Vasorelaxation to the endothelium- and NO-dependent vasodilator acetylcholine (ACh) was significantly improved in SupraH compared to SupraN (AUC: 247.6 ± 12.9 vs 206.3 ± 15.1 U; +20%, $p < 0.05$), and in LowH compared to LowN (AUC: 228.9 ± 9.0 vs. 208.0 ± 9.0 U; +10%, $p < 0.05$). The degree of improvement in vasorelaxation was significantly higher in SupraH than in LowH (AUC: 247.6 ± 12.9 vs. 228.9 ± 9.0 U; +8%, $p < 0.05$). Contrary our expectations, there were no differences between the groups for the expression of eNOS, p-eNOS and the ratio of p-eNOS/eNOS. Moreover, no differences were observed between the groups for the expression of any of the anti- nor pro-oxidant proteins studied (SOD1, SOD2; SOD3 and p47-phox). Plasma concentration of NOx and NO₂ did not differ between the groups. Vasorelaxation to the endothelium-independent vasodilator DEA/NO was significantly improved in LowH compared to LowN (AUC: 373.3 ± 10.9 vs. 370.0 ± 8.0 U; +5%, $p < 0.05$), indicating an increased sensitivity of vascular smooth muscle cells to NO and/or an upregulation of guanylyl cyclase activity.

CONCLUSION:

This study provides the first experimental evidence that supramaximal exercise intensity in hypoxia improves vascular endothelial function, which was not associated with an increase in expression of aortic proteins or pro- and anti-oxidant proteins.

Lavier, J., Beaumann, M., Ménétrey, S., Mazzolai, L., Peyter, A.-C., Pellegrin, M., and Millet, G.P. (2019). Supramaximal Intensity Hypoxic Exercise and Vascular Function Assessment in Mice. *J Vis Exp*.

HOLD YOUR BREATH: PERIPHERAL AND CEREBRAL OXYGENATION DURING DRY STATIC APNEA.

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INTRODUCTION:

Acute breath-holding deprives the human body from oxygen. In an effort to protect the brain, the diving response is initiated, coupling several physiological responses. The aim of this study was to describe the physiological responses to voluntary breath-holding at the cardiac, peripheral and cerebral level in order to obtain insight into the protective mechanisms for the brain.

METHODS:

31 physically active subjects (17 male, 14 female, 23.3 ± 1.8 years old) performed a maximal static breath-hold in a seated position. Heart rate (HR) and muscle (M. Vastus Lateralis) and cerebral (prefrontal cortex) oxygenation (by means of near-infrared spectroscopy) were continuously measured. RM MANOVA's were used to identify changes in HR, cerebral (cTOI) and peripheral tissue oxygenation (mTOI) and oxygenated (O₂Hb) and deoxygenated (HHb) hemoglobin at different time points during apnea.

RESULTS:

Subjects held their breath for 157 ± 41 s on average (range: 96-244 s). HR started decreasing 15 s after the onset of apnea ($p = 0.003$) reaching minimal values after 83 ± 58 s. HR dropped on average by 27 ± 14 bpm ($30 \pm 13\%$) from baseline ($p < 0.001$). mTOI started decreasing 10 s after apnea ($p < 0.001$) and continued to decrease until 10 s post apnea, reaching baseline only 30 s post apnea ($p = 0.369$). mTOI fell on average by $8.6 \pm 4\%$ ($p < 0.001$). Following an immediate drop after 5 s ($p < 0.01$), cTOI increased continuously, reaching a maximal increase of $4.6 \pm 3\%$ ($p < 0.001$) after 100 ± 49 s, followed by a steady decrease until the end of apnea. cTOI fell on average $6.5 \pm 7.6\%$ below baseline ($p < 0.001$) with individual decreases up to 25%. cTOI increased immediately after apnea, already reaching baseline 10 s post apnea ($p = 0.811$). One subject fainted during testing after only 65 s of apnea. Visual analysis revealed a similar pattern for HR. Examination of mTOI, mO₂Hb and mHHb suggested impaired peripheral vasoconstriction, while cTOI showed a very strong immediate drop, followed by incomplete recovery resulting in a second fast drop in cTOI until the subject passed out.

CONCLUSION:

During apnea, the human body elicits several protective mechanisms in order to protect itself against the deprivation of oxygen. HR slows down decreasing oxygen demand of the cardiac muscle. The decrease in mTOI and increase in cTOI imply a redistribution of blood flow prioritizing the brain. However, data from one participant suggests that syncope can be induced by impaired redistribution, observed as a less pronounced peripheral vasoconstriction deduced from muscle oxygenation responses and a disturbed cerebral oxygen.

OP-PN03 Metabolism and Hypoxia

STRESS RESPONSE DURING A HIMALAYAN TREK: SUB-CLINICAL ETHNIC DIFFERENCES REVEALED BY A MULTI-DOMAIN APPROACH

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INTRODUCTION:

Altitude hypoxia is known to act as a physiological stressor. Among other adaptations, HRV and hormonal factors have been stressed [1,2], while mood has been poorly addressed. Beyond the emergence of AMS, the present work aimed to explore sub-clinical adaptations from a multi-domain perspective during a Himalayan trek, comparing two ethnic groups.

METHODS:

This work is a subset of "Kanchenjunga Exploration & Physiology" project. 6 healthy Italian trekkers (1 f and 5 m, age 43.83 ± 15.30 years y, BMI = 25.81 ± 3.25 Kg/m²) and 6 healthy Nepalese porters (all males, age 30.33 ± 8.55 y, BMI = 24.36 ± 4.70 Kg/m²) were recruited. All of them completed ≈ 300 Km distance along a demanding route, covering ≈ 6 hours daily walk, in the Kanchenjunga mountain range, Nepal. None of them suffered from AMS during the trek. All participants underwent: ECG recording, before the trek (Pre), at 3427 m of altitude before the North Base Camp (5143 m of altitude) circuit (bBC), and after that circuit (aBC); blood sample at Pre and after the trek (Post); Italians were required to complete also a mood state questionnaire (58-item POMS) at Pre, at high altitude (4780 m) in the last village prior to the Base Camp (HA), and at Post. From 5 minutes-ECG recording at rest, we evaluated HRV by the mean of time-domain (SDNN and pNN50), frequency-domain (absolute LF and HF power) and non-linear parameters (CSI, CVI and HFD). From blood samples, we evaluated Cortisol (COR) and Prolactin (PRL) concentrations. From POMS questionnaire, we evaluated the Total Mood Disturbance (TMD) score [3].

RESULTS:

Linear and non-linear measures of HRV suggested an overall higher parasympathetic tone at bBC, with a following reduction at aBC only in the Italian group. PRL was lower at Post in respect to Pre, but only in the Italian group ($p = 0.043$, $\mu_2 p = 0.352$), whereas no clear trends were found for COR. Mood state of Italians tended to be better ($p = 0.075$, $\mu_2 p = 0.404$) at HA and at post, in respect to Pre.

CONCLUSION: