Within-Day Reliability of a Laboratory Metabolic Cart: Implications for Running Economy and Footwear Testing

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ABSTRACT

A metabolic cart measures respiratory gas exchange during exercise. Running economy, a measure of a runner's oxygen consumption (VO_2) at a fixed speed, is an important performance determinant. Economy can be manipulated by changes in footwear, but the ability to detect changes depends on the metabolic cart's reliability. **PURPOSE**: Determine the within-day reliability of VO_2 measures on a metabolic cart when assessed as single or duplicate trials. **METHODS**: Four subjects completed 4 x 5-minute running trials in their standard shoes on a treadmill while VO_2 was measured with a calibrated metabolic cart (VacuMed Vista Mini-CPX). For analysis of duplicate measures trials 1 and 4 were averaged and compared to trials 2 and 3 to mimic the ABBA sequence commonly used in footwear testing. The mean VO_2 and standard deviation across these pairings was used to calculate the coefficient of variation (CV; standard deviation expressed as percentage of the mean) for each subject. To compare the reliability of using single measures, the CV was calculated between just trials 1 and 2 as well. **RESULTS**: For duplicate measures, the average CV for the trials across the 4 subjects was 0.89% (range: 0.06-1.45%). For the single trial comparisons from just trials 1 and 2, the average CV was 2.87% (range: 2.19-3.22%). **CONCLUSIONS:** The within-day reliability of the metabolic cart was better when averaged by duplicate measures as compared to single measures, which is important for same-day interventions like footwear testing. Further, the observed magnitude of the CV can inform the minimum changes we can expect to detect in same-day within-subject interventions using this particular metabolic cart.