

# 高強度持久性運動に対する脳循環制御機構の解明

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## Cerebrovascular Regulation in Response to High-intensity Interval Exercise

by

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### ABSTRACT

We examined central arterial and cerebral hemodynamics during intermittent high-intensity exercise. In addition, the response of the pulsatile buffering function in the arterial system from the aorta to the cerebral vessels was also evaluated. Twelve healthy young adults (age  $24 \pm 2$  years) underwent an intermittent high-intensity cycling exercise test consisting of four alternating sessions of 3 minutes of exercise at 50-60% maximal workload (moderate-intensity) and 4 minutes of exercise at 80-90% of maximal workload (high-intensity). Throughout the exercise protocol, brachial arterial pressure waveforms were invasively recorded for estimation of systemic hemodynamic

variables including stroke volume, cardiac output (CO), and total peripheral resistance (TPR) (via Modelflow method). In addition, aortic blood pressure was computed from brachial arterial pressure waveforms (via general transfer function technique). Middle cerebral arterial blood flow velocity (CBFV) was measured by transcranial Doppler method. Cerebrovascular admittance was evaluated by transfer function method. The total peripheral vascular resistance (=mean arterial pressure/CO) decreased gradually after the start of exercise, and exhibited edging lower after the third moderate-intensity exercise. In contrast, the cerebral vascular resistance index (=mean arterial pressure/mean CBFV) and admittance did not change significantly during the exercise. These results indicate that although systemic vasodilation occurs during intermittent high-intensity exercise, vasodilation is less likely to occur in the cerebral vascular bed. The cerebral vascular bed may maintain vascular tonus against the excessive cerebral perfusion associated with transient high-intensity exercise as a defense mechanism against the mechanical stress of pulsatile fluctuation.

## 要 旨

本研究では、間欠的高強度運動中の中心動脈及び脳循環動態、ならびに大動脈から脳血管へかけの動脈系における拍動緩衝機能の応答を検討した。健康な若年成人12名(年齢 $24 \pm 2$ 歳)を対象に、下肢サイクリング運動を最大作業負荷の50～60%で3分間(中強度運動)と80～90%で4分間(高強度運動)、交互に4回ずつ行う間欠的高強度運動を施行した。総末梢血管抵抗は運動開始後に漸減し、3回目の中強度運動以降で下げ止まりとなった。これに対し、脳血管抵抗性指数及びアドミッタンスは運動中に有意な変化を示さなかった。この結果は、間欠的高強度運動中に全身的な血管拡張が生じるものの、脳血管床においては血管拡張が起こりにくいことが示された。これは、一過性の高強度運動に伴う過大な脳灌流に対して、脳血管床は血管トーンスを維持する、すなわち、拍動性変動というメカニカルストレスに対する防御機構である可能性が示唆された。