Exercising Metabolic, Ventilatory, and Cardiovascular Responses to Isometric Whole Body Vibration Exercise

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ABSTRACT

Purpose: To determine if metabolic, ventilatory, or cardiovascular response to isometric squats with or without external load was enhanced by the addition of a whole body vibration (WBV). **Methods**: Fifteen subjects (28.4±6.5y; 173.7±8.6 cm; 75.5±20.8 kg) underwent four exercise sessions with three days' rest between sessions. The sample included 7 males and 8 females. Subject performed 10-sets of one-minute isometrics squats with 45 degrees of knee flexion standing on a WBV platform under four conditions: Unloaded, Unloaded Vibration, Loaded, and Loaded Vibration. Each condition was performed on a separate day; the session order was presented at random. One-minute recovery was given between sets. During the vibration conditions, the plate vibrated at 4mm peak-to-peak displacement and 30Hz. Loaded sessions were performed with a barbell equal to 30% body weight across the subjects shoulder. Oxygen consumption (VO_2) and ventilation (V_E) were measured using a metabolic cart and heart rate was obtained using polar chest straps. A 2x2 ANOVA was used to evaluate main effects for vibration (vibration vs. no vibration), load (loaded vs. unloaded), and interactions. **Results:** There were significant vibration (p = 0.02) and load (p = 0.003) main effects for VO_2. VO_2 during vibration (9.2±3.3 $mL \cdot kg^{-1} \cdot min^{-1}$) was significantly greater than no vibration (7.9±1.2 $mL \cdot kg^{-1} \cdot min^{-1}$); VO_2 was also greater during the loaded (9.6 ± 3.1 $mL \cdot kg^{-1} \cdot min^{-1}$) condition compared to unloaded (7.5±1.1 $mL \cdot kg^{-1} \cdot min^{-1}$). There were significant vibration (p=0.01) and load (p=0.01) main effects for V_E. V_E during vibration (20.8±10.0 $L \cdot min^{-1}$) was greater than no vibration (17.8±4.8 $L \cdot min^{-1}$); V_E was greater during loaded (21.5±9.4 $L \cdot min^{-1}$) conditions compared to unloaded (17.7±5.5 $L \cdot min^{-1}$). There were significant vibration (p=0.02) and load (p=0.008) main effects for HR. HR during vibration (97.0±20.3 beats $\cdot$ min^{-1}) was greater than no vibration (86.8 ± 25.7 beats $\cdot$ min^{-1}); HR was also greater during loaded (101.3±20.8 beats $\cdot$ min^{-1}) conditions compared to unloaded (90.8±12.6 beats$\cdot min^{-1}$). No interaction effects were detected for VO_2 (p= 0.16), V_E (p=0.14), or HR (p=0.84). **Conclusion**: Significant differences were observed in VO_2, V_E, and HR while exercising with WBV. Differences were similar across loaded and unloaded conditions. It is unclear if these small differences would be sufficient to induce enhanced long-term training adaptations. Future research should investigate similar physiological responses during dynamic exercise with a range of loads. Further, research is also needed to determine if these responses are enhanced or diminished by the amplitude, frequency, or duration of the vibration stimulus.