

太极拳对大学生执行功能及脑白质结构网络的影响

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摘要: 执行功能是对其他认知过程进行控制和调节的高级认知过程,是个体认知和社会功能的核心,对个体的身心脑健康发展至关重要,包含抑制、刷新、转换三个子功能。研究发现,,大学生处于“成年初显期”阶段,是个体成长与发展的重要时期,也是个体重新分化的关键时期,经历认知、情感和行为方面的多重变化,心理适应面临很大挑战,探索提升其执行功能的有效途径及机制,对全民健康提升具有重要意义。太极拳是身心合一的中华传统健身养生运动,已有研究发现太极拳可以改善记忆等认知功能,然而以往的太极拳套路存在门槛过高,动作结构复杂等问题,不便于推广普及,为了使更多人受益,国家体育总局委托研究团队创编了更简单易学的太极(八法五步)套路。那么,太极(八法五步)是否能提升执行功能,且效果是否优于其他运动,其机制如何,均值得深入探讨。

本团队以大学生为对象,综合运用了体育测量、心理测量、多模态成像技术(sMRI、rs-fMRI、task-fMRI、DTI、EEG、ERP),从行为学和脑科学层面,分析、比较了8周太极(八法五步)与健步走运动干预前后执行功能、脑结构、脑功能及相关心理学指标(如情绪、睡眠等)的变化及差异,旨在揭示太极(八法五步)对大学生执行功能各子功能的影响及机制,为采用太极(八法五步)提升大学生身心脑提供理论和实践基础。

本研究采用纵向运动干预研究设计,探索太极(八法五步)在改善个体执行功能,优化、重塑脑白质结构上的独特优势,发现:(1)太极(八法五步)能够提升大学生的执行功能各子功能运行效率,且效果优于健步走。(2)太极(八法五步)、健步走对脑白质结构的可塑性影响不同,太极(八法五步)对脑白质结构的优化重塑具有优势,体现在白质纤维束完整性的增强、脑网络功能整合水平的提升。(3)太极(八法五步)提升大学生执行功能的脑机制可能是促进了脑白质纤维束完整性增强。

关键词: 太极(八法五步); 执行功能; 脑白质; 弥散张量磁共振成像, 大学生

The Effect of Tai Chi Exercise on Executive Function and White Matter of College Students

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Executive function (EF), as a higher cognitive process controlling and regulating other cognitive processes, is the core of individual cognitive and social functions. It consists of three foundational components: inhibition, updating, and shifting. Studies found that EF could be changed throughout the life cycle. Therefore, exploring effective ways to improve EF has become a focus of researchers in multiple disciplines. Tai Chi Chuan (TCC, also known as Taiji, Taijiquan, and Tai Ji Quan) is a popular mind-body exercise and a form of traditional Chinese exercise. The benefits of TCC have been widely reported for cognitive function, emotional regulation, motor function, and fall prevention. Bafa Wubu of Tai Chi (BWTC) is based on the existing 24-form TCC, refined and organized systematically from the Bafa Wubu techniques, which are the essence of various types of TCC. It is a new set of TCC that is easy to learn and practice and is now being popularized in China by the General Administration of Sport of China (GASC). Therefore, whether BWTC intervention can improve the EF of college students, and whether the effect is better than other general exercise, and how its mechanism is worth to explore.

Our team used physical, psychological and multimodal imaging measurement (such as sMRI, rs-fMRI, task-fMRI, DTI, EEG, ERP) to explore the 8-week BWTC intervention on the EF, brain structure and functional plasticity, and other psychological indicators. Revealing the mechanism of BWTC to enhancement on EF in college students, which can provide theoretical and practical basis for the use of more effective exercise to promote the development of college students' EF.

This study based on graph theory, revealing the brain mechanism of BWTC to enhancement on EF in college students, found that: (1) BWTC can improve the processing efficiency of EF, and the effect is better than brisk walking. (2) BWTC and AE have different effects on the plasticity of white matter structure, and BWTC has advantages in the optimization and remodeling of white matter structure, which is embodied in the promotion of white matter integrity and improvement the efficiency of brain global information transmission. (3) The brain mechanism of BWTC to promote the EF may be the increasing of white matter integrity.

Key words: Bafa Wubu of Tai Chi, Executive function, DTI, College students