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III.8. Femoral Artery Exercise Blood Flow Response to Hypoxia in Danish Lowlanders and Aymara Natives.

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Problem and Aim.
The aim of the present project was to elucidate the influence of acute and chronic hypoxia on limb exercise blood flow, and whether any vasodilatory changes were related to the interstitial concentrations of adenosine, prostaglandins, or K^+.

Göran Radegran measuring blood flow on an Aymara native.

Methods: Femoral artery blood flow (FaBF) was measured with ultrasound Doppler (Vingmed CFM 750 and 800, Vingmed Sound, Horten, Norway) during rest and one-legged dynamic knee-extensor exercise (1L-KEE), in (i) 16 Danish lowlanders (DL, 25 ± 1 years, 74 ± 3 kg, 178 ± 2 cm) during normoxia (NX) at sea level (SL) and after ~7-10 weeks of chronic hypoxia (CHX) at altitude (ALT, (5260 m.a.s.l.), as well as at ALT in 6 Aymara natives (AN, normally resident at ~3600-4200 m.a.s.l., 28 ± 2 years, 64 ± 2 kg, 164 ± 2 cm).

The effect of acute hypoxia (~11% O_2, AHX) in DL at SL and hyperoxia (~55% O_2, AOX) in DL and AN at ALT, was studied during sub-maximal (SM) 1L-KEE (~20 W, 60 rpm), with each condition lasting ~30 min. In addition, incremental 1L-KEE (with 10 W increments every 5th min from 10 to 40 W) was performed in DL at SL and in DL and AN at ALT. Hct and [Hb] (OSM3 Hemoximeter, Radiometer, Copenhagen, Denmark) were measured in venous blood at SL and ALT, respectively. The interstitial concentrations of adenosine (HPLC, Ylva Hellsten), prostaglandins (RIA, Henning Langberg) and K^+ were measured by microdialysis.

Results: The [Hb] and Hct increased ($p<0.003$) in DL at ALT by ~39 % and ~26 %, respectively, i.e. to a level similar (p=ns) as in AN (~189 g/l and 53 %, respectively).

FaBF was the same (p=ns) in DL during incremental 1L-KEE at SL and ALT, respectively. Moreover, with CHX during SM 1L-KEE at ALT, FaBF was insignificantly different (p=ns) in AN and DL. The decrease ($p<0.05$) in FaBF with AOX in AN in CHX was of similar magnitude as in DL. The FaBF was furthermore insignificantly different (p=ns) in DL and AN during incremental 1L-KEE at ALT.

Conclusion
With CHX [Hb] is elevated in DL, allowing for limb blood flow to return to a normoxic exercise level, and similar to that observed in AN at ALT. The effect on FaBF of AHX at SL and hyperoxia after

chronic ALT exposure emphasises that limb blood flow during exercise is regulated to match oxygen delivery to the metabolic demand. This further indicates a critical role of arterial oxygen content in skeletal muscle blood flow regulation. The regulatory role of the vasodilators remains to be investigated.

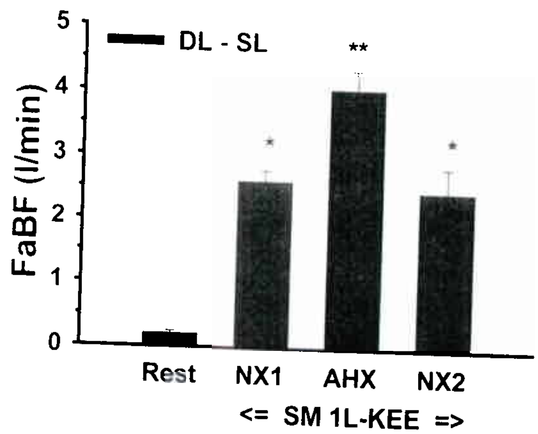

Figure 10. *With acute hypoxia (AHX) in DL during SM 1L-KEE at SL. FaBF was elevated ($p<0.005$) with ~50% compared to NX. * SD from rest. ** SD from rest and NX.*

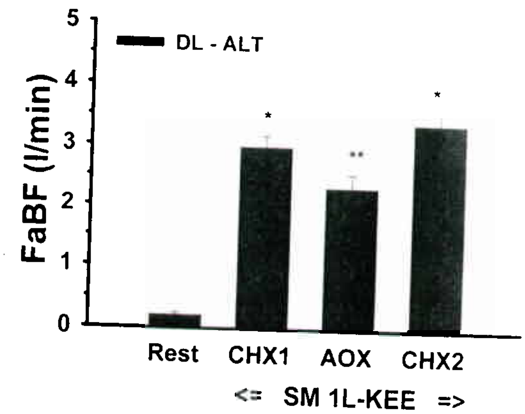

Figure 11. *With chronic hypoxia (CHX) in DL during SM 1L-KEE at ALT, FaBF returned (p=ns) to SL NX values. Acute hyperoxia (AOX) in DL in the CHX condition brought FaBF down ($p<0.05$) by ~25 %. * SD from rest. ** SD from rest and CHX.*