

Response to hypoxic training

The term hypoxia is a condition where the tissues are not oxygenated adequately, usually due to an insufficient concentration of oxygen in the blood.

Hypoxia-inducible factor-1 α (HIF-1 α ; encoded by HIF1A gene) is a transcription factor regulating several genes in response to hypoxic stimuli. HIF-1 α protein levels were found to be constitutively higher in the more glycolytic muscles (fast twitch muscle fibers) compared with the more oxidative muscles (slow twitch muscle fibers). A lower proportion of type fast twitch fibres in the soleus muscles of HIF-1 α knockout mice was detected as well as a metabolic shift away from glycolysis toward oxidation, and as a consequence, improved endurance and decreased strength capacity.

Lunde et al. research team had shown that when HIF-1 α was overexpressed (excessive levels of HIF1A) for 14 days after somatic gene transfer in adult rats, a slow-to-fast transformation was observed.

In humans, a missense polymorphism in the HIF1A gene, Pro582Ser, is present in exon 12 (rs11549465 C/T). The rare T allele is predicted to increase HIF-1 α protein stability and transcriptional activity and therefore, may improve glucose metabolism and lower the risk of type 2 diabetes.

Recent studies investigated a hypothesis that HIF1A Pro582Ser genotype distribution may differ for controls and Russian sprint/strength athletes, for which anaerobic glycolysis is one of the most important sources of energy for power performance. The frequency of the HIF1A T allele was significantly higher in weightlifters than in 920 controls (17.9% vs. 8.5%) and increased with their levels of achievement (sub-elite (14.7%) \rightarrow elite (18.8%) \rightarrow highly elite (25.0%)).

These results were replicated in a cohort of Polish power-orientated athletes (the frequency of the HIF1A T allele: 17.1% vs. 9.1%; $P = 0.01$; in comparison with 254 sedentary controls), but not in 81 Israeli sprinters.

Furthermore, the T allele was significantly associated with an increased proportion of fast-twitch muscle fibres and a significantly higher slow-to-fast fiber transformation in response to a hypoxic state.

YOUR RESULTS

Gene	Your results	Effects
HIF1A	CT	High slow-to-fast fiber transformation in response to hypoxic training

Conclusion : You exhibit higher slow-to-fast fiber transformation in response to hypoxic training.

If your goal is muscle building / strength performance : Doing hypoxic training (such as Occlusion training) will have a significant positive impact on your fast twitch muscle fiber ratio and your glucose metabolism.

If your goal is endurance performance : You should avoid hypoxic training as it will have a



negative impact on your slow twitch muscle fibers composition.

Examples of hypoxic training :

- Occlusion training, or what scientists call "blood flow restriction training" (BFR), involves restricting blood flow (thus oxygen) in the veins of a working muscle to elicit gains in size and strength.
- Training in high altitude : At high altitudes, the lower air pressure makes it more difficult for oxygen to enter our vascular systems. The result is hypoxia.
- Training mask : Elevation Training Mask mimics the effects of High Altitude Training.

