Title

Time point, gender, and training type do influence session rating of perceived exertion after endurance training

Authors/Affiliation

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Abstract

Introduction

In a recently conducted focus group with 22 coaches of elite endurance athletes, the coaches were asked to rate the most important methods to assess their athletes' external or internal training load. The session rating of perceived exertion (sRPE) was named by 91% of participants, further 63% of the interviewed coaches reported to use sRPE during daily training (Roos, Taube, Brandt, Heyer, & Wyss, 2013). However, little is known about factors that potentially influence the repeated and optimal assessment of sRPE. Thus, the aim of this study was to identify the factors which influence the assessment of sRPE after running training sessions.

Methods

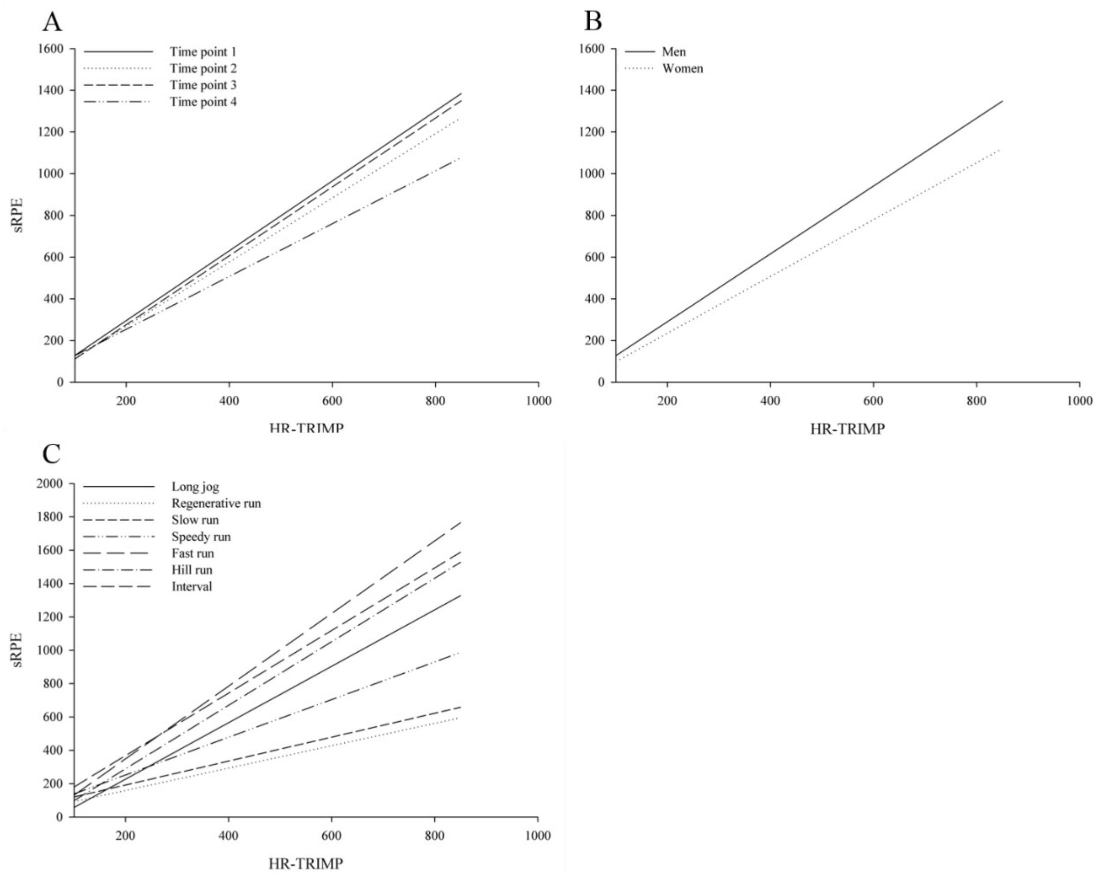
Forty recreational and competitive endurance athletes (28 men, 12 women; age 31.3±9.5 years) were recruited to perform four blocks of five running training sessions. For every block, the time point to report sRPE after training cessation was randomly assigned. The four time points were directly after training cessation, 30 minutes after training cessation, in the evening of the same day before going to bed, or the next morning directly after waking up. An online questionnaire was used to answer the question "How hard was your training today?" on the RPE scale (Foster et al., 2001). When answering the RPE question, the athletes further had to describe the content of the training session (e.g. long jog, regenerative run, slow run, speedy run, fast run, hill run, or interval training) or hand in a copy of their training diary. The athletes were allowed to train according to their individual training programs while wearing a heart rate monitor and had no restrictions concerning training type or content. The duration of a training session was multiplied with the reported RPE value, which resulted in the sRPE. The time passed between training cessation and answering the questionnaire was calculated to the minute and used to group the training sessions into four categories: time point 1 = 0–30 minutes, time point 2 = 31–180 minutes, time point 3 = 181–720 minutes, time point 4 = more than 720 minutes passed since training cessation. The HR data of each individual training session was used to calculate the training impulse according to Edwards (1993; HR-TRIMP). The maximal heart rate (HRmax) was determined by an individual maximal performance test. To compute HR-TRIMP, five HR zones were defined ranking from 1=50%–60% HRmax to 5=90%–100% HRmax. The duration in minutes in each HR zone was multiplied with its corresponding factor (1 to 5) and summed to obtain the total training load for each training session.

Statistical analyses were performed with IBM SPSS Statistics 22 (IBM Corporation, Armonk NY, USA) and SAS 9.4 (SAS Institute Inc, Cary NC, USA). Data are shown as mean ± standard deviation (SD). The alpha level was set at p=.05. A Generalized Linear Mixed Model with repeated measures was computed. The sRPE was modeled in a hierarchical function of subjects' training sessions and time point of sRPE assessment. Fixed effects were HR-TRIMP, training type, time point of sRPE assessment, gender, fitness level, weekly training hours, running experience, and the interactions between time point, HR-TRIMP, and training type. Random effects were the random intercept, training type, time point of sRPE assessment, and cross-level interaction "time point x training type". To simplify and visualize the effects of the identified predictors on sRPE, linear regressions with sRPE as the dependent variable and HR-TRIMP as the independent variable were performed. The regression slopes were tested for significant differences by administering a global Chow test.

Results

Overall, 750 (93.8%) valid training sessions were analyzed. The mean duration passed since training cessation was as follows: time point 1 = 13.9±9.9 minutes, time point 2 = 64.8±35.0 minutes, time point 3 = 430.9±181.4 minutes, and time point 4 = 1072.9±285.4 minutes, with an equal number of training sessions per time point. The analysis revealed HR-TRIMP, gender, and training type to be significant predictors of sRPE (all p<.011). HR-TRIMP, modeled as a third order orthogonal polynomial,

improved the model fit substantially and remained with statistical significance effects for the linear (p=.002), quadratic (p<.001), and cubic effect (p<.001). The interaction "time point x HR-TRIMP x training type" showed an overall effect on sRPE by trend (p=.090), implying that the time point of sRPE assessment does have some influence. The linear regressions analysis for the variables time point, gender, and training type are presented in Figure 1. The variables' category slopes were tested for equality, with the slopes being statistically different for time points (p=.015), gender (p<.001), and training types (p<.001). For time point 4, standing for the longest duration between training cessation and sRPE assessment, lower sRPE values were reported at a given HR-TRIMP compared to the previous time points (Figure 1A). Women reported lower sRPE values than men for the same objective HR-TRIMP (Figure 1B). Finally, for the same objectively measured HR-TRIMP smaller sRPE values were observed



for regenerative runs compared to high-intensity running sessions (Figure 1C).

Figure 1. Linear regression slopes with session rating of perceived exertion (sRPE) as the dependent variable and objective measured training load (HR-TRIMP) as the independent variable for A) time points, B) gender, and C) training types.

Discussion/Conclusion

The analysis showed that HR-TRIMP, time point, gender, and training type had an effect on sRPE (Figure 1). The longer the period between training cessation and sRPE assessment, the lower the sRPE values at a given HR-TRIMP. These findings are in contrast to previous studies (Kraft, Green, & Thompson, 2014) that reported no significant differences concerning the length of the duration between the end of a training session and the sRPE assessment; however, only one study investigated a duration longer than 60 minutes, namely 24 hours (Christen, Foster, Porcari, & Mikat, 2016). In the present study, women reported lower sRPE values compared to men for the same HR-TRIMP. In the available literature, the results concerning gender differences between sRPE and HR are inconclusive. Some studies have reported no differences between gender (Herman, Foster, Maher, Mikat, & Porcari, 2006; Robertson et al., 2000). However, another study reported lower RPE values for women when performing resistance training at the same relative intensities as men (O'Connor, Poudevigne, & Pasley, 2002), similar to the current results. These authors explained the gender differences with the fact that the absolute weights lifted by women were lower. However, in the present study, HRmax did not differ between men and women. Additionally, differences depending on the type of training were observed in the present study. This finding is in line with previous results reporting sRPE to be a sensitive method, which allows to differentiate between types and intensities of exercises to assess training load (Christen et al., 2016; Egan, Winchester, Foster, & McGuigan, 2006; Foster et al., 2001).

To conclude, sRPE is a feasible and recommendable method to monitor daily training load. However, the assessment method should be kept standardized for a given athlete and comparisons between male and female athletes are not recommended.

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