

Name of research institute or organization:

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**Center for Integrative Human Physiology, Institute of Physiology,  
University of Zürich**

Title of project:

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Influence of CO<sub>2</sub> during maximal exercise at altitude

Project leader and team:

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Project description:

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Exercise capacity at altitude may be reduced because of lowered cerebral oxygenation due to reductions in arterial oxygen content and cerebral blood flow secondary to hyperventilation-induced hypocapnia. Here we tested whether restoration of arterial PCO<sub>2</sub> would increase middle cerebral artery blood flow velocity (MCAv) and frontal lobe oxygenation and, thereby, lead to increased exercise performance. Eight healthy subjects performed two incremental exercise bouts in randomised order at the Jungfrauoch research station (3,471 m). The two exercise bouts were separated by at least 2 hours and were carried out either with (“isocapnia”) or without (“hypocapnia”) CO<sub>2</sub> supplementation aimed to keep end-tidal PCO<sub>2</sub> at 40 mmHg. [Heart rate, arterial oxygenation, ventilatory variables, MCAv and cerebral oxygenation (TOI) was recorded continuously.] No changes in breathing frequency (50.8±3.0 vs. 47.7±3.2 breaths min<sup>-1</sup>, hypocapnia and isocapnia, respectively), tidal volume (2.8±0.3 vs. 3.0±0.3 l), maximal oxygen consumption (3.3±0.4 vs. 3.1±0.4 l min<sup>-1</sup>) or maximal CO<sub>2</sub> elimination (3.8±0.4 vs. 3.5±0.4 l min<sup>-1</sup>) were observed. End-tidal PCO<sub>2</sub> were kept at 40±1 mmHg during isocapnia while it decreased to 30±0.8 mmHg in the hypocapnic trial (P<0.0001). While arterial oxygenation did not increase significantly (80±5 vs. 87±5 %, P=0.37), increases in MCAv (17±4 vs. 33±4 %, P=0.0001) were greater and reductions in TOI (-5.4±0.9 vs. -4.7±0.9 %, P=0.002) smaller with CO<sub>2</sub> supplementation than without. The increase in oxygenation, however, did not increase exercise capacity as maximal power output (231±22 vs. 233±24 W, P=0.95) was unaffected. We conclude that reductions in cerebral oxygenation are not the cause of reduced exercise capacity at medium altitude.

Key words:

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Human physiology, exercise, limitations, brain oxygenation

Scientific publications and public outreach 2011:

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Manuscript is in preparation and is planned to be submitted before summer 2012.

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