# The Work Of Breathing And The Slow Component Of O2 Uptake Kinetics During Strenuous Exercise


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kinetics in obese adolescents.
**METHODS:** Twenty-five obese adolescents (13.81±1.65 yrs, 36.15±4.65 kg/m2) volunteered to participate and completed a graded exercise test to exhaustion on a treadmill. Breath by breath data from the first 4-min of treadmill walking (2.5 mph, 0% grade) at moderate intensity (<60% of peak VO2) and during the immediate 4-min passive recovery was averaged into 10s intervals and fit with a monoexponential equation to determine the pulmonary oxygen on- and off-kinetic time constant, respectively.
**RESULTS:** A significant inverse relationship (r = -0.585, P = 0.002) was found between the time constant for pulmonary O2 off-kinetics during exercise recovery (36.80±9.07 s) and peak VO2 (45.72±5.4 mLO2•leankg-1•min-1). Similar to previous studies, oxygen on-kinetics during the transition to moderate intensity exercise was not related to peak VO2 (r = -0.294, P = 0.154).
**CONCLUSIONS:** These results suggest that the greater an obese adolescents cardiorespiratory fitness, the faster their pulmonary O2 off-kinetics during recovery from exercise. A longer O2 off-kinetic time constant displayed with lower cardiorespiratory fitness may reflect the effects of elevated pulmonary ventilation, cardiac work, deep body temperature, lactate clearance, and gluconeogenesis during recovery from exercise.
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**True Maximal Muscle Deoxygenation Attainment During Intense Cycling Is Site-specific**

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*(No relationships reported)*

Time-resolved near-infrared spectroscopy (TRS NIRS) derived muscle deoxygenation ([HHb]; absolute μM) reflects the balance between O2 availability & O2 utilization. Dynamic heterogeneities exist across the quadriceps muscle complex during exercise, even after correction for differences in adipose tissue thickness (ATT). The profile of [HHb] during ramp incremental (RI) exercise is characterized by a near-plateau ([HHb] peak) at higher intensities; however, it is unknown whether this [HHb]peak represents the true maximum.
**PURPOSE:** To compare the ATT-corrected [HHb]peak responses at 3 quadriceps muscle sites during RI and severe-intensity (SVR) exercise, and occlusion (OCC).
**METHODS:** Healthy males (n=7; 25±4yr) each completed a stationary cycling RI (20 W/min) test to determine [HHb]peak (at proximal and distal vastus lateralis (VLp and VLd) and rectus femoris (RF)), VO2peak and peak work rate (WRpeak). Following this test (≥48 hours post-RI), subjects completed SVR exercise (WR corresponding to 120%VO2peak) with [HHb] and VO2p monitored continuously. Additionally, [HHb] and total hemoglobin ([Hb]tot) were monitored continuously at rest and during subsequent OCC (250 mmHg; cuff positioned proximal to NIRS probes) of sufficient duration to elicit a near-plateau in [HHb]. Site-specific ATT was assessed (B-mode ultrasound) and its relationship with resting [Hb]tot was used to correct absolute [HHb] values. ATT-corrected [HHb]peak and VO2peak were given as the highest continuous 20s average for each condition.
**RESULTS:** Subjects' VO2peak and WRpeak during RI were 53±10 ml·min-1·kg-1 and 306±44W, respectively; this resulted in a SVR WR of 337±49W. For VLd and RF, [HHb]peak was higher (p<0.05) during OCC (VLd=131±44; RF=134±31μM) than RI (VLd:75±16; RF=100±24; p<0.05 between) and SVR (VLd=75±15; RF=95±21; p<0.05 between). [HHb]peak was similar (p>0.05) across conditions at the VLp (OCC=79±20; RI=81±20; SVR=74±19μM). [HHb] peaked and then decreased prior to exercise cessation during SVR at all 3 sites.
**CONCLUSION:** A "[HHb] reserve" exists during RI and SVR at the VLd and RF, implying either sufficient blood flow to meet oxidative demands or insufficient diffusion time for complete equilibration. In VLp this [HHb] reserve was absent suggesting that a critical PO2 is challenged during RI and SVR cycling.

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**Influence Of The Phosphodiesterase-5 Inhibitor Tadalafil On Oxygen Uptake Kinetics During Moderate-intensity Exercise In Humans**

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*(No relationships reported)*

Previous research has shown that nitric oxide (NO)-3'5'cyclic guanosine monophosphate (cGMP) signaling pathway play an important role both in muscle vasodilatation and in the regulation of oxidative metabolism during exercise. Tadalafil, a phosphodiesterase-5 inhibitor commonly used for therapeutic and nontherapeutic purposes, reduces cGMP hydrolysis and might, to some extent, influence muscle hemodynamic and oxidative processes, and arguably, affect oxygen uptake (VO2) kinetics during exercise.
**PURPOSE:** To examine whether the oral administration of Tadalafil influences pulmonary VO2 kinetics during moderate-intensity exercise in humans.
**METHODS:** Twelve healthy males (age 26.0 ± 3.6 yrs, VO2peak 48.7 ± 5.1 ml.kg-1. min-1) were randomly assigned to receive either two tablets of placebo or Tadalafil (20mg) in a double-blind crossover design, with a 14-days wash-out period between the two conditions. After the administration of either placebo or Tadalafil, subjects performed a 30-min. bout of moderate-intensity exercise on a cycle ergometer. Pulmonary gas exchange (breath-by-breath) and heart rate were measured continuously throughout baseline and exercise transition, and the kinetics of VO2 was modeled using non-linear regression. Blood lactate concentrations and blood pressure responses were recorded every 5-min period of the test. Data were analyzed using paired t-tests.
**RESULTS:** Compared to placebo, the Tadalafil condition did not differ for heart rate (139 ± 13 vs. 142 ± 13bpm), systolic (145 ± 17 vs. 143 ± 26 mmHg) and diastolic blood pressure (58 ± 15 vs. 64 ± 13 mmHg), and blood lactate concentration (3.5 ± 0.5 vs. 3.6 ± 0.7 mmol/L, respectively for placebo and Tadalafil conditions) (P > 0.05). In addition, the time constant (49 ± 14 vs. 43 ± 13 sec), amplitude (1.25 ± 0.2 vs. 1.28 ± 0.2 L/min), and functional 'gain' (9.5 ± 0.8 vs. 9.7 ± 1.4 ml/min/W) of the fundamental phase of VO2 kinetics were also similar between placebo and Tadalafil conditions, respectively (P > 0.05).
**CONCLUSION:** Inhibition of Phospodiesterase-5 with Tadalafil does not substantially influence pulmonary VO2 kinetics during moderate-intensity exercise in humans.

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**The Work Of Breathing And The Slow Component Of $O_2$ Uptake Kinetics During Strenuous Exercise**

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*(No relationships reported)*

The slow component of $O_2$ uptake kinetics ($VO_{2sc}$) represents a progressive decline in work efficiency during strenuous constant-load exercise. The majority of the $VO_{2sc}$ is explained by factors intrinsic to the working muscles (~86%). The remainder of the $VO_{2sc}$ is likely due to the rising work of breathing (Wb) associated with the hyperventilatory response to strenuous activity. To date, no study has quantified the Wb (and its components) with respect to the $VO_{2sc}$ during strenuous exercise.
**PURPOSE:** The aim of this study was to quantify the Wb during strenuous constant-load exercise, and to examine the relationship between the resistive and elastic components of Wb, and the amplitude of the VO2sc.
**METHODS:** 11 healthy, physically active participants (24 ± 1 yr) performed two separate, 6-min bouts of heavy (HVY) and severe intensity (SEV) cycling exercise. Gas-exchange and oesophageal manometry were used to quantify the amplitude of the VO2sc and Wb parameters during exercise. The VO2sc was determined as the difference in O2 uptake between the 3rd and 6th min of constant-load exercise. The Wb parameters were quantified over the same period.
**RESULTS:** The amplitude of the VO2sc was significantly greater (p<0.01) during SEV (291 ± 32 ml·min-1) compared with HVY trials (148 ± 31 ml·min-1). The relative increase in total Wb over the VO2sc period was significantly greater during SEV than for HVY exercise (79 ± 14% v 13 ± 3%, p<0.01). There was no relationship between the Wb and the VO2sc for HVY trials. Conversely, the VO2sc was positively (p<0.01) correlated with the increase in inspiratory elastic Wb (R2 = 71%), inspiratory resistive Wb (R2 = 86%) and expiratory resistive Wb (R2 = 87%) between the 3rd and 6th min of SEV exercise.
**CONCLUSIONS:** These results suggest that the resistive and elastic Wb significantly influences the development of the VO2sc during strenuous exercise, particularly in the severe intensity domain.

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**Effect Of Eccentric Muscle Damage On $O_2$ Uptake Kinetics And Muscle Deoxygenation During Moderate-intensity Cycling Exercise**

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*(No relationships reported)*

Eccentric exercise-induced damage is known to alter the structure and function of muscles and produce substantial microvascular dysfunction. The impact of this dysfunction on O2 delivery during exercise in the moderate-intensity domain has yet to be elucidated.
**PURPOSE:** To determine the impact of unaccustomed eccentric exercise-induced muscle damage on the rate of adjustment in muscle deoxygenation and pulmonary O2 uptake (VO2p) kinetics during cycling exercise performed in the moderate domain.
**METHODS:** Nine untrained healthy young men (25±3 yr; mean±SD) completed