TACSM Abstract

Effects of Virtual Reality During Rowing Ergometry on Metabolic and Performance Parameters

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ABSTRACT

Physical activity and moderate or intense exercise improve musculoskeletal and metabolic health; however, approximately 80% of Americans do not meet the minimum exercise recommendations from the American College of Sports Medicine (ACSM) or the Centers for Disease Control (CDC). Exercise intensity may be the most important factor in eliciting positive physical outcomes with exercise. **PURPOSE**: To assess the effectiveness of a proprietary virtual reality (VR) interface to increase metabolic and physical performance during rowing ergometry. **METHODS**: A novel VR software program for rowing ergometry was developed. Subsequently, sixteen apparently healthy, recreationally active individuals (12M, 4F; 35.5 ± 13.9 y; 174.5 ± 10.1 cm; 80.4 ± 12.8 kg; VO_2max: 38.1 ± 5.6 mL/kg/min) were familiarized with the rowing ergometer and VR software, and then completed a VO_2max test during two separate sessions. Finally, subjects performed four, 30-min rowing sessions in a randomized, counterbalanced order at maximal voluntary intensity in four different conditions: 1) no augmented visual or audio stimuli (CON), 2) no augmented visual stimuli with self-selected music (MUS), 3) screen-based environmental display (SB), and 4) a virtual reality environment (VR). Oxygen consumption, ventilation, heart rate, and the respiratory exchange ratio (RER) were measured continuously during the four experimental sessions; these data were then averaged over each 30-min testing period. Power output (W) and distance rowed (m) were measured and similarly reduced. Data (mean ± SD) were analyzed by repeated measures ANOVA and appropriate Tukey's post hoc tests. Alpha was set at $P < 0.05$. **RESULTS**: Oxygen consumption (CON: 2.23 ± 0.63 L/min; MUS: 2.30 ± 0.63 L/min; SB: 2.23 ± 0.71 L/min; VR: 2.19 ± 0.69 L/min), ventilation (CON: 74.2 ± 21.0 L/min; MUS: 77.5 ± 20.5 L/min; SB: 73.4 ± 23.9 L/min; VR: 71.7 ± 23.8 L/min), heart rate (CON: 154 ± 16 bpm; MUS: 156 ± 17 bpm; SB: 152 ± 23 bpm; VR: 154 ± 17 bpm), and RER (CON: 0.94 ± 0.04; MUS: 0.95 ± 0.04; SB: 0.94 ± 0.04; VR: 0.93 ± 0.05) were not different between conditions (all $P > 0.05$). Performance outcomes also did not differ between conditions (CON: 126 ± 40 W, 6337 ± 763 m; MUS: 130 ± 42 W, 6486 ± 617 m; SB: 128 ± 46 W, 6358 ± 862 m; VR: 124 W ± 44 W, 6294 ± 849 m; all $P > 0.05$). **CONCLUSION**: The pilot version of the VR software for rowing ergometry did not increase voluntary effort as determined by metabolic or physical performance outputs. Added features, such as greater immersion for reluctant exercisers, and competitive elements for highly motivated individuals, may elicit greater voluntary exertion with VR in rowing ergometry. Moreover, such applications may be more beneficial and improve exercise enjoyment in less experienced exercises who are not accustomed to high exercise intensities.