Why might high-intensity interval training be attractive to the recreationally inactive contingent?

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Abstract

Objective of the study was to objectify the dynamics of affective valence in a group of healthy recreationally inactive females in response to low-volume, high-intensity interval training with their own body weight (whole-body HIIT).

Methods and structure of the study. Recreational-inactive healthy female students (n=11) who met the inclusion criteria took part in the experiment. Affective valence, heart rate and external parameters of physical activity were recorded.

Results and conclusions. Affective valence significantly decreased from 3.0 (3.0–3.0) to 0.0 (-1.0–1.0) points after overcoming the 85% threshold of the maximum predicted heart rate value, but after a cool-down (3.0 (3.0–5.0) points) the majority of subjects (54.5%) felt better than before the training (3.0 (2.0–3.0) points), which confirms presence of affective rebound. Thus, it is fair to conclude that the state of affective elation experienced after training may be one of the factors of adherence to low-volume whole-body HIIT.

Keywords: *affective rebound, low-volume whole-body HIIT, recreationally inactive students.*

Introduction. Over the past two decades, affective determinants of exercise behavior have received increasing attention in health promotion and noncommunicable disease prevention research [6]. The assumption that affective experiences play an important role in motivation to exercise is supported by the results of current research [12]. There is currently no consensus among health and fitness experts regarding the effects of high-intensity interval training (HIIT) protocols on exercise enjoyment. The following provisions are found: 1) HIIT is not suitable for widespread use in public health, as it causes negative sensations (displeasure) [2], the severity of which depends on the depth of the disturbance of homeostatic balance [5, 13] and, on the contrary, 2) HIIT contributes to obtaining pleasure due to affective rebound, directly related to the intensity of physical activity [12]. In this regard, Zenko & Ladwig [15] suggest that one of the most common maxims of exercise science, that "exercise improves well-being and brings pleasure," may be partially explained by suboptimal timing and frequency of measurement of affective reactions.

Nevertheless, rationally selected physical activity variables for the target population leading a sedentary lifestyle make it possible to program the desired physiological [4] and affective reactions [11]. In this regard, the development of low-volume, high-intensity training protocols and their testing on a recreationally inactive population, including those with metabolic disorders, has become relevant [9].

However, the available data from the scientific literature do not allow us to state whether the above provisions are valid for a healthy young recreationally inactive female population when performing low-volume high-intensity interval training with their own body weight (whole-body HIIT).

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ationally inactive females in response to low-volume, high-intensity interval training with their own body weight (whole-body HIIT).

Methods and structure of the study. Female students of Pskov State University (n=11) who met the inclusion criteria (body mass index (BMI) <25 units; main group for physical education; lack of physical training practice over the past two months and medical contraindications to physical activity), possible risks and incentives for participation.

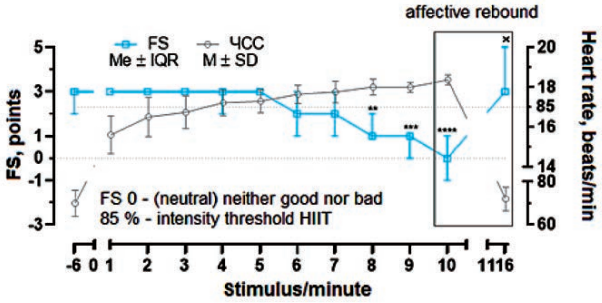
Detailed description of the low-volume whole-body HIIT training protocol (10 stimuli: 30 s - load / 30 s - rest) and procedures for measuring heart rate (HR, bpm (average value per minute)), affective valence (FS, points), external parameters of physical activity (number of repetitions of the exercise during each stimulus), body length and weight and the volume of weekly physical activity are presented in a previously conducted experiment [11]. To assess baseline and post-training indicators of physiological and affective reactions, additional measurements were taken at two extreme time points: a minute before the warm-up (-6 minutes) and after the cool-down (16 minutes).

Statistical processing, data analysis and visualization of the results were carried out in the GraphPad Prism 8 program (GraphPad Software, USA, 2020). The D'Agostino-Pearson and Anderson-Darling tests were used to check the normality of data distribution. Variables that passed normality tests were analyzed using parametric statistical methods. Comparison of group median values of variables obtained in the main part of the training was carried out using the Friedman test for repeated measures and Dunn's post-specific test. Data from the text are presented in Me format (Q1–Q3). Comparisons of group means were performed using one-way analysis of variance (ANOVA) for repeated measures and Dunnett's post hoc test. Data in the text are presented in M±SD format. Comparisons of pre-warm-up and post-cool-down scores were made using the Wilcoxon test (nonparametric data) and paired Student's t test (parametric data). Statistical significance was accepted at $p < 0.05$.

Results of the study and discussion. The average age of the subjects in the group was 19.6 ± 0.9 years, total physical activity was 2934.0 ± 664.0 MET min/week, body mass index was 22.4 ± 1.5 units. All subjects had a main group for physical education and declared no physical training over the past two months.

The figure shows the main results of the study.

Before the warm-up, the group mean heart rate was 69.9 ± 6.1 beats/min, after the cool-down it was



Dynamics of physiological and affective reactions to low-volume whole-body HIIT

Note: M – average value; SD – standard deviation; Me – median; IQR – interquartile range; ** – significant differences in FS compared to the first stimulus ($p<0.01$), *** – ($p<0.001$), **** – ($p<0.0001$); × – significant differences in FS "before warm-up – after cool-down" ($p<0.05$)

72.0 ± 5.5 beats/min ($p=0.0863$). Starting with the fourth stimulus, the group mean HR exceeded 85% of the theoretically predicted maximum. The average heart rate increased throughout the main part of the training protocol, the group indicator from stimulus to stimulus became more homogeneous and reached 91.6% of the theoretically predicted maximum. The first stimulus on average for the group was 156.0±9.5, and the tenth 183.7±2.6 beats/min ($p<0.0001$).

The group median value of affective valence before the warm-up was 3.0 (2.0–3.0) points, after the cool-down 3.0 (3.0–5.0) points ($p = 0.0313$). After the cool-down, six subjects felt better (54.5%) than before the warm-up, five felt at the same level (45.5%), and none felt worse. The sample range was 2.0 points at both points.

Affective valence decreased in response to physical activity. However, the first stimuli did not initiate reliable changes in affective valence. Extreme stimuli caused a significant decrease in affective valence and had a wider variability of reactions, with uniformly high heart rates. After the first stimulus, well-being was rated as 3.0 (3.0–3.0), and after the final one 0.0 (-1.0–1.0) points ($p<0.0001$). The range for the sample was 0.0 and 4.0 points, respectively.

The number of exercise repetitions during each stimulus was within the 95% confidence interval previously experimentally obtained as the maximum achievable values for this category of subjects [1], which indicated work in the "all-out" target mode.

The main result of the study is confirmation of the presence of the phenomenon of affective rebound in healthy recreationally inactive female individuals in response to low-volume whole-body HIIT. This correlates well with the results obtained by researchers that the discomfort associated with high-intensity physical activity "rebounds" (i.e., returns to the same or higher level) immediately after the cessation of exercise

[3, 10]. Therefore, presumably, after the cool-down, many subjects felt better than before the workout.

A decrease in affective valence was observed after passing a threshold of 85% of the maximum predicted heart rate, which is consistent with the theoretical dual mode model (DTM) [7]. Therefore, most people experience pleasant sensations at subthreshold intensities of physical activity; near the anaerobic threshold, strong interindividual variability of sensations is visible, and at suprathreshold intensities, uniformly negative sensations are recorded [8]. The findings may have practical implications for programming low-volume health-improving, high-intensity training protocols to maximize positive affective responses. At the same time, the etiology of affective rebound remains unclear, and the extent to which a decrease in affective valence during whole-body HIIT and, conversely, affective rebound influence the formation of adherence to this type of training.

Conclusions. The dynamics of affective valence when performing low-volume whole-body HIIT in a group of recreationally inactive female students has a negative trend. However, at the end of the workout, participants often feel better than before the workout, which confirms the presence of affective rebound, which may be a factor in adherence to low-volume, whole-body HIIT.

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