TACSM Abstract

An Investigation of Expired Gas Influence on the Shape of the Heart Rate Response at Maximal Effort In Cyclists

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ABSTRACT

PURPOSE: To use mathematical examination to determine if expired gases, (i.e. VO_2 and VCO_2), influence neural response and affect the shape of the three phases of a heart rate (HR) response during a maximal, incremental cycling test. **METHODS:** Archived data from ten (10) well-trained cyclists (mean VO_2 max 68.7 ml/kg/min) who performed VO_2 maximal tests using the Australian Institute for Sport (AIS) protocol was used to calculate group mean HR, VO_2 and VCO_2 values for each phase of a test to volitional fatigue. A trend line of best fit was assigned to each phase of HR, VO_2 and VCO_2 response. The trend line equations compared graphed patterns of response and rates of change (i.e. slopes) within each phase of each physiological response at fixed time points. Comparison of rates of change between variables and phases was accomplished with first derivative analysis of the slope of each trend line. Group mean slope values of HR taken at two-second intervals were tested for association to matched group mean slope values of the expired gases, VO_2 and VCO_2. The set of slope values for each phase of HR, VO_2 and VCO_2 responses was tested for associations using a T-test of independent variables. A Pearson Product R test for correlation investigated the strength of any associations. Statistical significance was set *a priori* at $p \leq 0.05$. **RESULTS:** A similar pattern response for the three variables occurred in Phase I and II of HR response. Graphed HR, VO_2 and VCO_2 responses were best fit by logarithmic trend lines in Phase I and polynomial trend lines in Phase II. Pattern responses of HR and VO_2 in Phase III were best fit by polynomial trend lines. Phase III VCO_2 response was best fit by an exponential trend line. Mathematical comparison of HR, VO_2 and VCO_2 slope values at identical time points indicated that neither VO_2 nor VCO_2 responses changed at a similar rate to HR response in Phase I, II and III. **DISCUSSION:** Endurance training has been shown to alter HR and expired gas response differently in humans. While the slope of HR during an incremental test is generally less steep in trained subjects, steeper VO_2 and VCO_2 slope responses are often a characteristic of the trained. These physiological characteristics of trained subjects could explain why the pattern of HR, VO_2 and VCO_2 was mostly similar, while the rate of increase of HR to expired gases was different.