

腕運動によって脂肪は燃焼するか？
- 運動時間と強度からみた腕運動中の代謝特性 -

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Does the Arm Exercise Promote Lipid Utilization?
-Effects of Exercise Intensity and Duration on Metabolism During Arm Exercise.-

by

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ABSTRACT

The present study investigated the difference in metabolic responses to exercise intensity and duration between arm cranking and leg cycling, to clarify the effectiveness of arm exercise in fat combustion. During each experiment, oxygen uptake ($\dot{V}O_2$) and respiratory exchange ratio (RER) were monitored. Near-infrared spectroscopy was used to measure changes in muscle deoxygenation in the triceps during arm cranking as well as in the vastus lateralis during leg cycling. (Experiment 1) Twenty-seven females completed incremental arm cranking and leg cycling tests. During arm cranking, there was a rapid increase in the RER, and a lower lactate threshold, as compared with leg cycling. In addition, muscle deoxygenation during arm cranking rose up to the middle of $\dot{V}O_2$ peak (mean 51.4%). These results suggest that the oxygen demand in the triceps reached a maximum. (Experiment 2) Ten females performed three-intermittent 10-min arm cranking and leg

cycling sessions at 20, 40, and 60% of the mode-specific maximal workload. RER at steady state was significantly higher during arm cranking than during leg cycling at all intensities. (Experiment 3) Four females performed 60-min arm cranking and leg cycling at 40% of the mode-specific $\dot{V}O_{2peak}$. Both modes showed similar response for RER, namely, gradual decrease from the 10-15th min until the end of exercise. At the beginning of arm cranking, however, temporary increase in RER and promotion of muscle deoxygenation were observed. In conclusion, the results of the present study suggest that anaerobic glycolytic metabolism is easily promoted during arm exercise, compared with leg cycling, especially at the beginning of exercise.

要 旨

本研究は、アームクランキング運動（AC）と脚サイクリング運動（LC）中の運動強度および運動時間に対する代謝応答の違いを明らかにし、腕運動の脂肪燃焼の有効性を検証することを目的とした。各実験において、酸素摂取量（ $\dot{V}O_2$ ）および呼吸交換比（RER）を測定した。また、近赤外分光法により主動筋の組織酸素飽和度（ S_dO_2 ）を評価した。<実験1> 27名の女子にACおよびLCを漸増負荷法により実施した。ACは急激なRERの上昇および低い換気性閾値を示した。さらに、ACの主動筋の S_dO_2 は最高 $\dot{V}O_2$ （ $\dot{V}O_{2peak}$ ）の約50%の強度で止まった。このことは、AC運動の主動筋の酸素取り込み能力が速く最大に達したことを示唆している。<実験2> 10名の女子に、両運動を3つの最大下負荷（最高作業負荷の20, 40, 60%, 各10分間）で実施させた。RERはどの運動強度においても腕運動の方が有意な高い値を示した。<実験3> 4名の女子に、両運動を40% $\dot{V}O_{2peak}$ の強度で60分間実施させた。両運動とも運動時間が長くなるにつれてRERは低下し、主動筋の S_dO_2 は上昇した。以上の結果より、腕運動は脚運動に比べ、同じ相対強度でも脂肪燃焼が低いが、長時間継続することにより脂肪燃焼が促進することが示唆された。