LETTER TO THE EDITOR

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Which Exercise Performance is More Important for Cognition? Incremental or Protective Effects

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Dear Editor,

Studies have shown that exercise has important implications for learning, cognitive performance, and general health. It has been broadly indicated that running improves various neurological diseases, promotes functional improvement, and enhances resistance to brain insult and stroke. Physical activity can also improve mood disorders, such as anxiety-like behavior.[1–3] However, the underlying mechanisms by which it does this are poorly understood. One probable reason is that exercise augments cell proliferation, long-term potentiation,[4] and synaptic plasticity[5] in animal brains. These beneficial effects of exercise on the brain and synaptic plasticity have been mediated to increase messenger RNA (mRNA) and protein levels of brain-derived neurotrophic factor (BDNF) and other neurotrophins.[4,6] Some evidence indicates the significant promotion of cognitive performance, learning and memory, long-term potentiation and signaling molecules by physical activities.[1,6,7] Other studies have revealed a lack of increments of cognition in normal or control animals.[8–14]

In addition, investigators have observed that regular physical activities prevent cognitive impairments in sleep-deprived male[14] and female rats.[8–12] Previously, it has been revealed that voluntary exercise can increase the cell proliferation in the hippocampus under estrogen-deprived conditions in female mice.[15] Another study reported that treadmill exercise prevented spatial navigation and aversive memory impairments in ovariectomized rats.[16] It has been revealed that regular physical activity has neuroprotective effects on cognitive deterioration correlated with elderly,[17] neurodegenerative diseases such as Alzheimer's[18] and ischemia.[2] Although physical exercise seems to improve cognitive and brain insult, these studies did not show any effect of exercise on spatial learning and memory, synaptic plasticity, and BDNF mRNA and protein levels in the hippocampus of normal animals.[8–11,13] These findings confirm the notion that maybe different exercise regimens have positive effects on patients with brain insults or disorders (i.e., sleep loss, brain injury, stroke, neuropsychiatric disorders, and neurodegenerative diseases). Some studies have indicated that both voluntary and forced exercises can augment acquisition and preservation in a variety of hippocampus-dependent tasks, and also can increase the trophic factors and other signaling molecules in the hippocampus in otherwise healthy subjects.[6] Therefore, these controversial outcomes may be due to the differences in the length, type, and intensity of the performed exercise paradigms. In addition, the differences in findings may be due to the differences in the sex and species of experimental animals. Also, due to the effects of the sexual cycle and ovarian hormones on structure and functions of the brain, fewer studies have been done in female animals. Therefore, more behavioral, electrophysiological, and molecular studies are necessary in this field with various exercise regimens in both sexes of humans and animals.

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