Gas Exchange Kinetics and Workload During Different Exercise Protocols in Healthy Children and Young Adults

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This is a pilot study that is being conducted to identify gas exchange kinetics during exercise bouts and rest periods in different workloads during treadmill exercise and cycle ergometer. From past research of single exercise bout gas exchange kinetics the following theoretical model, has been proposed to describe VO2 as a function of time across the bout: Kp G(s) = ---------- * exp(-Td*s) 1+Tp1*s Kp= gain/amplitude; Tp1 = time constant; Td = time delay; s=second of exercise bout The goal of the current research is to apply this functional form to observed kinetics during repeated exercise bout protocols. Evaluation of the fit of this model to observed kinetics will be performed using the system identification toolbox in Matlab. The modules for modeling of nonlinear dynamic systems will be applied which produces parameter estimates of the fitted model based on maximum likelihood and prediction-error minimization (PEM). Applying this curve fitting tool may also give rise to variations in the proposed model that should be considered. Comparisons of Final Prediction Error and Mean Squared Error will be performed to determine the model with optimal fit. In addition, to address the issue of out of sample generalizability, cross validation analyses will also be employed to assess model performance. A secondary goal to this research is that once a functional form has been established, comparisons of the distributions of the function's parameters (Kp, Tp1, Td) can be made in relation to participant characteristics such as sex, pubertal status, and developmental stages (e.g, children, adolescence, adults). For example, a significant difference in the average time constant (Tp1) would be interpreted as more efficient oxygen consumption and differential adaptation to the physiologic challenge of exercise.