

## The Need for Reporting Metabolic Sampling Interval in Publication: An Example Using Maximal $\text{VO}_2$ Values and Running Economy

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### ABSTRACT

**Background:** Knowledge of metabolic outcomes, such as maximal oxygen consumption ( $\text{VO}_2$ ) or running economy, has wide-ranging application. Metabolic outcomes are widely reported in literature yet the metabolic sampling interval (example: breath-by-breath, 30-sec average) utilized for collection is rarely ever stated. **Purpose:** The purpose of the present investigation was to probe the potential discrepancies created when analyzing running economy and  $\text{VO}_{2\text{max}}$  raw metabolic data with four different metabolic sampling intervals. **Methods:** Five recreationally-active and endurance-trained subjects were included in the present analysis and four metabolic sampling intervals were analyzed: 30-sec average, 20-sec average, 8-breath, and 4-breath. Subjects engaged in 4-min running economy phases at 55 and 65% of their  $\text{VO}_{2\text{max}}$  before entering into a maximal protocol purposed to elicit  $\text{VO}_{2\text{max}}$  in 8-12 minutes. Utilizing the steady state and maximal  $\text{VO}_2$  data, metabolic sampling intervals were analyzed for their effect on reported  $\text{VO}_2$  values. **Results:** For running economy at 55%, there was no differences found ( $f = 0.207$ ;  $df = 1.862$ ;  $p = 0.799$ ) between sampling frequencies when analyzed by repeated measures analysis of variance and corrected with Greenhouse-Geisser for a violation of sphericity. For running economy at 65%, there were also no differences found ( $f = 1.456$ ;  $df = 3$ ;  $p = 0.799$ ) between sampling frequencies. For inspection, the relative  $\text{VO}_2$  values were: 27.2 ( $\pm 3.1$ ), 27.9 ( $\pm 4.1$ ), 28.4 ( $\pm 3.6$ ), and 28.8 ( $\pm 5.1$ ) for the 30-sec, 20-sec, 8-breath, and 4-breath average, respectively. Maximal  $\text{VO}_2$  values of 53.0 ( $\pm 6.6$ ), 55.1 ( $\pm 7.2$ ), 55.1 ( $\pm 7.2$ ), and 59.6 ( $\pm 9.4$ ) for the 30-sec, 20-sec, 8-breath, and 4-breath average, respectively, were found to be significantly different ( $f = 21.062$ ;  $df = 1.278$ ;  $p < 0.001$ ) after adjusting for a violation of sphericity ( $p < 0.001$ ). Bonferroni analysis indicated differences between the 30-sec average and all other averages and also the 20-sec and 8-breath averages when compared against the 4-breath average. The 4-breath average yielded the highest  $\text{VO}_{2\text{max}}$  value. Coincidentally, the 20-sec and 8-breath averages were identical. **Conclusion:** In the present investigation of raw metabolic data, sampling interval was found to impact the maximal oxygen consumption ( $\text{VO}_{2\text{max}}$ ) values but not running economy values when investigating a small sample of data with four select sampling intervals. The report of maximal  $\text{VO}_2$  is rather common in the literature and knowing sample interval is vital for between-study comparison, determination of regression-related activities, or for pre-post comparison of data from the same or different labs.