

27th ECSS Anniversary Congress, 30.08 – 02.09.2022

Effect of performance level on changes in economy during prolonged running

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INTRODUCTION:

Running economy (RE) is an important determinant of endurance running performance [1]. Although RE is known to be sensitive to fatigue during prolonged running [2,3], the pattern of this deterioration may be mediated by training status, which currently remains unexplored. The aims of this study were to quantify the changes in RE during a prolonged run and compare changes between sub-populations of male endurance runners.

METHODS:

Thirty-four well-trained distance runners (maximal oxygen uptake (VO₂max) 62.7±7.3 ml/kg/min; 10km time 35:57±4:24) completed two treadmill trials separated by 5-10 days. The first trial involved an incremental test to determine lactate threshold (LT) and VO₂max. The second trial involved a 90 min run at the speed corresponding to LT (sLT). Respiratory gases were collected at 15 min intervals for 5 min, and blood lactate (BLa) was measured at 15, 60, and 90 min. Subsequently, two subgroups of 12 athletes were identified based on 10km race time as high-performers (HP; 10km <33:00, VO₂max 70.0±5.0 ml.kg⁻¹.min⁻¹) and low-performers (LP; 10km 38:00-45:00, VO₂max 56.7±4.4 ml.kg⁻¹.min⁻¹) A two-way repeated measures ANOVA with Bonferroni post-hoc corrections was used to detect changes over time and between groups, and effect sizes (ES) were calculated as Cohen's d. Significance was defined as p<0.05.

RESULTS:

The athletes ran at 14.3±1.5 km/h, corresponding to 79.8±2.9 % of VO₂max, and mean RE was 212.6±12.0 and 220.6±13.7 ml/kg/km at 15 and 90 min, respectively. Compared to the 15 min time-point, RE remained unchanged at 30, 45 and 60 min but was significantly elevated after 75 min (1.8±2.6%, p=0.003, d=0.30) and 90 min (3.6±2.9%, p<0.001, d=0.57). Between 15 and 90 min, the respiratory exchange ratio (RER) remained unchanged (0.92±0.03 vs 0.91±0.03), but BL increased from 1.7±0.3 to 2.5±0.6 mMol/L (p<0.001, d=0.62). The two subgroups did not differ in RE after 15 min (HP: 214.3±10.6 ml/kg/km, LP: 212.1±10.0 ml/kg/km), and although the difference in RE change after 75 min wasn't significant, there was a large effect of performance level on it (HP: 1.5±2.7, LP: 3.3±2.6%, p=0.06, d=0.81). The between-group difference in RE change at the 90 min time-point was also not significant (HP: 3.7±2.0, LP: 5.0±3.6%, p=0.29, d=0.44).

CONCLUSION:

During a 90 min run at sLT, RE remains stable until 60 min before deteriorating significantly in well-trained male runners. BLa also increases as the exercise progresses, whereas RER remains stable. The performance level of endurance runners didn't significantly influence changes in RE between the two groups, although a moderate effect was reported. More data is required to clarify the possible differences depending on performance level.

1. Joyner (2008); 2. Brueckner et al. (1991); 3. Kyrolainen et al. (2000)

Topic: Training and Testing

Presentation form: Oral

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