Metabolic and Ventilatory Responses to Interval-Based Active and Passive Treadmill Sprinting

ROBERT BROWN, NICHOLE GADD, JARED DALPE, TIMOTHY CARTER, CAYLON ROGERS, TERRY L. DUPLER, and WILLIAM E. AMONETTE

Human Performance Laboratory; Department of Clinical, Health, and Applied Sciences; University of Houston – Clear Lake; Houston, TX

Category: Masters

Advisor / Mentor: Amonette, William (amonette@uhcl.edu)

ABSTRACT

Historically, exercise scientists and practitioners believed that continuous, steady exercise at a single moderate intensity was most beneficial for health, but recent findings suggests that higher intensity interval training may be more beneficial for many health and performance-based outcomes. **Purpose:** The purpose of this study was to compare the metabolic and ventilatory responses to a brief, intense interval protocol using a treadmill in the active and passive mode. **Methods:** Twelve physically fit participants (30.5±6.2y; 175.9±9.9 cm; 79.1±18.2 Kg) completed three exercise sessions. In the first session, biometric and demographic data were obtained prior to the performance of a peak VO_2 treadmill test using a single speed, variable incline protocol. In sessions 2 and 3, participants performed an intense, 4-minute exercise protocol. The interval protocol consisted of eight repetitions, each 20 seconds in length with 10 seconds rest between with a 15% incline. The interval exercise was performed in an active or passive treadmill mode. During the active mode (ACT), participants controlled the speed of the treadmill belt using an electronic control board mounted on the front of the treadmill. During the passive mode (PAS), participants controlled the speed of the treadmill belt by exerting greater effort against the belt with their legs. In each condition, the participants were encouraged to exert a maximal effort; the ACT and PAS conditions were performed in random order on separate days. Continuous oxygen consumption (VO_2), carbon dioxide production (VCO_2), Respiratory Exchange Ratio (RER), and Ventilation (VE) were collected during all sessions using a metabolic cart and data were compared using a factorial ANOVA with repeated measures using mode (ACT vs PAS) and interval (8 intervals). **Results:** VO_2 peak in the participants tested was 44.4±4.5 $mL \cdot kg^{-1} \cdot min^{-1}$. There was a significant mode by interval interaction for VO_2 ($p=0.003$). VO_2 was elevated compared to baseline in both conditions, but PAS was greater than ACT at intervals 2 ($\Delta 3.55$ $mL \cdot kg^{-1} \cdot min^{-1}$; $p=0.003$) and 3 ($\Delta 3.40$ $mL \cdot kg^{-1} \cdot min^{-1}$; $p=0.004$). There was a significant interaction for RER ($p<0.001$). RER was elevated compared to baseline in both conditions, but PAS was greater than ACT at intervals 3 ($\Delta 0.12$; $p<0.001$), 4 ($\Delta 0.12$; $p<0.001$), and 5 ($\Delta 0.07$; $p=0.03$). Finally, there was a significant interaction for VE ($p=0.004$). VE was elevated compared to baseline in both conditions, but PAS was greater than ACT at intervals 2 ($\Delta 10.7$ L/min; $p=0.009$), 3 ($\Delta 18.2$ L.min-1; $p<0.001$), 4 ($\Delta 12.6$ L/min-1; $p=0.003$), 5 ($\Delta 10.2$ L/min; $p=0.01$), and 6 ($\Delta 8.5$ L/min; $p=0.04$). **Conclusions:** The results indicate that participants completing self-selected sprints in the PAS mode exert greater metabolic effort in earlier, but not late intervals compared to ACT. This could be due to the extreme fatigue resulting from anaerobic work in PAS. Future studies should determine if participants training using ACT or PAS sprinting adapt strategies to improve metabolic efficiency or gain capabilities to exert greater metabolic effort during a single session of treadmill exercise.