

Comparison of RPE (Rating of Perceived Exertion) Scales for Session RPE

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Purpose: The session rating of perceived exertion (sRPE) is a well-accepted method of monitoring training load in athletes in many different sports. It is based on the category-ratio (0–10) RPE scale (BORG-CR10) developed by Borg. There is no evidence how substitution of the Borg 6–20 RPE scale (BORG-RPE) might influence the sRPE in athletes. **Methods:** Systematically training, recreational-level athletes from a number of sport disciplines performed 6 randomly ordered, 30-min interval-training sessions, at intensities based on peak power output (PPO) and designed to be easy (50% PPO), moderate (75% PPO), or hard (85% PPO). Ratings of sRPE were obtained 30 min postexercise using either the BORG-CR10 or BORG-RPE and compared for matched exercise conditions. **Results:** The average percentage of heart-rate reserve was well correlated with sRPE from both BORG-CR10 ($r = .76$) and BORG-RPE ($r = .69$). The sRPE ratings from BORG-CR10 and BORG-RPE were very strongly correlated ($r = .90$) at matched times. **Conclusions:** Although producing different absolute numbers, sRPE derived from either the BORG-CR10 or BORG-RPE provides essentially interchangeable estimates of perceived exercise training intensity.

Keywords: training, training monitoring, rating of perceived exertion

Training load (TL) is used to quantify training programs and to determine if athletes are performing prescribed training, with the intent of optimizing the training response and minimizing the occurrence of nonfunctional overreaching, injury, and illness.¹ A number of methods are used to monitor both external (mechanical stress) and internal (physiological or psychological stress) TL.² However, many of these methods are reliant on technology, are expensive to implement, and require trained staff to gather and interpret. Banister³ created a method for quantifying internal TL called the training impulse or TRIMP score. This score is generated from the average percent of heart rate (HR) reserve and the duration of the exercise session. Although the TRIMP method is widely accepted as a valid quantification of internal TL, the method is dependent on the availability of knowledge of maximal HR, download capable HR monitors, and steady-state HR values, limiting its use for high intensity and interval exercise training. Furthermore, calculation of the TRIMP is mathematically complex.

In an attempt to simplify the TRIMP method, Foster et al^{4,5} developed a simple, low-technology method to quantify internal TL using a modification of the rating of perceived exertion (RPE) method developed by Borg.⁶ This method is known as the session RPE (sRPE). The sRPE is derived by multiplying the overall RPE obtained at the end of a training session, using the Borg category-ratio 10 scale (BORG-CR10) by the total duration (in minutes) of the training session, to provide a modified TRIMP score. The sRPE is considered valid and reliable and has become a widely used method of quantifying internal TL.^{1,7,8}

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Although clearly conceptually related, it is unclear how the sRPE derived from the BORG-CR10 relates to a sRPE score derived using the more widely used Borg 6 to 20 RPE scale (BORG-RPE). Accordingly, to broaden the utility of the sRPE method, it is of interest to determine the interchangeability of the BORG-RPE for deriving TRIMP scores compared with the BORG-CR10. In a recent study,⁹ it was shown that the BORG-RPE and BORG-CR10, used as momentary ratings in the same sense as pioneered by Borg,⁶ were strongly correlated ($r = .95$) on an intraindividual level and were thus interchangeable during incremental exercise testing and interval training. However, despite the independently validated status of the BORG-CR10 for sRPE, using the BORG-RPE for momentary ratings cannot be easily compared with sRPE data.¹⁰ Evidence of the interchangeability of the BORG-RPE and BORG-CR10 for sRPE would allow exercise practitioners and coaches to use the BORG-RPE for monitoring training. Consequently, the purpose of this study was to determine the validity and interchangeability of the BORG-RPE and BORG-CR10 for sRPE based on responses observed during matched interval exercise training sessions.

Methods

Fourteen recreational-level, but systematically trained, athletes (18–30 y of age) served as subjects. Each subject underwent preparticipation screening to exclude individuals with contraindications for participation. Written informed consent was provided by each subject prior to testing. Approval was obtained from the University of Wisconsin–La Crosse Institutional Review Board for the Protection of Human Subjects.

The experimental protocol consisted of measuring RPE following matched interval training sessions using BORG-RPE and BORG-CR10. Each subject performed 6 randomly ordered (3 × BORG-RPE and 3 × BORG-CR10), 30-minute interval training sessions, designed to be easy, moderate, and hard for overall intensity. Based on responses during preliminary exercise testing,

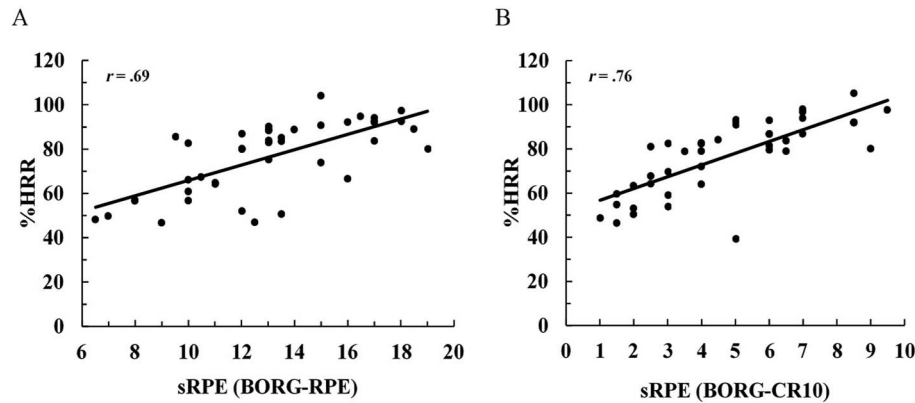


Figure 1 — Relationship between %HRR and sRPE with (A) the BORG-RPE and (B) the BORG-CR10 during interval exercise training. %HRR indicates percentage of heart-rate reserve; sRPE, session rating of perceived exertion; BORG-RPE, Borg 6–20 rating-of-perceived-exertion scale; BORG-CR10, Borg category-ratio 10 scale.

each interval training session consisted of four 4-minute intervals at 50%, 75%, or 85% of peak power output with a 1-minute interset rest period at 25 W. In addition to the 4 intervals, an incremental 5-minute warm-up and cooldown was conducted to construct a total session duration of 30 minutes. Each training session was performed under standardized conditions of environment, diet, and exercise training in the preceding 48 hours. All testing and interval training sessions were conducted using an electronically braked cycle ergometer (Lode Excalibur, Groningen, The Netherlands).

Standardized written instructions were provided prior to each training session for the BORG-RPE and BORG-CR10.⁶ HR and RPE, using either the BORG-RPE or BORG-CR10, were recorded during the last 10 seconds of the peak warm-up and cooldown intensity (100 W) and during the last 10 seconds of each interval. sRPE ratings were obtained 30 minutes postexercise in accordance with Foster et al^{4,5} using the selected scale. sRPE TL was not calculated due to the fixed duration of each interval session.

Linear regression analysis was used to analyze the relationship between average percent of HR reserve (%HRR) for each session with BORG-RPE and BORG-CR10 sRPE ratings. Because the relationship was visually nonlinear, and because the fitted R² was meaningfully greater, nonlinear regression analysis was used to analyze the relationship between BORG-RPE and BORG-CR10 sRPE ratings. The magnitude of correlations was defined by the following criteria: trivial (<.10), small (.10–.29), moderate (.30–.49), large (.50–.69), very large (.70–.89), and almost perfect (.90–1.0).¹¹ Standard error of the estimate (SEE) was calculated for all regression analyses. Alpha was set at .05 to achieve statistical significance. Data were analyzed using SPSS version 25.0 (IBM Corp, Chicago, IL).

Results

Linear regression analysis revealed large and very large positive relationships between average session %HRR and corresponding BORG-RPE ($r = .69$, $SEE = 11.9\%$, $P < .001$) and BORG-CR10 ($r = .76$, $SEE = 10.8\%$, $P < .0001$) for sRPE during interval exercise (Figure 1). Quadratic regression analysis also revealed a very large to almost perfect positive relationship between BORG-RPE and BORG-CR10 sRPE ratings for interval exercise for matched workouts ($r = .90$, $SEE = 1.435$, $P < .001$) (Figure 2).

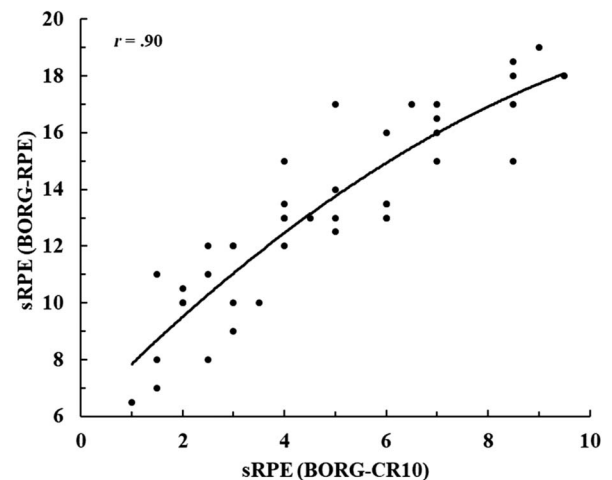


Figure 2 — Relationship between the BORG-RPE and BORG-CR10 ratings for sRPE at matched workloads from interval exercise. BORG-RPE indicates Borg 6–20 rating-of-perceived-exertion scale; BORG-CR10, Borg category-ratio 10 scale; sRPE, session rating of perceived exertion.

Discussion

This study demonstrates the validity of using both the BORG-CR10 and BORG-RPE for monitoring sRPE, revealing congruence and interchangeability between the 2 scales. Regression analysis of mean %HRR during interval exercise and sRPE revealed a large and very large relationship with the BORG-RPE and BORG-CR10, supporting the validity of the BORG-RPE for sRPE. The magnitude of the present correlations during interval training sessions is in agreement with the original data of Foster et al⁴ ($r = .65$) when comparing mean %HRR and BORG-CR10 during 30-minute steady-state running sessions.

Corresponding sRPE values for the BORG-RPE and BORG-CR10 were found to have a very large to almost perfect, nonlinear relationship. When comparing the relationship of sRPE ratings using both the BORG-RPE and BORG-CR10 with the relationship of momentary RPE ratings for maximal incremental exercise testing and interval exercise training from our previous study,⁹

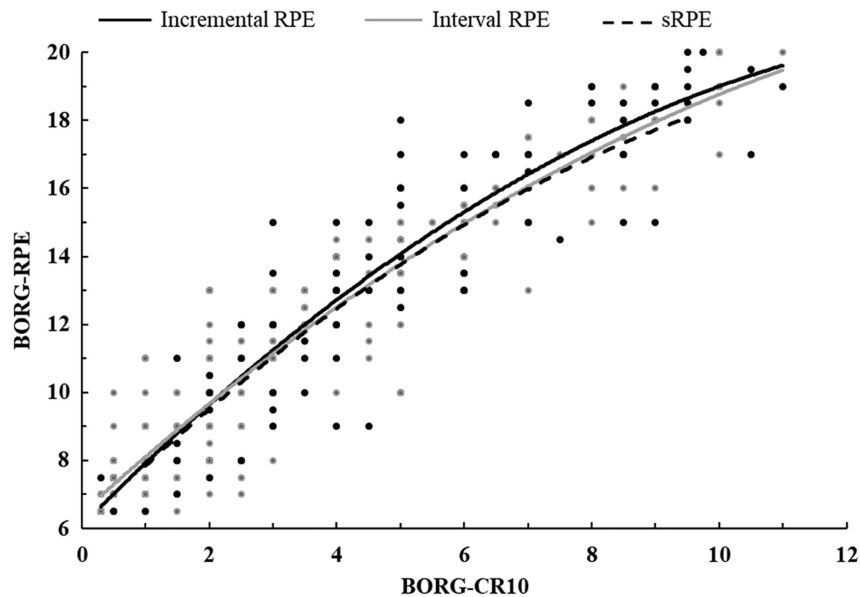


Figure 3 — Overlap of momentary incremental and interval RPE and interval sRPE using the BORG-CR10 and the BORG-RPE comparison best-fit lines. Results represent data from a previous study from our laboratory with acute exercise⁹ and the present data using sRPE. BORG-CR10 indicates Borg category-ratio 10 scale; BORG-RPE, Borg 6–20 RPE scale; RPE, rating of perceived exertion; sRPE, session RPE.

overlapping lines of best fit were identified (Figure 3). Both results demonstrate the interchangeability between the 2 scales for sRPE.

The present findings suggest the validity of using the BORG-RPE for calculating sRPE, although further research is needed with different exercise protocols (eg, recreational sports and steady-state training).

Practical Applications

The simplistic, low-technology nature of sRPE allows coaches and training staff to use the method with a great degree of ease to quantify internal TL. With the wide use of both the BORG-RPE and BORG-CR10 in sports and exercise, it was important to determine the degree to which the BORG-RPE could be used alternatively to calculate sRPE. The findings of this study support the use of the BORG-RPE for sRPE and provide coaches and training staff the ability to interchange and translate sRPE data from one scale to the other.

Conclusions

The BORG-RPE can apparently be used interchangeably with the BORG-CR10 for calculation of sRPE. Although the specific numerical values will be different, the relationship is very regular, suggesting that the 2 scales can be used interchangeably.

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