ACUTE AND DELAYED SSC FATIGUE EFFECTS ON TREADMILL RUNNING: MEANINGFUL EARLY NEURO-MECHANICAL ADJUSTMENTS

Morio, C.[1,2], Barla, C.[1], Mesure, S.[2], Berton, E.[2], Nicol, C.[2]
1: Oxylane Research (Lille, France), 2: UMR 6233 (Marseille, France)

Introduction

Stretch-shortening cycle (SSC) defines natural, but challenging forms of ground locomotion. Effective as well as economical SSC actions are known to require well-timed preactivation, short and fast stretching action and immediate stretch-shortening transition (Komi 2000). Due to necessary initial adjustments, the SSC pattern is usually analysed once stabilized. In case of fatigue, however, meaningful compensatory and/or protective neuro-mechanical adjustments are expected to take place in the early exercise. Fatigue induced by exhaustive SSC exercise is of particular interest as it includes acute functional defects, but also delayed ones associated with muscle soreness and potential influence of III and IV muscle afferents (Nicol et al. 2006). This fatigue paradigm was used to compare the neuro-mechanical adjustments observed during the first 3 min of a treadmill run and once stabilized.

Methods

An exhaustive SSC exercise was performed on a sledge apparatus by 8 healthy male subjects who repeated series of 25 bilateral jumps, with inter-series rests of 3 min. Rebound height was set at 80% of maximal performance. Functional fatigue effects were quantified before (PRE), after (POST) and two days (D2) later in maximal drop jump test. Fatigue-induced neuro-mechanical changes were examined for the last 15 seconds of the first and third minutes of each treadmill run at pre-set submaximal velocity using 3D kinematics and electromyography of 8 major muscles of the right lower limb. Appropriate two-way ANOVA analyses and Tukey *post-hoc* comparisons were performed with a 0.05 level of significance.

Results

Maximal rebound height decreased similarly by 6% at POST and D2. Muscle soreness was elevated up to day 4. Treadmill run analysis of the third minute revealed most changes at D2, which presented (12 ± 8%) increased lower limb stiffness, with a knee strategy supported by (7 ± 23%) increased vastii preactivation (33 ± 45% at the first minute), straighter knee at impact and reduced subsequent flexion. In contrast, ankle and midfoot eversions were larger. Unexpectedly, most initial neuro-mechanical adjustments remained similar whatever the subject fatigue state was.

Discussion

In circumstances where DOMS is involved, reduced knee flexion could aim at preventing further muscle pain in vastii muscles (Dutto & Braun 2007) at the expense of impact shocks. This could explain the observed ankle protective strategy. Influence of the initial running strategy on the stabilized one supports the influence at D2 of III and IV muscle afferents on the running pattern.

References

Komi PV (2000). J Biomech, 33, 1197-1206.
Nicol C, Avela J, Komi PV (2006). Sports Med, 36, 977-999.
Dutto DJ, Braun WA (2004). Med Sci Sports Exerc. 36:560-566.