

胸郭圧迫が運動時の呼吸・循環応答，筋酸素動態およびパフォーマンスに及ぼす影響

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The Effects of Chest Wall Restriction on Cardio-respiratory Responses, Muscle Oxygenation and Performance during Exercise

by

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ABSTRACT

The purpose of the present study was to elucidate the effects of chest wall restriction by external chest compression on endurance performance, and cardio-respiratory responses, muscle energy metabolism and oxygenation during exercise. Nine collegiate male subjects performed maximal exercise to exhaustion (MAX) under chest wall

restriction (CR) and non restriction control (NR) conditions, and sub-maximal constant load exercise (SUB) for 15 min under both conditions at 40, 60, and 80% of peak oxygen uptake (peak $\dot{V}O_2$) measured during CR conditions. We found that under CR conditions, as compared with NR, 1) peak $\dot{V}O_2$ and endurance time were less by about 9% in MAX, and 3 of the subjects could not complete the 80% load task during SUB, 2) minute ventilation was greater at the sub-maximal level during MAX and at 40% and 60% load tasks during SUB, but the maximal value was lower in MAX, 3) tidal volume was less while respiratory rate was higher throughout the experiment, 4) oxygen saturation (SpO_2) became less at a higher exercise intensity during both MAX and SUB, 5) heart rate was higher during SUB and at exhaustion, 6) the muscle deoxygenation rate estimated by near-infrared spectroscopy showed no difference at only 80% load task but tended to decrease in the other cases, 7) blood lactate concentration was less at the maximal value in MAX, but showed no difference during incremental and sub-maximal exercise, 8) respiratory discomfort measured by the subjects' rating of perceived exertion tended to be higher during SUB. These results indicate that endurance performance should be decreased by CR, and this would be attributed directly to impaired respiration due to CR.

要 旨

胸部圧迫による胸郭制限が、持久的運動のパフォーマンスおよび生理学的機能にどのような影響を及ぼすか明らかにするため、9名の被検者に、ストラップで胸部を締める胸郭制限 (CR) 条件と非制限 (NR) 条件で、漸増負荷による最大運動テストを行った。さらに、CR 条件での最高酸素摂取量の 40, 60, 80% の運動強度で 15 分間の最大下の定常負荷運動テストも実施した。その結果、NR 条件に比べ CR 条件では、1) 最高酸素摂取量と運動継続時間は低下し、80% 強度の定常負荷運動で 3 名の被検者が運動継続できなくなった、2) 毎分換気量は 80% より下の運動強度では高いがその最大値は低く、その影響で 80% 強度以上で動脈血酸素飽和度 (SpO_2) は低下する、3) 一回換気量は低く、呼吸数は高い、4) 筋の脱酸素化率は 80% 強度では差がないが、それ以外は低い傾向を示す、5) 乳酸濃度は最高値

は低い、最大下および乳酸閾値や乳酸蓄積開始点 (OBLA) は差がない、6) 呼吸の疲労度 (困難感) が高い、ことが明らかとなった。胸郭制限により持久的運動のパフォーマンスが低下し、それには呼吸系の機能低下が直接的に影響することが示唆された。