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Evaluation of the Accuracy of the ACSM Walking Metabolic Equations During the Bruce Protocol

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The metabolic equations from the American College of Sports Medicine (ACSM) are used to determine energy expenditure during exercise. However, the equations have been shown to overestimate the actual measured value of oxygen uptake (VO_2). **PURPOSE:** To determine the validity of the ACSM metabolic equations for walking in predicting the VO_2 during the first three stages of the Bruce Protocol Treadmill Test. **METHODS:** 48 subjects (24 males, 24 females) aged 31.7 ± 13.3 years and with a BMI 25.1 ± 3.3 kg/m^2 completed a maximal treadmill test using the Bruce Protocol. A Parvo Medics TruOne 2400 system was calibrated before each test and used to collect and measure VO_2 . Steady state, defined as a heart rate ± 5 bpm for the last 2 minutes of each stage, was attained in all subjects during each stage. The measured values of VO_2 during the last minute of each stage were compared to the predicted values calculated using the ACSM walking metabolic equation. **RESULTS:** Dependent t-tests were used to compare predicted against measured VO_2 values for each stage. The predicted and mean measured values \pm SD of stages 1-3 were 16.3 ml/kg/min and 15.4 ± 1.7 ml/kg/min ($p = 0.0001$), 24.7 ml/kg/min and 22.1 ± 2.1 ml/kg/min ($p = 0.0001$), and 35.6 ml/kg/min and 31.8 ± 4.1 ml/kg/min ($p = 0.0001$), respectively. The equation overestimated VO_2 during stages 1-3 in 37 (77.1%), 46 (95.8%), and 43 (89.6%) subjects, respectively. **CONCLUSIONS:** The ACSM walking metabolic equation consistently overestimated the measured VO_2 for each of the three stages. The ACSM states the metabolic equations can have up to 7% error. However, the predicted VO_2 for stages 2 and 3 were both 12% greater than the measured. Due to the variability between the predicted and measured VO_2 values, caution should be taken when using the ACSM walking metabolic equation to estimate VO_2 during the first three stages of the Bruce protocol.