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Official URL: http://www.basesconference.co.uk/

EPrint URI: https://eprints.glos.ac.uk/id/eprint/3924

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# Changes in oxygenation kinetics following training in normoxia and normobaric hypoxia.



at Cheltenham and Gloucester

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## Introduction

Altitude camps are popular amongst elite endurance athletes seeking performance enhancement, however are not feasible for all. Subsequently, live-low-train-high protocols may be undertaken haphazardly in attempts to reap similar adaptations. The effects of exercise training in hypoxia on skeletal muscle oxygenation responses remain poorly understood (Bonetti & Hopkins, 2009).

## Results

Two-way repeated measures ANOVA revealed a significant main effect for condition (P = 0.03,  $\eta_p^2$  = 0.834). One-way ANOVAs revealed a significant difference across time in normoxia only (P = 0.01,  $\eta_p^2$  = 0.305). Post  $t_{y_{rec}}$  (6.79±2.18s) was 27% quicker than pre (9.25±3.41s, P = 0.03). Post 2, 3, and 4 weeks were slower than post (all P < 0.05).

## 4 weeks 13



Near-infrared spectroscopy (NIRS) has been used reliably to monitor training-induced changes in forearm oxygenation kinetics (Ryan et al., 2013). Wrist flexors are commonly studied due to their typically untrained nature and low adiposity (Fryer et al., 2015).

The purpose of this study was to determine the effects of handgrip training in normobaric hypoxia and normoxia on the oxidative capacity index of the flexor digitorum profundus (FDP).

## **Methods**

Nine recreationally trained, healthy males (mean ± SD, age: 20.7 ± 1.1 years; stature: 1.77 ± 0.08 m; body mass: 84.0 ± 14.2 kg) were studied. In a repeated measures, crossover design, participants completed 4 weeks of progressive endurance training of the wrist flexor muscles in normoxia and normobaric hypoxia (fraction of inspired oxygen = 14%). Training sessions comprised 30 min of continuous handgrip exercise. Contraction frequency increased from 0.3 Hz in week 1 to 1.2Hz in week four (~540 to ~2160 repetitions per session, respectively). Sessions ended with 60 s of 'sprint' contractions.



Figure 2. Time to half recovery of tissue saturation index of the flexor digitorum profundus following training and detraining in normoxia and normobaric hypoxia. Results are mean ± SD.





Changes in oxygenation kinetics of the FDP were assessed pre, post and 1, 2, 3, and 4 weeks post training. Briefly, participants were invited to lay supine for 20 min, before a tourniquet (Hokanson Inc, WA, USA) was utilised to sustain 5 min of brachial ischemia. Following rapid cuff deflation, time to half recovery (t<sub>1/2 rec</sub>) of the tissue saturation index was determined (McCully et al., 1994) using NIRS (Artinis Medical Systems BV, Ge, NL).



**Figure 3.** Percent change in time to half recovery of the flexor digitorum profundus following training in normoxia. A detraining half-time of 13.4 days was estimated using the regression equation of a logarithmic trend line fitted to the data. Results are mean ± SD.

## Conclusions

Oxygenation kinetics improved with 4 weeks of training in normoxia (27% faster  $t_{1/2rec}$ ), but not in normobaric hypoxia.

**Figure 1**. Assessment of oxygenation kinetics using near-infrared spectroscopy (left) and optode placement over the flexor digitorum profundus (right).





- In normoxia, both the magnitude of change and the rate of lacksquaredecline were consistent with previous findings (Ryan et al., 2013).
- Endurance training in normobaric hypoxia may blunt physiological lacksquareadaptations observed in normoxia.

## References

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