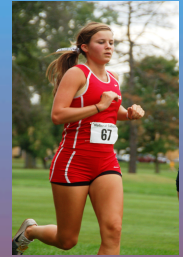


Relationship between Rate of Perceived Exertion and Blood Lactate Concentration in Female Cross Country Runners

Anna Krieger; Mary Stenson, PhD, Donald Fischer, MS

College of Saint Benedict/Saint John's University Department of Exercise Science Sport Studies

Sponsored by: Dr. Vincent J. Paolone, FACSM Springfield College, Springfield, MA



Abstract

Previous studies have found a strong correlation between the rate of perceived exertion (RPE) and blood lactate levels. However, the strength of this relationship has been shown to depend on the population. **PURPOSE:** To examine how closely the RPE corresponds to blood lactate concentration in Division III female cross country runners during a progressive treadmill test. **METHODS:** Fourteen Division III female cross country runners participated in this investigation. All participants finished in the top half of the team's 4.0 km time trial at the beginning of the season. Each runner performed a progressive treadmill test to assess blood lactate levels and RPE, with blood sampling every two minutes. **RESULTS:** Pearson's correlation analysis revealed a significant, positive correlation between RPE and blood lactate levels [$r(157) = .849, p < .001$]. **CONCLUSION:** The strength of the relationship between RPE and blood lactate concentration in female cross country runners is stronger than that found in other active populations, such as soccer players. The results provide additional evidence that blood lactate concentration may be a physiological mediator for perception of exertion during dynamic exercise and may serve as a stronger mediator for female cross country runners compared to other active populations.

Introduction

- Rate of perceived exertion (RPE) may be a more appropriate measurement of exercise intensity than individual physiological variables because it reflects factors affecting the internal load of exercise, such as an athlete's psychological state and training status, and the external training load.¹
- Research indicates that virtually everyone who participates in vigorous exercise is rationally aware of the intensity of work in which they are engaged and they are able to verbalize or describe their efforts in a relatively consistent manner.²
- Previous studies have found a positive correlation between RPE and blood lactate levels (r value range: 0.22-0.63); however, the strength of this relationship depends on the population.^{3,4}

Methods

Participants

- Fourteen Division III female cross country runners participated in this investigation (Table 1).
- All participants finished in the top half of a 4.0 km time trial at the beginning of the season.

Procedure

- The subjects performed a progressive treadmill test at a 1% incline beginning at 2.24 m/s and increasing by 0.224 m/s every two minutes.
- Blood sampling and RPE measurements were taken every two minutes.
- RPE was measured and reported using a 0-10 scale. The ratings range from 0 (nothing at all) to 10 (very very hard).⁵

Table 1. Mean (\pm SD) characteristics of subjects.

Age (yr)	20 (\pm 1.1)
Height (m)	1.66 (\pm 0.06)
Body mass (kg)	57.6 (\pm 5.4)
Body fat (%)	20.9 (\pm 2.1)
Lean body mass (%)	79.1 (\pm 2.1)
Peak VO ₂ (ml \cdot min ⁻¹ \cdot kg ⁻¹)	59.8 (\pm 3.3)
Maximum heart rate (bpm)	196.4 (\pm 6.0)

Results

Table 2. Pearson Correlation Analysis for RPE and blood lactate.

		Lactate	RPE
Lactate Correlation	Pearson	1	.849**
	N	157	157
RPE Correlation	Pearson	.849**	1
	N	157	157

** Indicates significant results ($p < 0.05$)

Discussion

- Positive correlation between RPE and blood lactate was consistent with previous research; however, the strength of this relationship was substantially stronger.
 - Soccer: amateur players (25 \pm 5 yr), outdoor small-sided games ($r = 0.63, p < 0.05$).³
 - High-Intensity Interval Cycling: active males ($r = 0.22, p < 0.001$).⁴
- The stronger correlations found in our study may be the result of cross country runners more frequently relying on internal cues to moderate exercise intensity during training sessions. This practice may make them more adept at reading physiological signals associated with specific exercise intensities, thus facilitating a stronger correlation between RPE and blood lactate.

Implications

- The participants in this study appear to have good awareness of how hard they are working; therefore, they should be able to adjust their running pace to the coach prescribed intensity.
- Testing in a controlled, indoor environment may allow for a stronger relationship between RPE and blood lactate levels.

Conclusion

- Pearson's correlation analysis revealed a significant, positive correlation between RPE and blood lactate levels (Table 2).
- The strength of the relationship between RPE and blood lactate concentration in female cross country runners is stronger than that found in other active populations.
- The results provide additional evidence that blood lactate concentration may be a physiological mediator for perception of exertion during dynamic exercise and may serve as a strong mediator for female cross country runners compared to other active populations.

References

- Robertson, D.T. & Noble, B.J. (1997). Perception of physical exertion: Methods, mediators, and applications. *Exercise Sport Science Review*, 25(1), 407-452.
- Williams, J. G. & Eston, R. G. (1989). Determination of the intensity dimension in vigorous exercise programs with particular reference to the use of the rating of perceived exertion. *Sports Medicine*, 8(3), 177-189.
- Coutts, A. J., Rampinini, E., Rampcora, S.M., Castagna, C., & Impellizzeri, F. M. (2009). Heart rate and blood lactate correlate of perceived exertion during small-sided soccer games. *Journal of Science and Medicine in Sport*, 12(1), 79-84.
- Green, J. M., Mclester, J. R., Crews, T. R., Wickwire, P. J., Pritchett, R. C. & Lomax, R.G. (2006). RPE association with lactate and heart rate during high-intensity interval cycling. *Medicine & Science in Sports & Exercise*. 38(1), 167-172.
- Foster, C., Florhaug, J., Franklin, J., Gottschall, L., Hrovatin, L. A., Parker, S., ... Dodge, C. (2001). A new approach to monitoring exercise training. *Journal of Strength and Conditioning Research*, 15(1), 109-115.

Acknowledgments

- Coach Robin Balder-Lanoue and the College of St. Benedict cross country team for their willing participation.