

周期的低圧低酸素環境下の持久性および 自重運動が食後高血糖抑制効果に与える影響

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Effects of Periodic Hypobaric and Hypoxic Environment Systems on Postprandial Hyperglycemia During Endurance Exercise and Calisthenics

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ABSTRACT

We developed a periodic pressure-controlling system to mimic a hypobaric hypoxic environment in a chamber. The characteristics of this system varied between decreased pressure at an altitude of 1,500 m for 180 seconds and increased pressure at an altitude of 0 m for 180 seconds. The present study aimed to determine the relationship between exercise in the periodic hypobaric hypoxic environment (PHHE) and physiological responses evaluated using an oral glucose tolerance test. This study included 2 groups of 13 (Experiment 1) and 8 (Experiment 2) healthy men, who provided written informed consent for participation in the study. All subjects performed an oral glucose tolerance test for 120 minutes and two exercise tests: endurance exercise (Experiment 1) and calisthenics (Experiment 2). The endurance exercise test consisted of 40% maximal oxygen intake for 18 minutes. The calisthenics test included performance of 3 sets of squat exercises (10 squats/set). We established three experimental conditions: exercise in PHHE system (periodic condition), at an altitude of 750 m (fixed condition), and at an altitude of 0 m (control condition). In the periodic condition, the atmospheric pressure was changed periodically from 967 to 817 hPa (external

pressure was 1,008 hPa). In the fixed condition, the atmospheric pressure was fixed at 892 hPa. In the control condition, the atmospheric pressure was fixed at 1,008 hPa. Pulse rate (PR), systolic (SBP) and diastolic blood pressure (DBP), arterial oxygen saturation (SpO₂), and blood glucose values were measured during the oral glucose tolerance test. Heart rate, SpO₂, and the rating of perceived exertion (RPE) were measured during exercise in experiment 1. SpO₂ was significantly lower in the periodic condition. PR, SBP, and DBP were significantly different among the 3 conditions. There were no significant differences in blood glucose values among the 3 conditions. During exercise, HR and RPE were not significantly different among the 3 conditions. In conclusion, glucose metabolism was not suppressed by exercise in the PHHE.

要 旨

周期的低圧低酸素環境を模擬したシステムを開発した。本研究は高度換算 1,500m の周期的低圧低酸素環境の運動と糖負荷試験中の生理応答の関連性を明らかにすることを目的とした。対象者は実験 1 が 13 名、実験 2 が 8 名であった。対象者には研究参加の同意を得た。対象者は 120 分間の糖負荷試験中に持久性運動（実験 1）と自重負荷運動（実験 2）を実施した。持久性運動は最大酸素摂取量の 40% の自転車漕ぎ運動を 18 分間とした。自重負荷運動は 3 セット（1 セット 10 回）のスクワットとした。測定条件は高度換算 1,500m 周期的低圧低酸素環境（周期的）条件、高度換算 750m 一定（一定）条件、常圧常酸素環境（対照）条件の 3 条件とした。糖負荷試験中の脈拍数、収縮期血圧、拡張期血圧、動脈血酸素飽和度、血糖値を測定した。運動中は心拍数、動脈血酸素飽和度、主観的運動強度を測定した。動脈血酸素飽和度は周期的条件が有意な低値を示した。脈拍数、収縮期、拡張期血圧は 3 条件間に有意な差が観察された。3 条件間の血糖値に有意な差は観察されなかった。周期的低圧低酸素環境下における耐糖能は運動を負荷することによって 3 条件間に有意な差が観察されないことが明らかになった。