間欠的低酸素トレーニングが身体パフォーマンスに及ぼす影響

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The Effect of Intermittent Hypoxic Exposure with Endurance Training on Physical Performance at Sea Level

by

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ABSTRACT

The present study was performed to clarify the effects of intermittent exposure to altitude at 4,500m with endurance training on physical performance at sea level and ventilatory chemosensitivity. Seven subjects （AL group） performed endurance training during hypoxic situation for 30 min・d $^{-1}$, 5 d・wk $^{-1}$ for 2 wk, while other seven subjects （SL group） trained at sea level for the same period. Before and after the training period, maximum oxygen uptake

($\dot{V}_{O_2max}$) and endurance time were measured for each subject using a bicycle ergometer with incremental loading. Hypoxic ventilatory response (HVR) was measured using an isocapnic progressive hypoxic method. Resting hypercapnic ventilatory response was measured by two methods, i.e., hypercapnic ventilatory response as an index of central hypercapnic chemosensitivity (HCVR) using CO_2 rebreathing method and hypercapnic ventilatory response as an index of peripheral hypercapnic chemosensitivity ($HCVR_{SB}$) using single breath CO_2 method. After 2 weeks of endurance training, significant increases were noted in $\dot{V}_{O_2max}$ and endurance time in both groups, but there were not significant differences between the groups. HVR tended to increase in the AL group but not statistically significant, while there was significantly decreased in the SL group. On the other hand, endurance training did not alter HCVR and $HCVR_{SB}$ in both groups. These results suggest that ventilatory chemosensitivity to hypoxia is more variable by endurance training than that ventilatory chemosensitivity to hypercapnia. It also suggests that changes of these chemosensitivity have little or no effect on $\dot{V}_{O_2max}$ and time to fatigue at sea level.

要　旨

本研究の目的は間欠的低酸素暴露と持久的トレーニングとの組み合わせ（間欠的低酸素トレーニング）が平地におけるパフォーマンスおよび呼吸の化学感受性に及ぼす影響を明らかにすることである．14名の被験者を7名づつ間欠的低酸素トレーニング群（AL群），および平地トレーニング群（SL群）に振り分けた．最大酸素摂取量（$\dot{V}_{O_2max}$），$\dot{V}_{O_2max}$測定時の運動時間（Endurance time），低酸素に対する換気応答（HVR），中枢化学受容器の高炭酸ガスに対する換気応答（HCVR），末梢化学受容器の高炭酸ガスに対する換気応答（$HCVR_{SB}$）をトレーニング前後に測定した．2週間のトレーニング後，$\dot{V}_{O_2max}$，Endurance timeは両群で有意に増加したが，群間で差は見られなかった．HVRはAL群で増加傾向を，SLで有意な低下を示したがHCVR，$HCVR_{SB}$には変化が見られなかった．これらの結果は，高度4,500mでの2週間の間欠的低酸素トレーニングは平地におけるパフォーマンスに影響を及ぼさないこと，安静時の低酸素および高炭酸ガスに対する換気応答の変化は平地でのパフォーマンスに寄与しないことを示唆している．