ATTENUATED RESPONSE OF MUSCLE DEOXYGENATION AT HIGHER WORKLOADS, DETERMINED BY NEAR-INFRARED SPECTROSCOPY.

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ABSTRACT

BACKGROUND: The relationship of muscle deoxygenation to maximum workload at peak exercise using near-infrared spectroscopy (NIRS) can provide insight into clinical populations with known exercise intolerance, but there are few studies available. **PURPOSE:** To characterize the relationship between change in muscle deoxygenation (deoxygenated hemoglobin; ΔHHb) and maximal workload achieved at peak exercise (MW). **METHODS:** 15 males and 3 females (mean±SD: 27.28±13.60 years [age]) underwent a cardiopulmonary exercise test (CPET) on a recumbent cycle ergometer. Measurements at peak exercise included ΔHHb of the left vastus lateralis using NIRS, MW (Watts), and oxygen uptake (VO_2peak). We regressed ΔHHb on MW at peak exercise as the primary predictor with VO_2peak as a covariate. We used a second order polynomial regression model to test for both linear and quadratic relationships. **RESULTS:** Participant characteristics (mean±SD) were as follows: ΔHHb =12.67±7.30 µmol, MW = 241.22±61.82 W, and VO_2peak = 40.71±9.29 mL/kg/min. A polynomial model including ΔHHb, MW and VO_2peak best characterized the relationship (F= 3.654, p= 0.05) where there appears to be an inflection point in the ΔHHb-MW relationship (see Figure 1). Each 30 W increase in workload was associated with 0.74 increase in ΔHHb up to 241 W, after which ΔHHb decreased curvilinearly (-0.17^2) with each further increase in 30 W. **CONCLUSION:** ΔHHb increases with incremental workload but appears to attenuate and slightly decrease at greater MW. It is possible that other factors may influence this relationship. Understanding how muscle deoxygenation, MW, and VO_2peak are related at the time of peak exercise, or if other factors are contributing the differences in ΔHHb at higher workloads, may provide a foundation for uncovering the physiological mechanisms of local oxygen uptake in low and high exercise capacity individuals, and to assess exercise-limiting factors in clinical populations. Supported by NIH Grant K01HD084690-01A1.

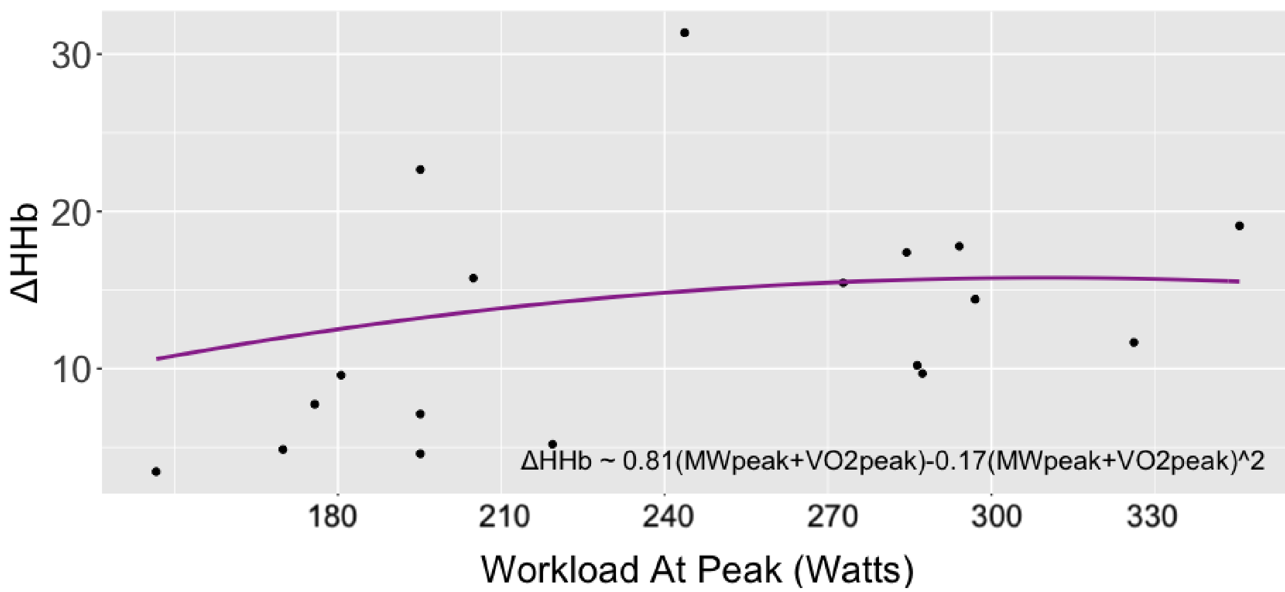

Figure 1 – Polynomial model demonstrating attenuated response of muscle deoxygenation at higher workloads.