Exercise can improve memory in 60-year-olds

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A new study, in which researchers from Karolinska Institutet participated, shows that physical activity can improve memory performance in older people through increasing volume and blood flow in an area of the brain called hippocampus. It is the first time these connections are being studied in people over 60 years of age. The results are published in the journal *Molecular Psychiatry*.

The hippocampus is a brain structure located deep in the temporal lobe and is important for memory and learning. Previous research shows that aerobic exercise can, among other things, increase blood flow in hippocampus among younger people. The present study, which was led by a research team from Magdeburg in Germany, is the first that also links these changes to improved memory functioning.

During a three month period, the researchers studied a group of individuals, aged 60 and older, who exercised during a personalised thirty-minute session on a treadmill three times a week. In the comparison group, participants performed stretching and muscle relaxation exercises. In both groups, measurements were taken of episodic memory (memory for personal experiences), volume and blood flow in hippocampus, and participants' physical fitness as measured by maximal oxygen uptake.

"We could then see that participants' fitness level had improved, which was related to changes in memory, hippocampal volume, and blood flow in hippocampus," says Lars Bäckman, Professor of Cognitive Neuroscience at Karolinska Institutet and affiliated to the Aging

Research Center in Stockholm.

Increased blood flow

The researchers tested various models to explore the relationships among the findings. It was revealed that the increase in hippocampal volume in those participants who underwent the exercise programme can largely be explained by increased blood flow. According to the researchers, it is probably due to an increase in vascular plasticity, i.e., the ability to expand and form new blood vessels, rather than to the formation of more neurons in hippocampus after physical activity.

"Thus, one point is that it may be the increase in blood volume and oxygenation that underlies improved memory, rather than an increase in the size of hippocampus itself," says Martin Lövdén, Professor in the Cognitive Neuroscience of Aging at Karolinska Institutet and also working at the Aging Research Center.

Younger elderly persons

The findings in this study apply to persons between 60 and 70 years, thus younger elderly persons. Among participants over 70, the same effects of the exercise were not observed, which suggests there may be an age limit for this type of plasticity in the brain. The team will now continue with its work and study if it is possible to combine physical exercise with cognitive training in order to achieve even higher plasticity among older persons.

The study is a collaboration between researchers at Otto-von-Guericke University Magdeburg; German Center for Neurodegenerative Diseases (DZNE); Center for Lifespan Psychology, Max Planck Institute for Human Development; Aging Research Center, Karolinska Institutet; and

Leibniz Institute for Neurobiology. The research has been funded by, among others, the Swedish Research Council, the Swedish Research Council for Health, Working Life and Welfare (FORTE), Swedish Brain Power, an Alexander von Humboldt Research Award, and a donation from the af Jochnick Foundation. Aging Research Center is a collaboration between Karolinska Institutet and Stockholm University.

More information: "Vascular hippocampal plasticity after aerobic exercise in older adults." Anne Maass, Sandra Düzel, Monique Goerke, Andreas Becke, Uwe Sobieray, Katja Neumann, Martin Lövden, Ulman Lindenberger, Lars Bäckman, Rüdiger Braun-Dullaeus, Dörte Ahrens, Hans-Jochen Heinze, Notger G. Müller, Emrah Düzel. *Molecular Psychiatry*, online 14 October 2014. DOI: 10.1038/mp.2014.114

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