

Mental, physical exercises produce distinct brain benefits

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Credit: Human Brain Project

Cognitive brain training improves executive function whereas aerobic activity improves memory, according to new Center for BrainHealth research at The University of Texas at Dallas.

The study, published in *Frontiers in Human Neuroscience*, found that

healthy adults who participated in [cognitive training](#) demonstrated positive changes in executive [brain](#) function as well as a 7.9 percent increase in global brain flow compared to study counterparts who participated in an aerobic exercise program. The aerobic exercise group showed increases in immediate and delayed memory performance that were not seen in the cognitive [training](#) group. The randomized trial is the first to compare [cerebral blood flow](#) and cerebrovascular reactivity data obtained via MRI.

"Many adults without dementia experience slow, continuous and significant age-related changes in the brain, specifically in the areas of memory and executive function, such as planning and problem-solving," said Dr. Sandra Bond Chapman, study lead author, founder and chief director of the Center for BrainHealth, and Dee Wyly Distinguished University Professor. "We can lose 1 to 2 percent in global [brain blood flow](#) every decade, starting in our 20s. To see almost an 8 percent increase in brain blood flow in the cognitive training group may be seen as regaining decades of brain health since blood flow is linked to neural health."

For the study, 36 sedentary adults ages 56 to 75 years were randomized into either a cognitive training or a physical training group. Each group took part in training three hours per week over 12 weeks.

Neurocognitive, physiological and MRI data were taken before, during and after training. The cognitive group received [Strategic Memory Advanced Reasoning Training \(SMART\)](#), a manualized brain training developed at the Center for BrainHealth. The strategy-based training focuses on three executive functions: strategic attention (prioritizing brain resources); integrative reasoning (synthesizing information at a deeper level); and innovation (encouraging fluid thinking, diverse perspective-taking, and problem-solving). The physical training group completed three 60-minute sessions per week that included five minutes of warmup and cool-down with 50 minutes of either walking on a

treadmill or cycling on a stationary bike while maintaining 50 to 75 percent of maximum heart rate.

"Most people tell me that they want a better memory and notice memory changes as they get older," said Dr. Mark D'Esposito, study co-author and professor of neuroscience and psychology, and director of the Henry H. Wheeler Jr. Brain Imaging Center at the Helen Wills Neuroscience Institute at the University of California, Berkeley. "While memory is important, executive functions such as decision-making and the ability to synthesize information are equally, if not more so, but we often take them for granted. The takeaway: Aerobic activity and reasoning training are both valuable tools that give your brain a boost in different ways."

The research team attributes the global cerebral blood flow gains to concerted mental effort during the reasoning training.

"We believe the reasoning training triggered neural plasticity by engaging the brain networks involved in staying focused on a goal, such as writing a brief business proposal, while continuously adapting to new information, such as feedback from a collaborator," Chapman said.

The aerobic exercise group did not show significant global blood flow gains, but the exercisers with improved memory performance showed higher cerebral [blood flow](#) in the bilateral hippocampi, an area underlying memory function and particularly vulnerable to aging and dementia.

"Our research has shown that all brain training protocols do not return equal benefits. When targeting the brain functions that give us a mental edge in daily life, strategy-based programs prevail," Chapman said. "This study highlights the potential to accelerate brain health in healthy adults by adopting lifestyle habits that exercise the mind and body. Future trials are needed to further develop and test neuroprotective programs that

unite physical and cognitive training protocols for the highest health returns starting early and continuing into late life."

Dr. Laura DeFina, chief executive officer of the Cooper Institute in Dallas and collaborator on the study, said the findings are encouraging.

"We know that physical activity can lead to improved fitness levels. In our Cooper Center Longitudinal Study population, higher fitness has been shown to result in less all-cause dementia with aging," DeFina said. "The current study highlights the benefit of training both the body and the brain, as both produce observable benefits. The initial findings are encouraging and underscore the need for a multifaceted approach when it comes to [brain health](#)."

More information: Sandra B. Chapman et al. Distinct Brain and Behavioral Benefits from Cognitive vs. Physical Training: A Randomized Trial in Aging Adults, *Frontiers in Human Neuroscience* (2016). [DOI: 10.3389/fnhum.2016.00338](https://doi.org/10.3389/fnhum.2016.00338)

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