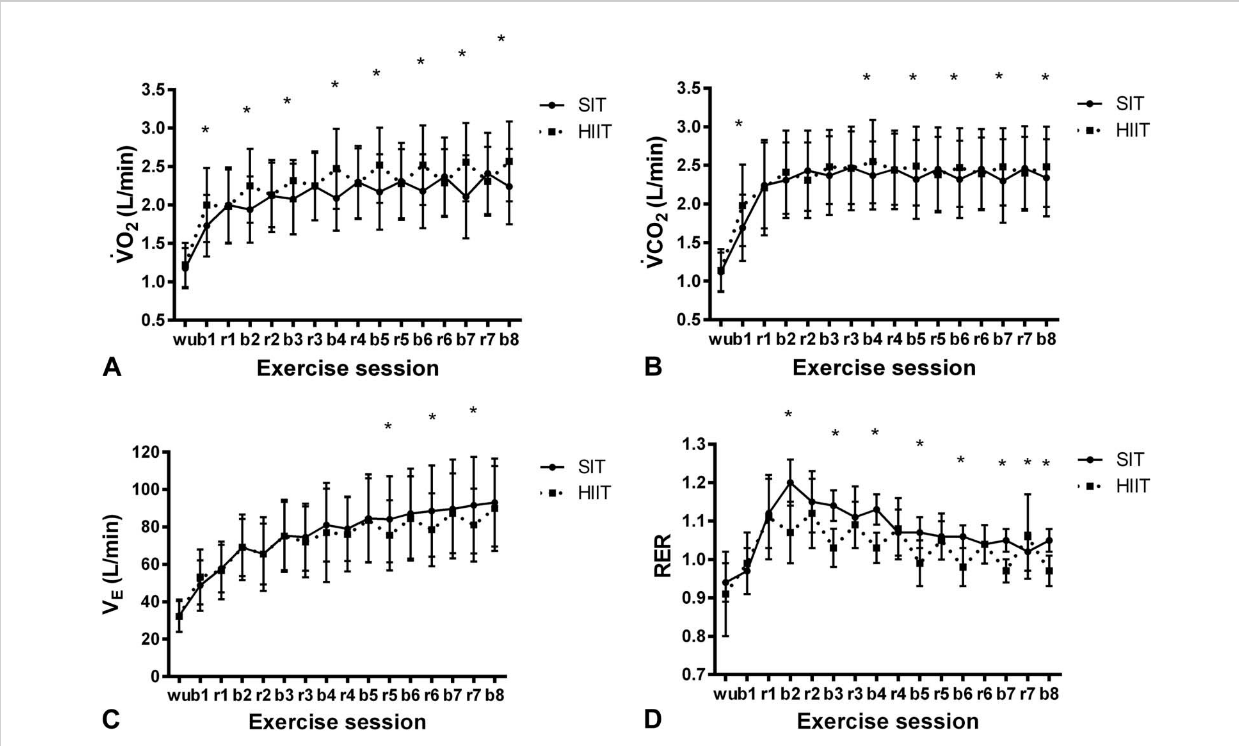

Figure 1. Change in (A) $\dot{V}O_2$, (B) $\dot{V}CO_2$, (C) V_E, and (D) RER in response to HIIT and SIT. *Significant difference ($p \leq 0.05$) between modes. b = bout; HIIT = high-intensity interval training; r = recovery; SIT = sprint interval training; V_E = ventilation; wu = warm-up; RER = respiratory exchange ratio.

Subjects initiated exercise at 50–60 W for 2 minutes after which workload was increased by 25–30 W$\cdot$min^{-1} following a ramp protocol until volitional exhaustion (cadence <50 rpm). Pedal cadence was maintained at 60–90 rpm, and participants were encouraged to exercise "all-out." During exercise, pulmonary gas exchange data (Parvo Medics TrueOne, Sandy, UT, USA) were obtained every 15 seconds to determine $\dot{V}O_2$max. Before exercise, the metabolic cart was calibrated according to standard procedures identified by the manufacturer. Variables obtained from this test included maximal determinations of $\dot{V}O_2$ (L$\cdot$min^{-1} and ml$\cdot$kg$^{-1}\cdot$min^{-1}), HR, respiratory exchange ratio (RER), $\dot{V}CO_2$, and ventilation (V_E). Attainment of $\dot{V}O_2$max was confirmed by incidence of a plateau in $\dot{V}O_2$ at $\dot{V}O_2$max ($\leq$150 ml$\cdot$min^{-1}) as well as RERmax >1.10 and HRmax 10 b$\cdot$min^{-1} within 220 – age (2). The coefficient of variation for $\dot{V}O_2$max and Wmax for active populations in our laboratory is equal to 3.2 and 3.7%, respectively. At volitional fatigue, maximal workload (in Watts) was noted and used to set intensities for subsequent interval training.

Interval Training

Across 2 subsequent sessions, participants were randomized to complete 1 session of SIT or HIIT. All sessions were preceded by a 5-minute warm-up at 25% Wmax and followed by a 3-minute recovery at this work rate. High-intensity interval training consisted of eight 1-minute bouts at 85% Wmax interspersed with a 1-minute active recovery at 25% Wmax. Sprint interval training consisted of eight 30-second bouts at 130% Wmax interspersed with 90-second active recovery at 25% Wmax. Session duration (24 minutes) was identical across regimens, but work was not matched across bouts.

Measurements

During all sessions, pulmonary gas exchange data were obtained and time averaged every 15 seconds. During HIIT and SIT, $\dot{V}O_2$ and related gas exchange data were determined as the mean of the last 2 data points from each bout and the first one in recovery, as data (11,20) show that $\dot{V}O_2$ typically peaks early in recovery. Recovery values of these parameters were determined using the average of all 4 data points for HIIT and from the first 4 data points in SIT. Heart rate was also continuously obtained through telemetry (Polar Electro, Woodbury, NY) and analyzed similarly to $\dot{V}O_2$. Blood lactate concentration was measured pre-exercise, immediately after bout 4, and 3 minutes' postexercise using a 0.7-μL fingertip blood sample (Lactate Plus; Sports Research Group, New Rochelle, NY, USA). Perceptual measures including RPE (6–20) (7) and affect (+5 to −5) (17) were obtained as participants sat on the bike before exercise and immediately at cessation of

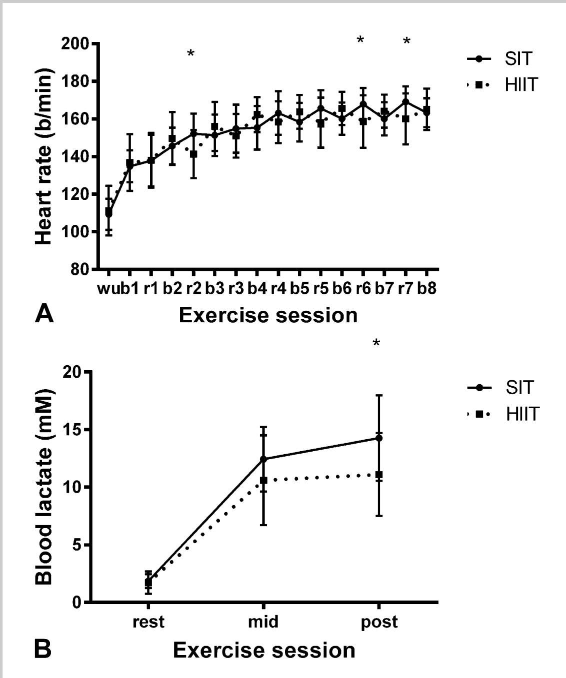

Figure 2. Change in (A) heart rate and (B) blood lactate concentration in response to HIIT and SIT. *Significant difference ($p \leq 0.05$) between modes. b = bout; HIIT = high-intensity interval training; r = recovery; SIT = sprint interval training; wu = warm-up.

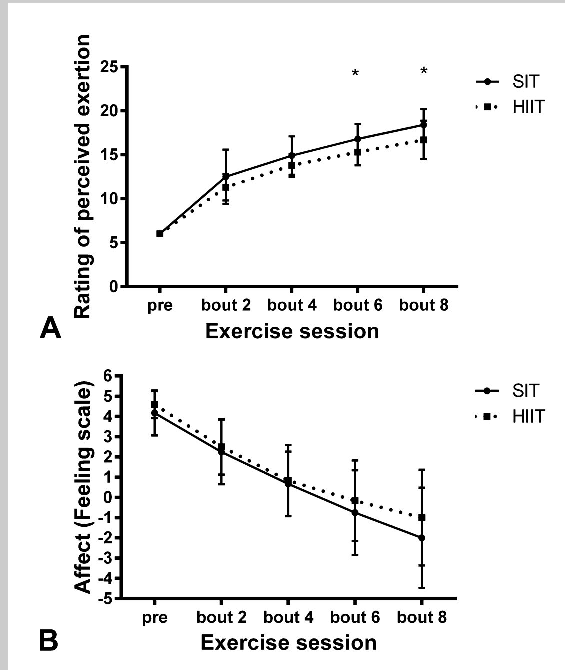

Figure 3. Change in (A) rating of perceived exertion and (B) affect in response to HIIT and SIT. *Significant difference ($p \leq 0.05$) between modes. HIIT = high-intensity interval training; SIT = sprint interval training.

bouts 2, 4, 6, and 8. Before each trial, participants read specific instructions according to what each measure encompassed. They were asked to respond to each scale of how they felt at that moment.

Statistical Analyses

Data are expressed as mean ± *SD* and were analyzed using SPSS Version 20.0 (Chicago, IL, USA). Two-way analysis of variance (ANOVA) with repeated measures (intensity = 2 levels and time = 5 levels) was used to examine differences in RPE and affect in response to HIIT and SIT. Two-way ANOVA with repeated measures (intensity = 2 levels and time = 16 levels) was used to examine differences in $\dot{V}O_2$, gas exchange data, and HR in response to HIIT and SIT. Two-way ANOVA with repeated measures (intensity = 2 levels and time = 3 levels) was used to examine differences in BLa in response to SIT and HIIT. If a significant *F* ratio was obtained, Tukey's post hoc test was used to identify differences between mean values. The Greenhouse-Geisser correction was used to account for the sphericity assumption of unequal variances across groups. Statistical significance was equal to $p \leq 0.05$.

Results

Mean $\dot{V}O_2$max, HRmax, RERmax, and Wmax obtained in the baseline session were equal to 40.6 ± 4.3 ml·kg^{-1}·min^{-1}, 179.2 ± 8.7 b·min^{-1}, 1.22 ± 0.07, and 283.7 ± 60.9 W, respectively. This $\dot{V}O_2$max value demonstrates that these participants were recreationally active.

Comparison of physiological responses between HIIT and SIT: Figure 1A demonstrates a significant difference ($p < 0.001$) in $\dot{V}O_2$ between HIIT and SIT, and a significant time × regimen interaction ($p < 0.001$) was revealed. Tukey's post hoc test showed that $\dot{V}O_2$ was significantly greater by 9–15% during all HIIT bouts compared with SIT. Results show that $\dot{V}O_2$ increased and eventually leveled off across bouts. Ventilation differed ($p < 0.001$) between HIIT and SIT and a time × regimen interaction was apparent ($p < 0.001$) (Figure 1B). In recovery, V_E was approximately 10% higher in response to SIT vs. HIIT for bouts 5–7. Similar results were demonstrated for $\dot{V}CO_2$ (Figure 1C) and RER (Figure 1D) in that they differed across regimen ($p < 0.001$ and $p = 0.002$), and significant interactions ($p < 0.001$) were evident. For example, $\dot{V}CO_2$ was 5–8% higher during HIIT bouts 1 and 4–8 compared with SIT, and RER in bouts 2–8 of SIT was higher than that in HIIT.

Heart rate differed between HIIT and SIT ($p < 0.001$) and a significant time × regimen interaction ($p < 0.001$) was demonstrated as in recovery, HR was higher in SIT vs. HIIT after bouts 2, 6, and 7 (Figure 2A). The average HR was slightly higher in SIT (153.0 ± 10.4 b·min^{-1}) vs. HIIT (151.4 ± 14.9 b·min^{-1}). Heart rate peaked at 95% HRmax in HIIT and 91% HRmax in SIT. Blood lactate concentration increased during exercise ($p < 0.001$) and was significantly different ($p = 0.049$) between modes, with post hoc analyses showing higher BLa after exercise in SIT (14.3 ± 3.7 $mmol \cdot L^{-1}$) than HIIT (11.1 ± 3.6 $mmol \cdot L^{-1}$) (Figure 2B). Additionally, there was a significant difference ($p = 0.002$) in energy expenditure during HIIT (209.3 ± 40.3 kcal) vs. SIT (193.5 ± 39.6 kcal).

Comparison of perceptual responses between HIIT and SIT: there was a significant difference ($p = 0.03$) in RPE between regimens, as seen in Figure 3A, and a significant time × regimen interaction ($p = 0.047$). Post hoc analyses revealed that RPE in bout 6 (14.8 ± 1.9 vs. 15.9 ± 2.4) and end-exercise RPE were lower in HIIT (16.7 ± 2.2) than SIT (18.2 ± 1.8). Affect as measured with the Feeling Scale decreased during exercise ($p < 0.001$) and yet was not different across mode ($p = 0.12$). These data are revealed in Figure 3B, showing a linear decrease and a tendency for more positive affect at cessation of HIIT (−1.0 ± 2.4) compared with SIT (−2.0 ± 2.5). When asked which mode of exercise was preferred on completion of the study, 50% of participants preferred HIIT and 50% preferred SIT.

Discussion

The aim of this study was to compare the acute physiological and perceptual responses between 2 widely used modes of interval training, HIIT and SIT. The hypothesis was met in that BLa and RPE were significantly greater in SIT, energy expenditure was significantly greater in HIIT, and oxygen uptake was significantly higher in HIIT vs. SIT. Although the results show that subjects perceived less exertion and attained higher oxygen consumption during HIIT vs. SIT, the magnitude of differences in various parameters between regimens was small; therefore, preference for either modality may be up to the individual.

Our results showing a significantly higher $\dot{V}O_2$ for HIIT vs. SIT (Figure 1A) are likely due to greater recruitment of lower threshold motor units (types I and IIa) during this submaximal regimen of interval training, which relies more on aerobic metabolism for ATP supply. Whether this greater oxygen uptake characteristic of HIIT elicits unique long-term adaptations compared with other modalities of interval training such as SIT is relatively unresolved. In a recent study by Matsuo et al. (26), improvements in $\dot{V}O_2$max were compared between 8 weeks of HIIT (13 minutes at 80% $\dot{V}O_2$max per session), SIT (5 minutes at 120% $\dot{V}O_2$max), and continuous exercise (40 minutes at 60% $\dot{V}O_2$max) performed by untrained men. Results revealed a significantly greater increase in $\dot{V}O_2$max in HIIT (22.5 ± 12.2%) and SIT (16.7 ± 11.6%) vs. continuous exercise (10.0 ± 8.9%) (25). In active men and women (18), similar increases in $\dot{V}O_2$max (9.2%) were revealed in response to 6 days of Wingate-based SIT despite dissimilar durations of exercise (10 and 30 seconds). In untrained women completing 12 weeks of moderate or more intense HIIT on a cycle ergometer, improvements in $\dot{V}O_2$max were comparable (~22%) (5). Overall, HIIT and SIT significantly improve $\dot{V}O_2$max in various individuals; yet, existing data indicate relatively similar physiological adaptations despite different intensities and durations administered across various studies. As $\dot{V}O_2$max has been identified as a significant predictor of mortality (27), discerning the optimal regimen of interval training leading to the greatest increases in this parameter is an important issue for scientists to identify. In this study, HIIT and SIT elicited oxygen uptake equal to approximately 88 and 80% $\dot{V}O_2$max, respectively, which is similar to and slightly lower than previously reported values from SIT (8,20), likely attributed to the "all-out" nature of SIT performed in these studies. Overall, repeated bouts of HIIT or SIT of ≤1 minute duration elicit near-maximal stress on the cardiorespiratory system that likely lead to improvements in $\dot{V}O_2$max demonstrated in previous studies.

The higher BLa observed in SIT vs. HIIT (Figure 2B) may be caused by greater fast oxidative-glycolytic/fast-glycolytic muscle fiber contribution at 130 vs. 85% Wmax, leading to greater reliance on nonoxidative metabolism and hence greater BLa accumulation. Peak BLa demonstrated in SIT and HIIT is slightly higher than values reported by Laurent et al. (25) in men and women performing treadmill interval training at 86–90% $\dot{V}O_2$peak, likely because of the smaller exercising muscle mass of cycle ergometry as used in this study. Results from Gosselin et al. (16) and Nicolo et al. (28) demonstrated higher BLa when HIIT required longer bouts in which more work, presumably supported by greater contribution from glycolysis, is completed compared with shorter bouts at the same intensity. Compared with shorter bouts (30:30), higher peak BLa in the Nicolo et al. (28) study occurred in response to 40:20 bouts despite ~60% lower total work and a dramatically lower exercise duration (10 vs. 38 minutes). However, these findings do not support our results regarding effects of bout duration on BLa, as the bouts in SIT were 50% shorter than in HIIT but at a markedly higher work rate equivalent to 130% Wmax. This indicates that not only duration but also intensity of interval training affects BLa concentration.

The greater V_E seen in response to SIT is caused by the greater need to ventilate during supramaximal exercise to minimize disturbances in muscle/blood acidity, leading to an accelerated rise in nonmetabolic CO_2 production and thus $\dot{V}CO_2$. In response to SIT consisting of 4 repeated Wingate tests (11), V_E increased to value ~100 $L \cdot min^{-1}$ that is slightly higher than peak values attained in this study equal to 85 $L \cdot min^{-1}$. In response to SIT, dramatically higher values for V_E were demonstrated in trained cyclists (28) and healthy men (20) that were equal to 130–160 $L \cdot min^{-1}$. Our use of lesser trained individuals including women and application of lower-intensity interval training led to the lower V_E values vs. those previously reported.

Rating of perceived exertion increased in response to both interval training regimens and was higher by approximately 1 unit late in SIT exercise vs. HIIT (Figure 3A). The higher BLa and V_E consequent with SIT may explain the different

RPE response vs. HIIT, as these are related to perceived exertion (32). This elevated RPE was coincident with a higher HR response in SIT vs. HIIT (Figure 2A). Oliveira et al. (30) explained that higher HR coincident with interval exercise is associated with higher RPE and more negative feelings. When interval training was performed at 90% $\dot{V}O_2$max, peak exercise RPE in response to a 90:30 work:rest ratio was significantly higher than that demonstrated for 60:60, 60:30, and 30:30 protocols (16). Interestingly, this result was coincident with higher BLa, HR, and $\dot{V}O_2$ in 90:30 vs. other protocols, suggesting that the overall magnitude of metabolic and cardiorespiratory strain determines RPE during submaximal HIIT.

Although our results did not show any significant differences in affect between HIIT and SIT, affect decreased linearly across bouts (Figure 3B) and it tended to be less positive in SIT compared with HIIT. Similarly, Ekkekakis et al. (10) demonstrated that affect declined during intense exercise. Oliveira et al. (30) demonstrated a significantly less positive affect during HIIT compared with continuous exercise despite similar intensity expressed as %$\dot{V}O_2$max and level of enjoyment. These authors suggested that HIIT with longer recovery periods may result in a more positive change in affect and that the magnitude of contribution of anaerobic metabolism during HIIT seems to be the primary determinant of perceptual responses. Women have been shown to rely more on aerobic metabolism during HIIT than men (14), which may explain the wide variability seen in affective responses. Moreover, different BLa responses are exhibited at identical intensities expressed as % $\dot{V}O_2$max (34), suggesting that the metabolic strain of selected intensities of interval training can widely vary across individuals and lead to dissimilar affective responses. Although SIT is characterized by shorter bouts and longer recovery periods than HIIT, the intensity is higher. Our results showed that SIT produced a significantly higher RPE and a tendency for less positive affect than HIIT. Thus, despite the lower work: rest ratio, the higher intensity of SIT may have a greater contribution in determining perceptual responses.

In this study, HIIT and SIT required a total session time equal to 24 minutes with actual time of exercise equal to 8 and 4 minutes, respectively. This duration is dramatically lower than the current public health guidelines for physical activity. In fact, recent data from Gillen et al. (14) showed that as little as 3 minutes of all-out SIT per week improved various physiological and health-related variables in untrained adults. Compared with continuous exercise, HIIT has been shown to elicit similar enjoyment and greater preference (22), which would seem to establish HIIT as a viable, and, in some cases, superior alternative to continuous aerobic exercise.

One limitation of this study was a higher number of male participants in comparison with female participants. Results from a recent study (25) reported that women self-selected higher intensities and reported lower exertion compared with men during acute interval training. Yet, in this study, intensities were not self-selected but fixed; therefore, the effect of gender on our measures is unclear. Gender differences in perceptual responses to exercise at absolute intensities may exist (33), although no differences were evident when exercise was performed at relative intensities (12). Whether this gender discrepancy altered our perceptual measures is unknown, especially considering the equivocal nature of previous data on this topic. Our study was limited to active individuals 18–45 years old; therefore, interval training performed by a less active and/or older population may elicit different responses. In addition, our study used 2 frequently used paradigms of exercise, HIIT and SIT, which were characterized by 8 and 4 minutes of actual exercise time and were not matched for work completed. Results may have differed if "all-out" SIT was performed and if different intensities, recovery durations, or number of bouts were implemented. Lastly, the significantly greater energy expenditure (+16 kcal) and differences in V_E, RPE, and BLa seen with HIIT vs. SIT were small and may not be clinically meaningful; therefore, additional study of 24-hour changes in energy expenditure and long-term adaptations in response to different modes of interval training is merited.

Practical Applications

Interval training is a popular modality of exercise because of its relatively low time commitment and constantly changing intensity. Characteristics of interval training that can be modified include bout duration and number, the duration of recovery, and the intensity of each bout. Our findings reveal that repeated 30-second sprints performed at supramaximal intensity on a cycle ergometer result in lower oxygen uptake and energy expenditure yet higher perceived exertion and BLa compared with 60-second bouts at submaximal intensities. Despite these results, 50% of subjects preferred SIT vs. HIIT. Overall, HIIT is recommended for persons seeking higher oxygen consumption and lower perceived exertion during acute bouts of interval training.

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