Muscle deoxygenation during repeated sprint running: effect of active vs. passive recovery

M. Buchheit1, P. Cormie2, C.R. Abbiss2, S. Ahmaidi1, K. Nosaka2 and P.B. Laursen2

1Laboratory of Exercise Physiology and Rehabilitation, Faculty of Sport Sciences, University of Picardie, Jules Verne, 80025, Amiens, France.
2School of Exercise, Biomedical and Health Sciences, Edith Cowan University, Joondalup, WA, Australia.

martin.buchheit@u-picardie.fr

Introduction

Active recovery has recently been shown to impair intermittent performance1,2 and repeated sprint ability (RSA) during cycling3,4. This is thought to be due to the reduction in oxygen availability that occurs with active recovery, which may limit muscular PCr and ATP resynthesis in the early recovery phase (within 20 to 30 seconds) following exercise5. However, in all pre-cited RSA studies, participants exercised exclusively on standard1,2 or front-access cycle ergometers3,5, neither of which replicates specific team sport movements. Since exercise mode can influence muscle recruitment patterns, the proportion of anaerobic system participation and RSA4, an assessment of the muscle deoxygenation levels during repeated sprint running was necessary to fully understand the effects of recovery type under conditions resembling those experienced during team sport activity. The purpose of the present study was to compare the effect of active (AR) versus passive recovery (PR) on muscle oxygenation during short repeated maximal running.

Methods

Ten moderately trained male subjects (26.9 ± 3.7y, VO2max: 55.1 ± 7.7 ml.min^-1.kg^-1) performed 6 repeated maximal 4-s sprints interspersed with 21-s of either AR (2.0m.s^-1) or PR (standing) on a non-motorized treadmill (Fig. 1). Recording was breath-by-breath for oxygen uptake (VO2, Medgraphics CPX Gas Analyzer System; St. Paul, MN), beat-to-beat for heart rate (HR), and 6Hz for near-infrared spectroscopy deoxyhemoglobin (HHb, NIRS, Niromonitor NIRO-200, Hamamatsu Photonics, Japan). Capillary blood lactate ([La]b) was also measured after each exercise. Mean running speed (AvSpmean) and percentage speed decrement (Sp%Dec) were computed for each recovery condition.

Results

Results show that AvSpmean was significantly lower and Sp%Dec significantly higher for AR versus PR (Fig. 2). All cardiorespiratory and NIRS values were higher during AR compared to PR: mean VO2 (3.64 ± 0.14 vs. 2.91 ± 0.15L, P=0.03), HR (159.9 ± 2.6 vs. 154.7 ± 2.6bpm, P < 0.01), HHb (94.4 ± 5.3 vs. 83.4 ± 1.5% of HHb during the first sprint, P<0.05) and [La]b (13.5 ± 0.8 vs. 12.7 ± 0.7mmol.l^-1, P=0.03).

Conclusions

The present study shows, as for cycling exercises, that during sprint running, active compared with passive recovery conditions were associated with a higher oxygen uptake, blood lactate accumulation, and muscle deoxygenation as well as a reduced repeated sprint ability. This implies that ‘lowering’ recovery intensity (i.e., walking or standing, if possible, rather than jogging) during team sport events might be an effective strategy for improving repeated sprint running performance.

References