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The effects of L-citrulline supplementation on cerebrovascular function during sprint interval training in taekwondo athletes

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ABSTRACT

Background: Sprint Interval Training (SIT), a high - intensity exercise commonly used to improve athletic performance in combat sports, can affect cerebral blood flow. As the maintenance of cerebrovascular health is crucial for athletic performance and recovery, this study aimed to examine the effects of L-citrulline supplementation on cerebrovascular function following SIT in Taekwondo athletes.

Methods: Twenty male Taekwondo athletes (ages 18–30) participated in a double-blind, randomized crossover design. Participants received either 8.8 g of L-citrulline or a placebo (maltodextrin) for 5 consecutive days. The protocol involved four 30-s maximal sprints. Cerebrovascular function was assessed using transcranial Doppler (TCD) to measure changes in the breath-holding index (ΔBHI) and Pulse Index (ΔPI) before and after exercise.

Results: No significant difference was found for average power between conditions ($F = 1.27$, $P = 0.275$, $\eta_p^2 = 0.07$). A significant improvement in cerebrovascular function was observed in the L-citrulline group, with a positive change in ΔBHI ($F = 5.09$, $P = 0.037$, $\eta_p^2 = 0.22$). No significant effect was found for ΔPI ($F = 0.19$, $P = 0.669$, $\eta_p^2 = 0.01$).

Conclusions: L-citrulline supplementation enhanced cerebrovascular function recovery after SIT, suggesting a protective effect for Taekwondo athletes engaged in high-intensity training by promoting cerebral vascular health without affecting performance or peripheral resistance.

1. Introduction

High-intensity exercise, especially Sprint Interval Training (SIT), is receiving more and more attention. SIT has been shown to significantly improve athletes' aerobic capacity, anaerobic capacity, and overall athletic performance by alternating short bursts of maximal-intensity exercise with brief recovery periods. [1,2] This high-intensity training mode is particularly suitable for confrontational sports, such as taekwondo, in which athletes need not only excellent muscular strength and endurance, but also quick reaction and explosive power. [3,4] However, the high-intensity loading of SIT also puts a greater strain on various body systems, especially the cardiovascular and nervous systems. [5,6] During sprint interval training, athletes often experience dramatic heart rate fluctuations, which may lead to changes in cerebral blood flow, thereby affecting neurological function and recovery. [7] Intense interval training has been demonstrated to trigger short - term fluctuations in cerebral blood flow, and these fluctuations might potentially influence the recovery of cognitive and motor functions. [8] In addition, research findings indicate that the recovery time of cognitive and motor functions is subject to variation, depending on elements like training intensity, individual fitness levels, and the specific characteristics of the task at hand. [9] Furthermore, it has been suggested by relevant studies that cognitive and motor functions are likely to commence their return to the baseline state within a time frame ranging from a few minutes to several hours following training. [5] Therefore, it is important to study the changes in cerebrovascular function after high-intensity training, especially in athletes of combat sports, to optimize training effects and improve recovery.

The brain is one of the most critical organs during exercise, and its demand for oxygen and nutrition increases dramatically during exercise. [10] Especially after high-intensity training, the brain needs to recover quickly to maintain the stability of cognitive and motor functions. Good cerebrovascular health is essential for maintaining recovery from exercise, reducing fatigue and optimizing neurological function. [11,12] It has

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