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The Utilization of Perceived Exertion is Valid for the Determination of the Training Stress in Young Athletes

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ABSTRACT

Manoel FA, Melo BP, Cruz R, Vilela CARS, Alves DL, da Silva SF, de Oliveira FR. The Utilization of Perceived Exertion is Valid for the Determination of the Training Stress in Young Athletes? **JEPonline** 2016;19(1):27-32. The purpose of this study was to determine if the rating of perceived exertion is valid method of determining training stress in young athletes. Rating of perceived exertion (RPE) is a variable used for physical assessment and training load monitoring in athletes. The goal is to assess the relationship between RPE and heart rate (HR) in aerobic tests during different training sessions in young athletes. We assessed 13 athletes (6 males and 7 females, mean age ± SD, 15.9 ± 1.09 yrs) of national and international level in their age categories. They underwent a progressive test on a track (PTT) and, then, they were monitored during 9 training sessions that consisted of continuous and interval runs (RUNT) and other types of training (OT, that included jumps, barriers jumps, weight lifting, plyometric training, speed training, technical training, and throwing). We found significant associations between RPE and HR in the PPT (r=0.76), RUNT (r=0.67) and OT (r=0.38). Thus, the rating of perceived exertion is a valid method of determining training stress in young athletes, particularly during aerobic exercises.

Key Words: Rating of perceived exertion, Running, Athletics, youths

INTRODUCTION

The training process involves the repetition of systematic exercises to optimize the execution of specialized motor skills and to develop structural and functional changes to improve athletic performance (18). The assessment of physical fitness parameters is present in the pedagogic-related decision associated with training in several sports. This is due to its direct importance on determining performance criteria and/or the basic requirements of fitness associated with young athletes' health. The progressive test (PT) is the most useful method to determine aerobic performance, given the relative ease of assessing specific physiological variables such as maximal oxygen uptake, lactate concentration, expired ventilation, and heart rate (HR) to calibrate training loads.

Foster and colleagues (10) proposed a simple method of monitoring training during different forms of exercise training using the rating of perceived exertion (RPE). Their work supports the use of the session RPE method as a subjective estimate of training load during non–steady state exercise and cyclic activities such as swimming (8,13), running (5), and cross-country skiing (17). Although the RPE method of quantitating exercise training is attractive, the use of RPE in monitoring the athletes' training is yet to be further investigated in non-cyclic activities (1). Besides, the literature presents a lack of studies on RPE application for controlling training load distribution of different forms of training by athletes. Accordingly, the intent of this study was to obtain scientific support for using RPE to determine training stress in young athletes.

METHODS

Subjects

This study evaluated 13 young athletes (6 males and 7 females) with a mean age ± SD of 15.9 ± 1.09 yrs. The athletes were national and international level competitors in their age categories. The sample was comprised of athletes from combined sports, jumpers, and middle distance runners. All the athletes trained ~3 $hrs \cdot session^{-1}$ at training frequency of 5 $sessions \cdot wk^{-1}$. All subjects and their parents signed a consent form to participate, thus respecting all the ethical aspects related to a research with humans according to the Declaration of Helsink (1964).

Familiarization with the RPE scale was performed during the 2 wks before applying the progressive test. All athletes underwent a maximal progressive test on a track (PTT) - VAMEVAL (CAZORLA, 1990), during which they performed a 400 m track test. The initial speed was set at 8.5 $km \cdot h^{-1}$ with increments of 0.5 $km \cdot h^{-1}$ during each 1-min stage. The test was interrupted after volitional exhaustion and/or when the athletes could not keep up with the speed, which caused two consecutive delays in the beep signal greater than 2 m. Heart rate and RPE (CR10) were recorded at the end of each stage.

After the PTT, each subject was monitored during 9 training sessions that included: (a) running continuous and interval training for sprint and endurance; and (b) other types of training (OT) that included alternate jumps, jumps over wood boxes, barriers jumps, weight lifting, plyometric training, speed training, technical training, and throwing. Each subject's HR and RPE were used to monitor training sessions. Session RPE (9,10) was applied to calibrate training loads. This method consists of 30 min at the end of the training session during which each subject was asked the following question: "How was your training session?" The answer was provided using a 0 to 10 scale of which the numbers corresponded to the subject's perceived effort during the session multiplied by the total training session duration.

Statistical Analyses
Normality was tested by Shapiro-Wilk Test. All data are presented as mean ± standard deviation. The association between HR and session RPE was tested by the Pearson correlation test. All the analyses were conducted using the SPSS 20.0 software. Statistical significance was set at P<0.05.

RESULTS

Table 1 presents the group correlation found between HR and RPE in the progressive test, running training and other trainings. We observed a significant high correlation for the progressive test, a moderate correlation for the running training and a weak correlation for other trainings.

Table 1. Correlation between HR and RPE.

	Progressive Test on a Track (PTT)				Continuous and Interval Runs (RUNT)				Other Types of Training (OT)			
	HR ($b \cdot min^{-1}$)	RPE	r	r group	HR ($b \cdot min^{-1}$)	RPE	r	r group	HR ($b \cdot min^{-1}$)	RPE	r	r group
1	168 ± 39.0	4 ± 2.5	0.92*		146 ± 20.0	3.6 ± 1.5	0.62*		135 ± 20.0	3.3 ± 0.6	0.2	
2	179 ± 37.0	3 ± 1.8	0.92*		168 ± 26.0	4.0 ± 1.6	0.69*		140 ± 18.0	3.1 ± 0.9	0.45	
3	177 ± 39.0	5 ± 3.7	0.70*		171 ± 17.0	4.5 ± 1.6	0.69*		147 ± 26.0	3.8 ± 1.4	0.47	
4	145 ± 29.0	3 ± 0.6	0.84*		169 ± 25.0	5.0 ± 1.7	0.80*		148 ± 16.0	4.0 ± 1.2	0.52	
5	161 ± 43.0	3 ± 1.6	0.90*		151 ± 18.0	3.9 ± 1.9	0.88*		136 ± 15.0	3.7 ± 0.7	0.12	
6	156 ± 34.0	3 ± 1.1	0.94*		145 ± 23.0	4.0 ± 1.3	0.73*		144 ± 11.0	3.9 ± 0.7	0.05	
7	156 ± 24.0	2 ± 0.8	0.93*	0.76*	145 ± 22.0	4.9 ± 2.0	0.80*	0.67*	147 ± 21.0	5.2 ± 1.7	0.4	0.38
8	158 ± 39.0	4 ± 2.5	0.80*		157 ± 10.0	3.0 ± 0.6	0.63*		131 ± 20.0	2.9 ± 0.7	0.35	
9	178 ± 31.0	4 ± 2.1	0.95*		152 ± 27.0	3.4 ± 0.6	0.83*		136 ± 30.0	3.3 ± 0.5	0.53	
10	162 ± 38.0	4 ± 2.3	0.77*		133 ± 26.0	2.4 ± 0.5	0.63*		136 ± 22.0	2.3 ± 0.5	0.29	
11	162 ± 38.0	4 ± 2.3	0.81*		136 ± 23.0	3.6 ± 0.8	0.61*		143 ± 15.0	3.9 ± 0.7	0.38	
12	166 ± 34.0	3 ± 0.8	0.92*		157 ± 25.0	3.9 ± 1.5	0.87*		155 ± 18.0	4.2 ± 1.1	0.35	
13	150 ± 35.0	2 ± 1.0	0.89*		132 ± 17.0	2.9 ± 0.9	0.73*		139 ± 12.0	2.2 ± 0.4	0.66*	

*Significant correlation (Pearson Correlation Test), P<0.05

DISCUSSION

The purpose of this study was to obtain validation for using rating of perceived exertion to determine training stress in young athletes engaged in multiple types of exercise and training loads. The primary finding is that the RPE method and the objective standard based on HR presented a high correlation with the maximal progressive test on a track and a moderate correlation in other types of training (e.g., jumps, lifting weights, plyometrics, speed, and throwing). This may be explained by the motor similarity between the types of exercise and the subjects' rating of perceived exertion.

In the study by Borresen and Lambert (5), the subjects performed predominately running training sessions *ad libitum* twice a week. The authors observed high correlations between the subjective session RPE and the objective HR based method (2,8). But, while the RPE method provided reasonably accurate assessments of training load compared with HR based methods, they concluded that the methods deviated in accuracy when proportionally more time is spent training at low or high intensity.

Bonacci et al. (4) studied triathletes using the physiological parameters of HR, VO_2 max, lactate concentrations, and RPE as a way of monitoring the subjects' internal training load during cycling and running. An important finding was the identification of a greater individual correlation in TP and TC in relation to the group, which shows the importance of monitoring the training session of individual athletes.

Previous studies indicate an association between RPE and HR in different sports such as soccer (1), swimming (19), basketball (10) and tennis (7,11). Moreover, Gomes et al. (11) reported a relationship between RPE and hormonal changes, thus reinforcing this important tool for controlling internal training load. In this way, session RPE seems to reflect internal training load, especially during aerobic and cyclic exercises (9,19).

The lack of association between RPE and HR in other types of training (Table 1) can be explained by the diversity in the training modes. A similar result was found by Alexiou and Coutts (1) after stratifying soccer training analyses, they also found a small and moderate correlation for training focused on muscular strength (r = 0.25 to 0.52). Robson-Ansley et al. (16) noted that the TRIMP method related to HR failed to identify the strain associated with intermittent sports. According to Gomes et al. (11), high-intensity training with short duration is hard to monitor by the HR method. The fact that they are conducted in few seconds does not allow for cardiovascular responses such as the increase in HR, thus these methods may not represent the stress imposed by the training session (3).

According to Nakamura et al. (15), training loads calculated from perceptual and cardiovascular responses during intermittent activities involving anaerobic metabolism may not correlate well with typical physiologic responses. Yet, this does not mean that the session RPE is not valid. Rather, it means that HR may not translate appropriately with the internal load for these types of training involving high-intensity intermittent effort (14). Despite the lack of association between RPE and HR in other types of training, training intensity was demonstrated by RPE. Thus, this suggests that the session RPE method can be used to control internal training load in session with this characteristic (3,10,12).

CONCLUSIONS

We found significant associations between RPE and HR in the progressive test on a track (r = 0.76), the 9 training sessions that consisted of continuous and interval runs (r = 0.67), and other types of training that included jumps, barriers jumps, weight lifting, plyometric training, speed training, technical training, and throwing (r = 0.38). Thus, the rating of perceived exertion is a valid low cost, simple, and reliable method to determine training stress in young athletes, particularly during aerobic exercises.

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