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> [Alzheimers Res Ther.](#) 2020 May 20;12(1):62. doi: 10.1186/s13195-020-00631-4.

Physical exercise during exposure to 40-Hz light flicker improves cognitive functions in the 3xTg mouse model of Alzheimer's disease

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Abstract

Background: Exercise promotes brain health and improves cognitive functioning in the elderly, while 40-Hz light flickering through the visual cortex reduces amyloid beta (A β) by stabilizing gamma oscillation. We examined whether exercise was associated with hippocampus-mediated improvement in cognitive functioning in the 3xTg-Alzheimer's disease (3xTg-AD) murine model following exposure to 40-Hz light flickering and exercise.

Methods: We subjected 12-month-old 3xTg-AD mice to exercise and 40-Hz light flickering for 3 months to investigate spatial learning, memory, long-term memory, A β levels, tau levels, mitochondrial functioning including Ca²⁺ retention and H₂O₂ emission, apoptosis, and neurogenesis in the hippocampus.

Results: Treatments had a positive effect; however, the combination of exercise and 40-Hz light flickering exposure was most effective in reducing A β and tau levels. Reducing A β and tau levels by combination of exercise and 40-Hz light flickering improves Ca²⁺ homeostasis and reactive oxygen species such as H₂O₂ in mitochondria and apoptosis including bax, bcl-2, cytochrome c, and cleaved caspase-3 and cell death, cell differentiation, and neurogenesis in the 3xTg-AD model of the hippocampus, resulting in improving cognitive impairment such as spatial learning, memory and long term memory.

Conclusion: Our results show that exercising in a 40-Hz light flickering environment may improve cognitive functioning by reducing A β and tau levels, thereby enhancing mitochondrial function and neuroplasticity.

Keywords: 40-Hz light flicker; Alzheimer's disease; Amyloid beta; Apoptosis; Cognitive function; Exercise; Hippocampus; Mitochondria; Neuroplasticity; Tau.

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Figures

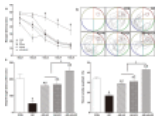


Fig. 1 Effects of exercise under exposure...

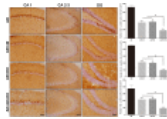


Fig. 2 Effects of exercise under exposure...

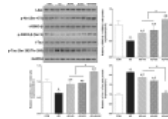


Fig. 3 Effects of exercise under exposure...

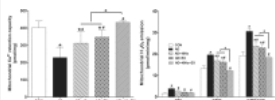


Fig. 4 Effects of exercise under exposure...

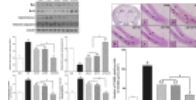


Fig. 5 Effects of exercise under exposure...

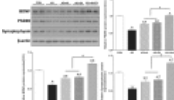


Fig. 6 Effects of exercise under exposure...

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