Average Heart Rate and Energy Expenditure Validity of Garmin Vivoactive 3 and Fenix 6 Wrist Watches During Light Circuit Resistance Training

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ABSTRACT

Our laboratory recently found wrist-worn wearable technology devices to be valid for measuring average heart rate (HR), but not valid for estimated energy expenditure (EE) compared to criterion devices, during steady state aerobic training (walking, running, biking). However, the validity of wrist-worn devices for HR and EE measures during resistance training is largely unknown. **PURPOSE**: The purpose of this study was to determine if two wrist-worn devices, Garmin Vivoactive 3 and Garmin Fenix 6 Pro, record valid measures of average HR and EE while performing circuit resistance training. **METHODS**: Twenty participants (n=10 female, n=10 male; age: 23.2 ± 7.7 years) completed this study. The Garmin Vivoactive 3 and Garmin Fenix 6 Pro were tested along with the Polar H10 chest strap and Cosmed K5 portable metabolic unit as the criterions for average HR and EE, respectively. Participants completed 4 circuits of 4 exercises (front squat, reverse lunge, push-ups, and shoulder press) using dumbbells at a light intensity with 1 set of 10 repetitions per exercise and 30 seconds rest between exercises and 1-1.5 min. rest between circuits. Mean absolute percent error (MAPE, ≤10%) and Lin's Concordance ($\rho \geq 0.7$) were used to validate the device's average HR (in bpm) and estimated EE (in kcals) compared to criterion reference devices. Dependent T-tests determined differences ($p \leq 0.05$). **RESULTS:** Average HR for Garmin Vivoactive 3 and Fenix 6 Pro were significantly different ($p<0.01$) than the Polar H10 (115.0±23.9 and 124.5±15.4 vs 128.9±19.0 bpm, respectively), and were not considered valid (MAPE: 44.8% and 25.1%; Lin's Concordance: 0.50 and 0.63, respectively). Estimated EE for Garmin Vivoactive 3 and Fenix 6 Pro were significantly different ($p<0.0001$) than the Cosmed K5 (31.7±12.3 and 39.7±13.1 vs 20.3±5.5 kcals, respectively), and were not considered valid (MAPE: 309.7% and 322.1%; Lin's Concordance: 0.04 and 0.15, respectively). **CONCLUSION**: Anyone involved in any resistance training aspect should be aware of the limitations of these wrist-worn devices in measuring average HR or EE.