

DIFFERENCES BETWEEN TWO MAXIMAL OXYGEN CONSUMPTION MEASUREMENTS ON ENDURANCE RUNNERS SHOULD REACH A THRESHOLD TO REPRESENT A REAL CHANGE IN TRAINING STATUS

Jagdeep, S.1, Gremion, G.2, Evequoz, B.1, Crettenand, A.1, Gobelet, C.1, Deriaz, O.1

1: Institut de recherche en readaptation, CRR, SuvaCare (Sion, Switzerland), 2: Hopital orthopedique de la Suisse romande, Universite de Lausanne, (Switzerland)

Introduction

Maximal O₂ consumption measurement (VO₂max) is often repeated on endurance runners in order to assess for the evolution of their training status. However, changes in laboratory results may not only be due to a training effect but also to measurement variability. We repeated tests to determine, for a given runner, the ideal least significant change (ILSC) that could be due to a training effect.

Methods

Healthy male runners were included for repeated laboratory tests without any training/nutritional intervention (means+/-SD): **Study 1**, n=94, 36+/-7 years, 177+/-7 cm, 71+/-8 kg, VO₂max 58+/-9 ml O₂/(kg.min), 3 tests repeated at 1 year interval, a subsample of 13 subjects performed two 17.17 km races separated by 1 year. **Study 2**, n=35, 35+/-6 years, 179+/-6 cm, 73+/-10 kg, VO₂max 55+/-6 ml O₂/(kg.min), 2 tests separated by 4 weeks. **Laboratory measurements:** Direct O₂ consumption on a treadmill with an incremental speed (1.8 km/h each 3 min) until exhaustion. Last step = maximal aerobic speed (MAS). **Statistical analyses:** The within subject SD was calculated (i.e. root mean square error). The ILSC (i.e. $1.414 \times 1.96 \times SD = 2.77 \times SD$, $\alpha=0.05$) represents, for a given subject, the threshold for which the likelihood to observe a real physiological change is 95% (Shepherd JA et al., 2007).

Results

No variables, except body weight in study 1, changed significantly with time. VO₂max was 4.1+/-0.5 L/min and 4.0+/-0.5 L/min and MAS was 16.4+/-2.7 km/h and 16.6+/-1.7 km/h for study 1 and study 2, respectively. The ILSC, in % of the initial value, was respectively for intervals between measurements of 4 weeks, 1 and 2 years: 3%, 6% and 7% for body weight, 10%, 16% and 16% for VO₂ max (L/min), 11%, 18%, 16% for VO₂max (ml/(kg.min)) and 8%, 14% and 15% for MAS. For the 17.17 km race (speed 14.3+/-1.7 km/h), the ILSC was 8%.

Discussion

Measurements of variables made with unsophisticated devices (e.g. body weight, race speed, and MAS) appear to be more sensitive to changes (i.e. lower ILSC) than VO₂max. The progressive shifts in measured variables with time, which are subjects' dependent, could explain the increase in ILSC with time. A coach does probably not need to assess an improvement in performance at the 95% level and can choose a lower threshold like, for instance, 68% (i.e. at $1.414 \times SD$, about the half values of the present ILSC).

When laboratory tests are repeated, differences lower than the ILSC may not be due to changes in training status and have to be interpreted with caution.

References

Shepherd JA, Lu Y. (2007) J Clin Densitom, Jul-Sep;10(3), 249-58