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Effects of High-Intensity Calisthenic Training on Mood and Affective Responses

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ABSTRACT

Evangelista AL, Evangelista RAGT, Machado AF, Miranda JMQ, Teixeira CVLS, Lopes CR, Bocalini DS. Effects of High-Intensity Calisthenic Training on Mood and Affective Responses. **JEPonline** 2017;20(6):15-23. The purpose of this study was to analyze affective and humor responses to high-intensity (HIIT) body work (calisthenic) training. Twenty-six healthy adult men who were recreationally active underwent an acute single session of HIIT body work training. based on 8 sets of 20 sec of all-out supramaximal intensity and 10 sec of passive recovery period. The exercises used were the burpee, jumping jack, mountain climber, and squat and thrust. The subjects responded to the Profile of Mood States (POMS) and a feeling scale before and after the session. After the HIIT body work training, fatigue was higher at the end of the session. There was a gradual reduction in the perception of recovery, especially after the third set. The affective response during the HIIT Whole Body session suffered a gradual reduction of the sensation of pleasure during the series, mainly from the fourth set onwards. The HIIT body work training led to changes in mood levels and progressive reduction in affectivity.

Key Words: Affectivity, Body Work Training, HIIT, Mood States

INTRODUCTION

In recent years, there has been a surge in interest concerning high-intensity interval training (HIIT) due to its ability to confer notable cardiometabolic health benefits rapidly, in a time-efficient manner (9). This type of training, which intercalates periods of high intensity efforts with intervals of active or passive recovery, has been proposed as an alternative to traditional activities of moderate continuous intensity to improve general physical conditioning (11,12).

Also, several studies (8,18,23) indicate that in healthy, young to middle-aged adults, HIIT improves maximal oxygen uptake to a greater extent than traditional endurance training. Other benefits of its practice include improved insulin sensitivity (29), decreased resting blood pressure, and a significant reduction in intra-abdominal fat and blood cholesterol levels (13).

The most commonly investigated forms of HIIT, although they include protocols varying in time proportion between stimulus and recovery, use cyclic exercises performed on ergometers (e.g., bicycle and treadmill). More recently, Machado et al. (19) and McRae et al. (20) have proposed the use of bodyweight exercises (calisthenics) in HIIT programs, calling the proposal "HIIT whole body" or "HIIT body work".

The use of calisthenics in training has been pointed out by Thompson (27) as a strong market trend in recent years, mainly for providing independence for the exercise performance, low operating cost, and three-dimensional freedom of movement. Although the calisthenics exercises seem simple, HIIT body work is a method-filled modality, mainly methodologically, about the manipulation of workloads (13). Thus, previous studies have suggested that HIIT body work offers physiological benefits similar to those observed in traditional HIIT protocols (10-12,20).

Despite the previously documented efficiency of HIIT body work on the physical conditioning of its practitioners, little is known about the behavior of the psychological variables in a HIIT body work session. Although research associating psychological variables with continuous low to moderate intensity methods is abundant in the literature, studies investigating the acute impact of HIIT on affective and mood responses are relatively scarce. Therefore, the purpose of this study was to analyze affective and humor responses to a HIIT body work training session.

METHODS

Subjects

After the research ethics committee approval, 26 healthy adult men (≥18 yrs) who were physically independent and recreationally active volunteered to participate in this study. Each subject signed an approved informed consent document. The subjects' biometric parameters assessed are: (a) age, 28.73 ± 5.64 yrs; (b) weight, 74.85 ± 13.71 kg; (c) height, 1.71 ± 0.09 m; and (d) BMI, 25.33 ± 3.30 $kg \cdot m^{-2}$. The following parameters were used to exclude potential subjects from participation in this study: positive clinical diagnosis of diabetes mellitus, smoker, and musculoskeletal complications, and/or cardiovascular alterations confirmed by medical evaluation.

Exercise Protocols
An acute single session of high-intensity interval training based on whole body exercise training was performed in a session that involved 5 min of warm-up (running at 70% of the subjects' maximum heart rate) followed by 8 sets of 20 sec of all-out supramaximal intensity at the subjects' respective self-selected gearing and 10 sec of passive recovery period between the sets. The exercises that were used included burpee, jumping jack, mountain climber, and squat and thrust in accordance with the work of McRae et al. (20). The sequence of exercises was repeated twice. After that, the subjects engaged in 5 min of stretching exercises to relax and recover.

Evaluated Anthropometric Parameters
Height was measured by a Cardiomed (WCS model) stadiometer with an accuracy of 115/220 cm. The measurement was performed with the cursor at an angle of 90° with respect to the scale while the subject was in the standing position with feet together in contact with Stadiometer. The subjects were instructed to stay in inspiratory apnea and head parallel to the ground. Total body mass was measured by a calibrated Filizola electronic scale (Personal Line Model 150) with a 100 g scale and a maximum capacity of 150 kg. Body mass index (BMI, $kg \cdot m^{-2}$) was calculated using the equation BMI = weight/height^2.

Training Intensity - Subjective Perception of Recovery
The subjective perception of recovery during the HIIT body work training session was assessed using the OMNI SCALE. Before the exercise session, the meaning of perceived exertion was explained to the subjects. Perceived exertion was defined as the subjective intensity of effort, strain, and/or fatigue that the subjects felt during exercise (28). A rating of 0 (low anchor, "very, very light") was assigned to the lowest exercise intensity, while a rating of 10 (high anchor, "very, very hard") was assigned to the highest exercise intensity. Rating of Perceived Exertion (RPE) values were recorded after each HIIT body work training session.

Recovery Monitoring
To monitor the subjects' recovery status, the Subjective Perception of Recovery (SPR) scale originally proposed by Laurent et al. (17) was used, which uses values from 0 to 10 (with values closer to 10 representing the subjects' recovery perception). The SPR scale was applied at the end of each exercise session series.

Profile of Mood State (POMS)
The subjects responded to the Profile of Mood States (POMS) questionnaire based on a test that assessed 6 transient mood states: tension, depression, anger, stamina, fatigue, and mental confusion. The POMS questionnaire is used to evaluate the subjects' mood profile before and after exercise, and it can be used as a trace or state measure. Its application is simple and fast, having 65 items following an evaluation of 5 points that mean: 0 = nothing; 1 = a little; 2 = more or less; 3 = quite; and 4 = extremely. The questionnaire was applied at the beginning and at the end of the body work training session. This questionnaire was validated for Portuguese by Brandão (2).

Feeling Scale (FS)
The FS (15) is an 11-point bipolar scale ranging from +5 to -5. It is commonly used to measure affective response (pleasure/displeasure) during exercise. This scale presents the

following verbal anchors: -5 = very bad; -3 = bad; -1 = fairly bad; 0 = neutral; +1 fairly good; +3 = good; and +5 = very good. Previous studies by Frazão et al. (6) and Petruzzello and Jones (24) recommend the FS to measure the subjects' affective responses during exercise. The subjects received standard instructions regarding the use of the FS during the initial screening and before the HIIT whole body training session. The FS values were recorded during each work bout in the HIIT whole body training session.

Statistical Analyses

The statistical characterization of the sample was done through descriptive statistics (mean ± standard deviation). The data for each POMS variable were analyzed using the Student *t* test for paired samples. For the calculation of the Feeling Scale and the recovery between the series, the ANOVA test was used for repeated measures followed by the Tukey's *post hoc* test. Statistical significance was established at $\alpha \leq 0.05$. The size of the Cohen effect (d) was calculated to quantify the magnitude of the responses. All statistical analyses were performed using the SPSS® software (v.15.0) on Windows.

RESULTS

No subjects presented any injuries as a result of the workout during and after the HIIT whole body training session. Table 1 presents the profile of mood states before and after the HIIT whole body protocol. Fatigue (P = 0.03, ES = 0.48) was higher at the end of the session. The effect size showed a small magnitude of reduction in anger (ES = 0.27) and depression (ES = 0.24) as well as in tension (ES = 0.18), confusion (ES = 0.14), and vigor (ES = 0.13).

Table 1. Profile of Mood States Before and After the Training Session.

POMS	Before	After	P	ES
Tension	12.54 ± 6.15	13.62 ± 5.46	0.56	0.18
Depression	7.62 ± 8.58	5.54 ± 7.98	0.15	0.24
Anger	9.54 ± 9.61	6.92 ± 7.77	0.07	0.27
Vigor	17.27 ± 6.69	18.15 ± 5.69	0.53	0.13
Fatigue	9.88 ± 6.59	13.04 ± 4.38	0.03*	0.48
Confusion	6.00 ± 3.82	6.54 ± 4.53	0.51	0.14

POMS = Profile of Mood States; **ES** = Effect Size; *P<0.05 = Significant Difference

Figure 1A shows the Subjective effort perception after each set during the HIIT whole body training session. The intensity of the stimuli was high in all sets performed. Figure 1B analyzes the subjective perception of recovery after each set during the HIIT whole body session. There was a gradual reduction in the perception of recovery, especially after the 3rd set. Figure 1C shows the affective response during the HIIT whole body session. There was a gradual reduction of the sensation of pleasure during the series, which occurred primarily from the 4th series to the end of the training session.

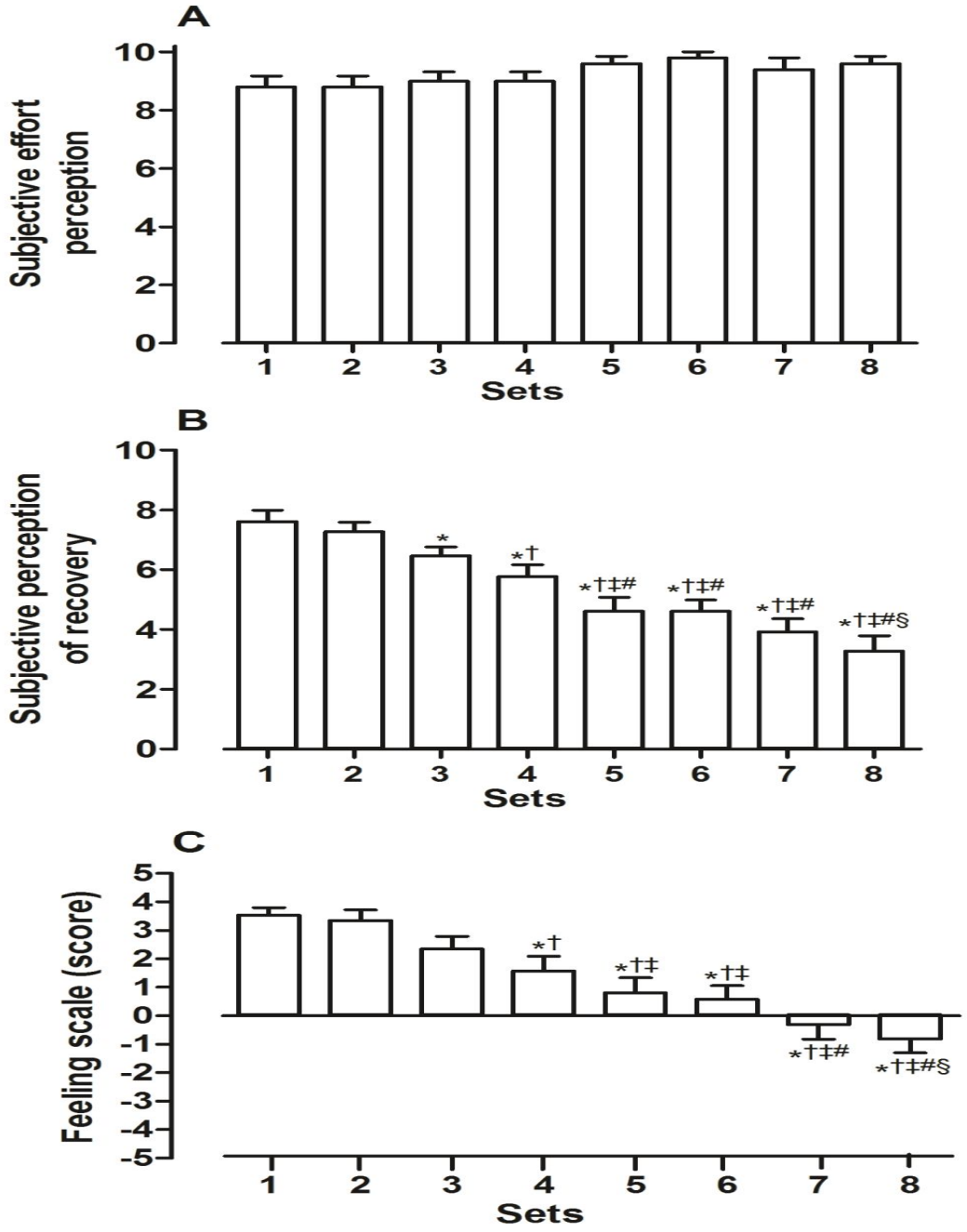

Figure 1A, 1B, and 1C. The Subjective Effort Perception after each set, The Subjective Perception of Recovery after each set, and The Affective Response during the HIIT Whole Body Session, respectively. **Figure 1B**∗ Work Bout 1 ≠ from Work Bouts 3 to 8; † Work Bout 2 ≠ from Work Bouts 4 to 8; ‡ Work Bout 3 ≠ from Work Bouts 5 to 8; # Work Bout 4 ≠ from Work Bouts 5 and 8; § Work Bout 6 ≠ from Work Bout 8. **Figure 1C**∗ Work Bout 1 ≠ from Work Bouts 4 to 8; † Work Bout 2 ≠ from Work Bouts 4 to 8; ‡ Work Bout 3 ≠ from Work Bouts 5 to 8; # Work Bout 4 ≠ from Work Bouts 7 and 8; § Work Bout 5 ≠ from Work Bout 8.

DISCUSSION

With the increase in popularity of HIIT and exercise with body weight (27), there is a growing need for studies to analyze the effects of interventions that combine the two strategies on the psychobiological variables. In this paper, we present the results of the literature on the use of HIIT body work (12,19,20), but to the best of our knowledge, this is the first report to compare the moods and affective responses to HIIT body work in recreationally active subjects. Our results demonstrate that the HIIT body work session caused alteration in the state of humor, besides a gradual reduction in the sensation of pleasure and recovery.

The mood state was evaluated through the responses of six subjective transient feelings. The HIIT body work training session resulted in a significant increase only in fatigue. The results were already expected, since a previous study also observed an increase in this component compared to sessions of physical exercises at moderate intensity (16). All-out training sessions maximize metabolic stress (20), which results in a high degree of fatigue.

Dishman et al. (4) have shown that positive effects on subjective feelings associated with mood in response to physical exercise are more evident when the intensity is self-selected. In the present study, the subjects' effort was all-out, which may explain the results. In fact, intense and complex exercises cause more central and peripheral fatigue, which directly affects mood (21).

Regarding the affective responses, the behavior of this variable showed a gradual decrease throughout the session. That is, with each subsequent high intensity stimulus, there was the tendency to decrease the sensation of pleasure. In support of this finding, Frazão et al. (6) demonstrated that HIIT demands high dependence on anaerobic metabolism, which negatively influences the affective response to exercise. The authors postulate that a likely greater dependence on anaerobic metabolism may increase the interoceptive afferent signals of the body to the brain areas related to the generation of the affective response (prefrontal cortex and subcortical areas). This induces deregulation of the prefrontal cortex, resulting in a negative affective response, mainly driven by subcortical areas of the brain (25,26).

It is reasonable to acknowledge that the protocol used in this study induced a high metabolic demand in addition to the subjects' significant muscle fatigue by mechanisms that may be associated with central and peripheral origin (7,14,22). Hence, the high metabolic demand and muscle fatigue resulted in higher scores in the perception of effort in recovery and changes in mood states, as well as the decreased sensation of pleasure (5). Also, as described in the literature by Bottaro et al. (1) and Dalamitros and colleagues (3), short recovery intervals between high-intensity stimuli generate residual fatigue among the stimuli, which may also have contributed to the decrease in the subjects' sensation of pleasure during the training session and negatively altered mood states (6).

It should be noted that, although the affectivity decreased gradually during the training session, perceptions in the displeasure zone were only observed in the last two series (7th and 8th). Thus, if the objective is to maintain the pleasure activity in order to maximize engagement and adherence to the training program, the HIIT body work session using a protocol similar to that of the study may be interrupted after the 6th grade.

CONCLUSIONS

The HIIT body work session used in the present study was configured as a high-intensity training session, which was demonstrated to be the case (given the subjective perceptions of effort and recovery that led to changes in mood levels and progressive reduction of affectivity during the course of the session).

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