

# Use of Rate of Perceived Exertion Measured During Progressive Treadmill Testing to Prescribe Running Intensity

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## Introduction

Coaches and trainers prescribe exercise intensity to facilitate specific physiological adaptations and to reduce the risk of injury.<sup>1,2,3</sup> Subjective measures of exercise intensity are more available and less expensive than objective measures.<sup>2</sup> For this reason, coaches and trainers frequently prescribe exercise intensity using rate of perceived exertion (RPE) with the RPE/heart rate (HR) relationship being established by a progressive treadmill test.<sup>2,4</sup> However, the reliability of this method of exercise prescription is not well established.

## Purpose

The purpose of this study was to examine the relationship between the athletes' reported session RPE during practice and their momentary RPE reported during a progressive treadmill test.

## Methods

- Fourteen Division III female Cross Country runners participated in this study (Table 1).
- The subjects performed a progressive treadmill test at a 1% incline,<sup>5</sup> beginning at 2.24 m/s and increasing by 0.224 m/s every two minutes.
- HR and RPE were recorded prior to, concurrent with, and immediately after testing.
- A HR/RPE scale was created for each athlete.
- Athletes wore Polar Team System heart rate monitors for all training sessions (recovery, slow long distance tempo, and interval) during a two week period.
- The HR values were averaged for each practice, producing a HR value to represent each training session.
- Athletes reported session RPE after each training session.
- The average heart rate of each training session and corresponding session RPE were compared to the HR/RPE scale.

## Results

Table 1. Mean ( $\pm$  SD) Characteristics of Subjects.

Age (yr)	20 ( $\pm$ 1.1)
Height (cm)	165.6 ( $\pm$ 5.8)
Body Mass (kg)	57.7 ( $\pm$ 5.4)
Body fat (%)	20.9 ( $\pm$ 2.1)
Lean body mass (%)	79.1 ( $\pm$ 2.1)
Peak VO <sub>2</sub> (ml min <sup>-1</sup> kg <sup>-1</sup> )	59.8 ( $\pm$ 3.3)
Maximum heart rate (bpm)	196.4 ( $\pm$ 6.0)

Table 2. Pearson Correlations of Session RPE and Treadmill RPE for Various Training Types.

Training Type	Pearson Correlation
Recovery Training (sRPE: n = 82) (tRPE: n = 83)	$r = 0.385^{**}$
Slow Long Distance Training (sRPE: n = 22) (tRPE: n = 21)	$r = 0.156$
Tempo Training (sRPE: n = 28) (tRPE: n = 27)	$r = -0.124$
Interval Training (sRPE: n = 21) (tRPE: n = 22)	$r = -0.226$

\*\* indicates significant results ( $p < 0.01$ ); sRPE = Session RPE; tRPE = Treadmill RPE

## Discussion

- An RPE scale based on a shorter-duration progressive treadmill test is significantly and positively related to session RPE at the lowest running intensity. However, the relationship may not be sufficient to justify exercise prescription based solely on a HR/RPE scale derived from a short progressive treadmill test.
- An RPE scale based on a shorter-duration progressive treadmill test is not significantly related to session RPE at long slow distance, tempo, and interval training intensities.
- Although it is convenient to conceptualize session RPE as simply being an average of many instantaneous RPE, it appears that exercise duration has a distinct impact on overall subjective intensity.
- Monitoring and quantifying training intensity is particularly difficult at high intensities.<sup>6</sup> The results support this tendency. As exercise intensity rises, the HR/RPE scale becomes increasingly less reliable for prescribing session RPE exercise intensity. For prescription of high training intensities, use of a HR/RPE scale based on a progressive treadmill test is not recommended.

## Conclusion

Momentary RPE, based on a short-duration progressive treadmill test, may not be an effective method for prescribing training intensities in female cross country runners.

## Future Research

Future research should investigate the reliability of HR/RPE scales that are based on progressive tests of comparable duration and environmental conditions as those of the subsequent exercise sessions.

## References

- Foster, C., Daines, E., Hector, L., Snyder, A. C., & Welsh, R. (1996). Athletic performance in relation to training load. *Wisconsin Medical Journal*, 95(6), 370-374.
- Borresen, J., & Lambert, M. I. (2009). The quantification of training load; the training response and the effect of performance. *Journal of Sports Medicine*, 39(9), 779-795.
- Foster, C. (1998). Monitoring training in athletes with reference to overtraining syndrome. *Medicine and Science in Sports and Exercise*, 30(7), 1164-1168.
- Dasilva, S. G., Guidetti, L., Buzzachera, C. F., Elsangedy, H. M., Krinski, K., Campos, W. D., Goss, F. L., & Baldari, C. (2011). Psychophysiological response to self-paced treadmill and overground exercise. *Medicine and Science in Sports and Exercise*, 43(6), 1114-1124.
- Jones, A. M., & Doust, J. H. (1996). A 1% treadmill grade most accurately reflects the energetic cost of outdoor running. *Journal of Sports Sciences*, 14(4), 321-327.
- Foster, C., Florhaug, J. A., Franklin, J., Gottschall, L., Hrovatin, L. A., Parker, S., Doleshal, P., & Dodge, C. (2001). A new approach to monitoring exercise training. *Journal of Strength and Conditioning Research*, 15(1), 109-115.

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