

ORAL PRESENTATIONS

Aerobic exercise training reduces central arterial stiffness and improves cerebral blood flow in older adults

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Background

Evidence of the benefits of aerobic exercise training (AET) on brain structure, function, and perfusion in older adults is inconclusive.

Methods

We conducted two randomized controlled trials (RCT) in sedentary older adults with or without mild cognitive impairment (MCI) to address this question.¹⁻³ The trial's intervention arm was a progressive moderate-to-vigorous intensity AET, and the active control arm was stretching-and-toning (SAT). Outcome measures included neurocognitive function focused on memory and executive function, global and regional brain volume and cortical thickness measured with structural magnetic resonance imaging (MRI), cerebral blood flow (CBF) and CBF pulsatility measured in the large cerebral arteries (the internal carotid artery, the vertebral artery, and the middle cerebral artery) with 2D duplex ultrasonography and transcranial

Doppler, central arterial stiffness measured with arterial applanation tonometry, and cardiorespiratory fitness measured with treadmill peak oxygen consumption (VO_{2peak}). The duration of both trials was one year.

Results

In both studies, we observed that AET increased VO_{2peak} significantly by ~10% while it did not change with SAT. Cognitive composite scores and domain-specific scores improved in both the AET and SAT groups, although no group differences were observed (likely reflected by cognitive test practice effects). Total brain and hippocampal volume and mean cortical thickness decreased in both groups over one year. Conversely, AET increased CBF, and decreased central arterial stiffness and CBF pulsatility. Increases in VO_{2peak} with AET were correlated with increases in CBF and decreases in cerebrovascular resistance (CVR). Further, the improved memory score in the AET group was associated with decreased CVR and central arterial stiffness measured with carotid β -stiffness index.

Conclusions

Taken together, these findings demonstrated that one-year moderate-to-vigorous intensity AET increased CBF and decreased central arterial stiffness in older adults with or without MCI. We speculate that improvement in cerebrovascular function with AET may precede its potential effects on brain structure and neurocognitive function in older adults. (The research findings presented herein were supported by the National Institutes of Health R01AG033106 and R01HL102457)

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References

1. Tarumi T, Patel NR, Tomoto T, et al. Aerobic exercise training and neurocognitive function in cognitively normal older adults: A one-year randomized controlled trial. *J Intern Med.* 2022. Available at: <https://onlinelibrary.wiley.com/doi/10.1111/joim.13534>.
2. Tarumi T, Rossetti H, Thomas BP, et al. Exercise Training in Amnesic Mild Cognitive Impairment: A One-Year Randomized Controlled Trial. *J Alzheimers Dis.* 2019;71:421-33.
3. Tomoto T, Liu J, Tseng BY, et al. One-Year Aerobic Exercise Reduced Carotid Arterial Stiffness and Increased Cerebral Blood Flow in Amnesic Mild Cognitive Impairment. *J Alzheimers Dis.* 2021;80:841-53.