From Booster to Breaker: Chronic EMS Dampens Hippocampal BDNF and Promotes Neuroinflammation

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Résumé

Physical exercise (EX) is the most effective non-pharmacological strategy for promoting health, preventing diseases, and aiding rehabilitation in stroke, depression, or neurodegenerative disorders (Mandolesi *et al.,* 2018). Its benefits are largely mediated by brain-derived neurotrophic factor (BDNF), a key regulator of neuroplasticity and neuroprotection. The critical role of BDNF is evident, as anti BDNF strategies abolish EX-induced cognitive benefits (Vaynman *et al.,* 2003). Recent findings highlight an endocrine dialogue between the brain and contracting muscles, where myokines secreted into the bloodstream stimulate cerebral BDNF synthesis. However, vulnerable populations (e.g., elderly, stroke, COPD or heart failure patients) may have limited capacity to engage in traditional EX. For individuals unable to perform dynamic exercise, electromyostimulation (EMS) - a transcutaneous peripheral electrical stimulation - emerges as a potential alternative to counteract cognitive decline and support brain health. Our team previously demonstrated that acute EMS (two sessions, one week apart) enhances cognition in humans and neuroplasticity in animals via muscle-brain humoral interactions (Chaney *et al.*, 2024). To amplify these benefits, we applied a chronic EMS protocol (7 days, 30 minute/day; 40Hz frequency, 400μs pulse width, 7s ON/14s OFF, progressive intensity: 6-20mA) on 8-week-old Wistar rats. Unexpectedly, chronic EMS disrupted hippocampal BDNF signaling, reducing neuroplasticity-related proteins. As assessed by several cognitive tests, this protocol also induced anxiety-like and depressive-like behaviors. At the muscular level, EMS induced tissue damage and elevated pro-inflammatory cytokines, with increased serum corticosterone. This heightened inflammatory response extended to the hippocampus, where EMS-treated animals exhibited exacerbated neuroinflammation. These findings reveal a dualistic nature in muscle-brain crosstalk and underscore the need to optimize EMS protocols for individuals unable to engage in conventional physical activity.

References:

*Intervenant

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