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Breese, BC; Cocksedge, SP; Thompson, C; Wylie, LJ; Vanhatalo, AV; Jones, AM; Bailey, SJ

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## **Effect of inorganic nitrate supplementation on O<sub>2</sub> uptake kinetics and exercise tolerance: influence of muscle oxygenation**

### **Abstract**

We tested the hypothesis that inorganic nitrate (NO<sub>3</sub><sup>-</sup>) supplementation would improve muscle oxygenation, oxygen uptake ( $\dot{V}O_2$ ) kinetics and exercise tolerance (T<sub>lim</sub>) in normoxia and that these improvements would be augmented in hypoxia and attenuated in hyperoxia. In a randomized, cross-over study, ten healthy males completed work-to-work step cycle tests to exhaustion following acute consumption of 210 mL NO<sub>3</sub><sup>-</sup>-rich beetroot juice (BR; 18.6 mmol NO<sub>3</sub><sup>-</sup>) and NO<sub>3</sub><sup>-</sup>-depleted beetroot juice placebo (PL; 0.12 mmol NO<sub>3</sub><sup>-</sup>). These tests were completed in normobaric normoxia (FIO<sub>2</sub>: 21%), hypoxia (FIO<sub>2</sub>: 15%) and hyperoxia (FIO<sub>2</sub>: 40%). Pulmonary  $\dot{V}O_2$  and quadriceps tissue oxygenation index (TOI), derived from multi-channel near-infrared spectroscopy, were measured during all trials. Plasma [nitrite] was higher in all BR compared to all PL trials ( $P < 0.05$ ). Quadriceps TOI was higher in normoxia compared to hypoxia ( $P < 0.05$ ) and higher in the hyperoxia compared to hypoxia and normoxia ( $P < 0.05$ ). T<sub>lim</sub> was improved after BR compared to PL ingestion ( $250 \pm 44$  vs.  $231 \pm 41$  s), with the magnitude of improvement being negatively correlated with quadriceps TOI at exhaustion ( $r = -0.78$ ), in the hypoxic trials ( $P < 0.05$ ). T<sub>lim</sub> tended to be improved with BR in normoxia (BR:  $364 \pm 98$  vs. PL:  $344 \pm 78$  s;  $P = 0.087$ ), but was not improved in hyperoxia (BR:  $492 \pm 212$  vs. PL:  $472 \pm 196$  s;  $P > 0.05$ ). BR ingestion increased peak  $\dot{V}O_2$  in hypoxia ( $P < 0.05$ ), but not normoxia or hyperoxia ( $P > 0.05$ ). Therefore, NO<sub>3</sub><sup>-</sup> supplementation is more likely to improve T<sub>lim</sub> and peak  $\dot{V}O_2$  as skeletal muscles become increasingly hypoxic.

**Key Words:** nitric oxide; vascular function; oxidative metabolism; exercise performance; fatigue; near-infrared spectroscopy