"LIVE LOW - TRAIN HIGH: MUSCULAR ADAPTIONS AND PERFORMANCE"

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Currently, there are to seemingly opposite training paradigms proposed to use altitude (or hypoxia) as an ergogenic aid. Levine and Stray-Gundersen (2) propose to live high - train low, while we have proposed to live low – train high (1). While these two approaches seem to be mutually exclusive – there is much that these contrasting prescriptions have in common. The basic mechanism that is at the base of both hypoxia-training approaches is the specific answer of mammalian tissue to a hypoxia stimulus. It has been shown by Semenza (see review 3) that mammalian tissue exposed to hypoxia produces a transcription factor called HIF-1alpha (HIF is short for hypoxia inducible factor). This transcription factor is a “master gene” that changes the transcription of many genes, which protect the organism in a situation of oxygen deprivation. HIF-1alpha is activated upon hypoxia exposure in almost all mammalian tissues – it is an important physiological response of all organisms that essentially depend on oxygen for survival. In general, HIF-1alpha shifts metabolism towards more glucose utilization and favors glycolytic pathways. As a consequence, organisms can save some energy by using glucose as a main substrate and are better capable of switching to anaerobiosis. HIF-1alpha is also is a potent inducer of vascular endothelial growth factor (VEGF) ultimately leading to better perfusion of hypoxic tissues. In muscle tissue we could further show that training in hypoxia leads to an increase of the concentration of myoglobin RNA (4). Both the increase in muscle capillaries as well as the increase in myoglobin would favour muscle oxygenation at altitude. We have recently gained experience with using hypoxia in training with top-level athletes and will discuss practical implications of using hypoxia training as an ergogenic aid.

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