The acute effects of strength training on running economy and lower extremity kinematics

Introduction: Whilst studies have shown that strength training (ST) can either impair (1) or have no affect on running economy (RE) (2), little is known of the effects of high intensity ST on running kinematics. Consequently, the purpose of this study was to examine running economy in conjunction with lower extremity joint kinematics 6 hours following a high intensity ST session. Methods Twelve trained and moderately trained runners (age 23.4 ± 6.4 years, height 1.8 ± 0.1m, weight 74.4 ± 8.3 kg) undertook a control RE test one week prior to a ST session (RE1) and another RE test 6 hours following a ST session (RE2). During the ST session, exercises were performed in the order of incline leg press with 6 sets of 6 repetitions and leg extension and leg curls with 4 sets of 6 repetitions. There were three minutes rest between each set. The RE test consisted of two 10-minute stages at an intensity of 70- and 90% of anaerobic threshold, respectively. There were two minutes rest between each stage. During the RE test, oxygen consumption (VO2) was collected with a K4b2 gas analyser. In addition, lower extremity joint kinematics were recorded for 10 strides using 8 Vicon cameras (Oxford, UK, 100Hz) at 9 minutes 30 seconds of each stage. Running gait parameters included hip range of motion (HROM), peak knee flexion during swing phase (KFS), peak knee flexion after foot strike (KFAS), and ankle range of motion (AROM). All variables were analysed using Paired-Sample T Tests. Results The HROM was significantly less and the AROM was significantly greater for RE2 compared to RE1 during the second stage ($p < 0.05$). No significant differences were found between RE1 and RE2 for the other variables during the first and second stages ($p > 0.05$). Discussion and conclusion Whilst VO2 appears to not have been affected, high intensity ST reduced HROM which may have been due to an increase in the stiffness of hip flexor- and extensor- muscles (3). As limited morphological damage would have been induced on the ankle plantar- and dorsi- flexors from the ST exercises, AROM may have significantly increased during RE2 in order to compensate for insufficient mobility of the hips. Subsequently, caution should be used when interpreting the effects of ST on RE solely on physiological parameters. References 1. Palmer et al., J Sci Med Sport, 4:447-59, 2001. 2. Paschalis et al., J Strength Cond Res, 22: 1222-7, 2008. 3. Paschalis et al., Gait and Posture, 25: 236-42, 2007.