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Inspiratory muscle training and its effect on oxygen saturation and perceptions of effort and dyspnoea during a trek to Everest Base Camp
Amanda L. Seims, John P. O’Hara, Roderick, F.G.J. King and Carlton B. Cooke.

**AIM:** To evaluate the effects of inspiratory muscle training (IMT) on oxygen saturation (SaO$_2$), rating of perceived exertion (RPE) and rating of breathlessness (RB) during exercise in normobaric hypoxia (NH) and then an 11-day trek to 5300 m.

**Introduction**
Increasing ascent during high-altitude expeditions is typically associated with a significant 16% decrease in SaO$_2$ and inspiratory muscle strength (MIP) which can exacerbate breathlessness (1). Weaker inspiratory muscles are associated with greater inspiratory muscle fatigue (2) which exacerbates physiological and perceived stress during exercise (3). IMT has been shown to attenuate the fall in MIP with ascent to 5050 m altitude and reduced breathlessness associated with daily activities (4). Resting SaO$_2$ between 4800 and 5550 m altitude was 6% higher following IMT compared to placebo, but RB at rest was not different between groups (5). Increased SaO$_2$ during high-altitude expeditions following IMT may attenuate physiological and perceptual stress during exercise.

**Methods**

**Participants:** 3 M, 6 F (age 34.8 ± 10.0 years)

**Exercise Protocol:** Bassey's self-paced walking test was completed three times (slow, normal and fast) in normoxia (NORM) and twice in normobaric hypoxia [NH1 (PIO$_2$ = 104.1 mmHg, 3440 m altitude) and NH2 (PIO$_2$ = 85.9 mmHg, 4930 m altitude]. RPE, RB and SaO$_2$ were interpolated to 4.8 km h$^{-1}$.

**IMT**
- Matched on baseline MIP, randomised to IMT (n=4) or placebo (P, n=5).
- Repeat exercise protocol.
- Seven weeks, twice daily IMT: 30 efforts @ 50% MP; P: 60 efforts @ 15% MIP.

**Expedition**
- Daily measurements of SaO$_2$.
- MIP and repeat of exercise protocol at 3400 m altitude (HH).

**Findings**

**Exercise, Resting SaO$_2$**

**Exercise and Resting SaO$_2$**

**Exercise and Resting SaO$_2$**

**Not different between groups (P=0.887)**
- No training effects in NORM.
- No change in MIP at 3440 m.

**MIP**

- P: 3.52 ± 9.84%.
- IMT: 5.56 ± 8.34%.

**Completion of training**

- P: 68.1 ± 16.7%.
- IMT: 79.8 ± 13.5% (NS).

**Conclusions**
IMT may attenuate the expected decrease in resting SaO$_2$ with ascent to altitude above 4900 m similarly to previous research. Large variability and small sample sizes, along with sub-optimal completion of IMT may have negated the training response. Further research should evaluate effects of IMT on exercise SaO$_2$ and other responses during trekking expeditions above 4900 m altitude. Supervised IMT may enhance the training response.

**References**
(1) Romer and McConnell (2000) Changes in respiratory muscle strength and endurance are significantly reduced at high altitude compared to sea-level. J. of Physiol, 523, 216-217.