Physical fitness and subcortical brain functions

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ABSTRACT

Composite volumes of the thalamus and pallidum were significantly correlated with walking performance in the overall sample; however these brain structures did not significantly account for group differences in walking performance after accounting for MVPA and/or cardiorespiratory fitness. This suggests that other factors like lifestyle physical activity and exercise may have a greater impact on walking performance than volumetric measures of certain brain structures.

Keywords: anesthesia, fitness, brain, spine.

TEXT

A few studies have recently reported that higher cardiorespiratory fitness is associated with higher volumes of subcortical brain structures in children. It is unknown how different fitness measures relate to shapes of subcortical brain nuclei.[1] Ortega et al.[1] examined the association of the main health-related physical fitness components with shapes of subcortical brain structures in a sample of forty-four Spanish children, showing that all physical fitness components studied were significantly related to the shapes of subcortical brain nuclei. A comprehensive analysis of associations between physical fitness and brain structure in young adulthood is lacking, and further, it is unclear the degree to which associations between physical fitness and brain health can be attributed to a common genetic pathway or to environmental factors that jointly influences physical fitness and brain health.[2-8] Analysis of links between physical fitness and body composition with neuroimaging markers of brain health specifically in early adulthood has been somewhat overlooked, despite acknowledgment that a lifespan perspective on brain health is warranted, in which risk factors for deterioration in brain health are potentially present across the lifespan.[9-11] Evidence for such associations could provide the grounds for future research that explores whether intervening in young adulthood to promote fitness and body composition might alter long-term trajectories of brain health into older age.[9,12,13] The parallel decline of mobility and cognition with ageing is explained in part by shared brain structural changes that are related to fitness. However, the temporal sequence between fitness, brain structural changes and mobility loss has not been fully evaluated.[9,14] Collectively, the temporal sequence between brain volumetric changes, gait deterioration or fitness, as well as the specific cortical and subcortical structures in this causal pathway, have not been examined.[14-16] Understanding the directionality and main areas of interest provides new insight into the complex mechanisms that explain the parallel decline of cog-

nitive and mobility function in specific older individuals. It is interesting to note that the temporal sequence between fitness and brain volumes is in the opposite direction of the sequence between brain and mobility. Tian et al.[14] observed a higher prior fitness unidirectionally predicts future brain volumes localized in the medial temporal lobe, including the significant association in the parahippocampal gyrus and trends in the hippocampus and entorhinal cortex. One previous study shows higher fitness is specifically associated with the microstructural integrity localized in the medial temporal lobe, and not in other areas, in another aging cohort.[14] Volumes of selected cortical gray matter and white matter, localized in frontal, medial, and temporal lobes, as well as corpus callosum, unidirectionally predict future mobility. Mobility performance may also predict future precuneus and hippocampal volumes, both important for allocentric processing of space.[14,16-18] Prior higher fitness unidirectionally predicts future medial temporal lobe, particularly in the parahippocampal gyrus. These findings are scientifically important and provide new insights into the complex mechanisms that explain the parallel decline of cognitive and mobility function in specific older individuals.[14] Therefore, continuous observation with daily clinical practice by physicians and surgeons, continuous scientific research and further discoveries can improve the knowledge of this topic.[19-23] Composite volumes of the thalamus and pallidum were significantly correlated with walking performance in the overall sample, however these brain structures did not significantly account for group differences in walking performance after accounting for MVPA and/or cardiorespiratory fitness.[19,24-26] This suggests that other factors like lifestyle physical activity and exercise may have a greater impact on walking performance than volumetric measures of certain brain structures. In addition to factors like physical activity and exercise, other neuroimaging measures warrant further investigation.[23,26-28]

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