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Complicated Role of Exercise in Modulating Memory: A Discussion of the Mechanisms Involved

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Abstract

Evidence has shown the beneficial effects of exercise on learning and memory. However, many studies have reported controversial results, indicating that exercise can impair learning and memory. In this article, we aimed to review basic studies reporting inconsistent complicated effects of exercise on memory in rodents. Also, we discussed the mechanisms involved in the effects of exercise on memory processes. In addition, we tried to find scientific answers to justify the inconsistent results. In this article, the role of brain-derived neurotrophic factor (BDNF) and tropomyosin receptor kinase B (involved in synaptic plasticity and neurogenesis), and vascular endothelial growth factor, nerve growth factor, insulin-like growth factor 1, inflammatory markers, apoptotic factors, and antioxidant system was discussed in the modulation of exercise effects on memory. The role of intensity and duration of exercise, and type of memory task was also investigated. We also mentioned to the interaction of exercise with the function of neurotransmitter systems, which complicates the prediction of exercise effect via altering the level of BDNF. Eventually, we suggested that changes in the function of neurotransmitter systems following different types of exercise (depending on exercise intensity or age of onset) should be investigated in further studies. It seems that exercise-induced changes in the function of neurotransmitter systems may have a stronger role than age, type of memory task, or exercise intensity in modulating memory. Importantly, high levels of interactions between neurotransmitter systems and BDNF play a critical role in the modulation of exercise effects on memory performance.

Keywords: BDNF; Exercise; Memory; Neurotransmitters; Synaptic plasticity.

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