

低酸素環境を利用したトレーニングが運動効率および ヘモグロビン酸素親和性に及ぼす影響

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Effect of Short-Term Intermittent Normobaric Hypoxia on the Cycling Efficiency and Hemoglobin O₂ Affinity

by

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ABSTRACT

The purpose of this study was to examine the effect of short-term intermittent normobaric hypoxia on the submaximal cycling efficiency and hemoglobin O₂ affinity in endurance cyclist. Twelve-male elite endurance cyclists were divided into a normoxic (N, n=6) or a hypoxic group (H, n=6). H group cyclists stayed in a normobaric hypoxic room (15.4% O₂; 2500m) for 10-12h a day at night over 5 days, with training sessions at sea-level. Before and after the experimental period, subjects were undergone the submaximal treadmill cycling and hematological tests. Submaximal cycling efficiency was measured at the intensities of 50% and 80% of $\dot{V}O_{2max}$ predetermined during baseline test. Also, resting RBC, Hb, Hct, Ret, 2·3-DPG and oxyhemoglobin dissociation curve (ODC)

were measured before (pre) and 5th day (after) of the experiment period. ODC was shift to the right by hypoxia. P_{50} value of H group was significantly increased ($p < 0.05$) on the 5th day (29.83mmHg) compared with the pre-value (28.19mmHg). RBC, Hb and Hct were not changed by hypoxia. After experimental period, $\dot{V}O_2$ at 50% and 80% of $\dot{V}O_{2max}$ of H group were significantly decreased ($p < 0.05$) by 15% and 18% compared with pre-values, respectively. HR and Blood lactate concentration at both intensities were also significantly decreased from the pre-values ($p < 0.05$) in H group. There were no different in $\dot{V}E$, $\dot{V}O_2$, HR and blood lactate concentration of N group at both intensities. From these results, it was concluded that short-term intermittent normobaric hypoxia shifts ODC to the right and could contribute to the improvement of submaximal cycling efficiency in endurance cyclist.

要 旨

自転車競技選手を対象に5日間の常圧低酸素環境への間欠的滞在が運動効率およびヘモグロビン酸素親和性に及ぼす影響について検討した。

12名の選手は高度2,500m (15.4% O_2) にシミュレートした低酸素室に主として睡眠のために1日10-12時間ずつ5日間にわたって滞在し、トレーニングは平地で行う低酸素 (Hypoxia; H) 群とコントロール (Normoxia; N) 群とに等分した。実験期間前後で血液性状および50% および80% $\dot{V}O_{2max}$ 強度での最大下一定負荷運動テストを実施した。

H群は酸素運搬を担うRBCやHb等の改善は認められなかったが、ODCの右方シフトおよび P_{50} 値の有意な増加が認められた。最大下一定負荷運動においては低酸素滞後に $\dot{V}E$ 、 $\dot{V}O_2$ 、HRおよびLaが有意に低下することが認められた。

以上の結果から、短期間の間欠的常圧低酸素環境への滞在はODCを右方シフトし末梢組織での酸素利用能を高め、また、最大下運動時の $\dot{V}O_2$ を減少させることから、運動効率を改善する可能性が示唆された。

緒 言