



Testing causality in the association Between exercise and Neurocognitive gains: A translational research study.



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ABSTRACT

In recent years, the connection between exercise, brain health, and cognitive function has received increasing research attention. Thus far, two lines of research have developed in parallel. First, several cross-sectional studies have reported an association between aerobic exercise and brain structure, specifically using measures of global brain volume. Additionally, longitudinal exercise interventions have been shown to increase grey matter volume in several brain areas. The other, more robust line of evidence has demonstrated a positive association between exercise and enhanced cognition. Although it may appear evident that the increases in grey matter volume could be directly causing the reported cognitive benefits, to date, this link has not been scientifically established. It has not yet been shown that the regions in the brain where grey matter volume increases are causally contributing to the observed improvements in cognitive function.

METHODS AND MATERIALS

-Participants:

This study will be a prospective controlled study to be conducted in a single phase.

A total of 40 participants meeting inclusion criteria will be included in the study.

-Methods:

MRI:

High-resolution anatomical images (voxel size, 1 mm³) of the whole brain will be acquired on a 3T Siemens whole-body scanner equipped with a standard head coil for radiofrequency (RF) transmission and signal reception. All participants will be scanned twice, at baseline and at the end of the study, using the same parameters to permit the assessment of longitudinal changes. Scanning will take place at King Khalid Medical Center. Images will be used for voxel-based morphometry (VBM) analysis. These MRI-based measures of brain structure have been shown to be sensitive to changes in previous longitudinal interventions.

Cognitive tasks:

All participants will be assessed using a battery of computer-based cognitive tasks that will focus on executive function, working memory, planning [intra/extradimensional set shift (IED) and spatial span (SSP) tasks], and inhibitory control stop-signal task (SST). These specific tasks have been validated for within-subject longitudinal assessments. They measure aspects of cognition that have been shown to be sensitive to exercise, and the underlying brain networks involved in these tasks include regions where increases in grey matter volume have been reported. These tests will be administered in a well-controlled and standardized manner using the CANTAB computerized neuropsychological assessment battery.

RESULT

We examined training-related changes in functional connectivity (FC) default mode network DMN and central executive network CEN within and between networks.

OBJECTIVES

To test whether the regional increases in grey matter volume associated with aerobic exercise and/or progressive resistance training are being used during performance in cognitive tasks.

To investigate whether progressive resistance training increases grey matter volume and improves cognitive function to the same extent that aerobic exercise does.

CONCLUSION

This investigation addresses a fundamental question that is of high relevance in the field due to its vast range of implications for athletic training, cognitive development, neurological disorders, age-related cognitive decline, and obesity.

REFERENCE

Almeida OP, Norman P, Hankey G, Jamrozik K, Flicker L. Successful mental health aging: results from a longitudinal study of older Australian men. *Am. J. Geriatr. Psychiatry* 14, 27-35.

American College of Sports Medicine Position Stand. Exercise and physical activity for older adults. *Med Sci Sports Exerc.* Jun 1998;30(6):992-1008.

American College of Sports Medicine Position Stand. The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults.

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