

**低酸素環境下での骨格筋電気刺激が
動脈ステイフネスと糖代謝に及ぼす影響**
—運動様刺激を用いたより簡単に効果が得られる健康増進方法の開発・提案—

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**Effect of Electrical Stimulation in Hypoxia on
Arterial Stiffness and Glucose Metabolism**

by

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ABSTRACT

Purpose: This study aimed to examine the effects of electrical stimulation in hypoxia on arterial stiffness and glucose metabolism.

Methods: Seven healthy male adults participated in experiments of four different protocols (*i.e.*, rest in normoxia (NR), rest in hypoxia (HR), electrical stimulation in normoxia (NES), and electrical stimulation in hypoxia (HES)) in random order on separate days. Throughout a 40-min measurement, the subjects breathed normoxic (20.9%O₂) or hypoxic (15.3 – 15.5%O₂) gas via a facemask connected to the oxygen generator. Also, in NES and HES, a 20-min electrical stimulation of 4 Hz was

conducted in a lower limb in the latter 20-min of the measurement.

Results: During electrical stimulation, heart rate and oxygen uptake in NES and HES increased, compared with each baseline. However, no significant difference was observed in the heart rate between NES and HES. Conversely, oxygen uptake during electrical stimulation was significantly lower in HES than in NES. Interestingly, CAVI, which is an index of arterial stiffness, significantly reduced, and the reduction in CAVI was significantly greater in HES than that in NES. In addition, lactate concentrations and respiratory exchange ratio were significantly higher in HES than the other three trials.

Conclusion: These findings suggest that electrical stimulation in hypoxia can induce both greater reduction in arterial stiffness and increase in glucose metabolism than those in normoxia.

要 旨

【目的】低酸素環境下での一過性の骨格筋電気刺激が動脈ステイフネスと糖代謝に与える影響について検討した。【方法】健康な成人7名に対し、常酸素安静、低酸素安静、常酸素電気刺激、低酸素電気刺激の4試行を行った。低酸素では15.3-15.5%O₂の低酸素ガスを吸入させ、電気刺激では下肢に4Hzで刺激した。【結果】常酸素安静、低酸素安静条件では変化がなかったが、電気刺激の条件で動脈ステイフネスの低下が認められ、低下率を比較すると、低酸素条件の方が大きな低下だった。さらに、低酸素電気刺激条件では、常酸素条件の場合よりも、血中乳酸濃度や呼吸交換比が有意に高い値を示した。【結論】本結果は、低酸素環境下で一過性の骨格筋電気刺激を行うと、通常環境下で同じ電気刺激を行うよりも、1) 動脈ステイフネスをより低下させること、2) 電気刺激時のエネルギー基質としての糖質の利用をより促進させる可能性を示唆するものであった。