8周太极（八法五步）对大学生抑制功能的影响及脑机制研究

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摘要：目的：抑制功能是指抑制占主导地位的、自动化的或优势反应的能力，包括使用注意力控制来抵抗与任务无关的刺激或反应的干扰。其作为执行功能的核心，是学习、推理、问题解决等智力活动的重要成分，对个体的身心脑健康发展至关重要。以往研究指出抑制功能具有可塑性，探索能够提升抑制功能的有效手段已经成为多学科领域研究者关注的前沿热点。大学生是国家的建设者和接班人，良好的抑制功能对大学生的社会成就、生活质量等十分重要。心理学领域近期的研究表明，认知训练、正念训练等可以有效的提升大学生的抑制功能。运动心理学领域的研究发现，运动能够改善抑制功能，但研究对象多为儿童和老年人，但针对大学生抑制功能提升的长期运动干预相对缺乏。而大学生处于成年早期，其抑制功能与大脑仍有发展空间。太极拳作为东方正念运动的代表，对个体具有积极的作用，此前已有研究发现太极拳可以改善记忆等认知功能和脑功能，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。本团队前期研究结果发现，短时太极（八法五步）能够改善大学生的抑制功能，并且体现在 N2 振幅的增大。因此，长期太极（八法五步）干预是否能提升大学生抑制功能，且效果是否优于其他运动，其脑机制如何，均值得深入探讨。**方法：**本研究以 36 名大学生为研究对象，综合运用体育测量、心理测量、静息态功能态磁共振成像技术，采用 3（组别：太极组、健步走组、对照组）×2（时间：干预前、干预后）的两因素混合实验设计，对太极组（12 名）进行 8 周太极（八法五步）运动干预，健步走（12 名）进行 8 周健步走运动干预，对照组（12 名）进行正常的学习生活。从行为学和脑科学层面，分析、比较 8 周太极（八法五步）与健步走运动干预前后抑制功能反应时、比率低频振幅（fALFF）的变化及差异，揭示太极（八法五步）对大学生抑制功能的影响及其脑机制，为采用太极（八法五步）提升大学生抑制功能提供理论和实践基础。为太极（八法五步）在大学生群体的推广普及提供科学依据，更好地服务“太极拳健康工程”和“健康中国”战略。**结果：**（1）在抑制功能反应时上，8 周太极（八法五步）能够提升大学生抑制功能；健步走对大学生抑制功能无显著影响；太极（八法五步）对抑制功能的改善效果优于健步走。（2）在比率低频振幅

上，8 周太极（八法五步）增强了 2 个脑区的比率低频振幅，即右侧梭状回、右侧内侧额上回，减弱了 2 个脑区的比率低频振幅，即左侧背外侧额上回、右侧中央旁小叶；8 周健步走运动增强了 1 个脑区的比率低频振幅，即右侧梭状回；与健步走相比，太极（八法五步）右侧内侧额上回的比率低频振幅显著增强。（3）在抑制功能变化与脑功能变化的关系分析上，抑制功能反应时变化与左侧内侧额上回的比率低频振幅变化存在非常显著的负相关关系，左侧内侧额上回比率低频振幅的增强能够非常显著预测抑制功能反应时的降低，预测力为 75. 9%。**结论：**（1）8 周太极（八法五步）能够提升大学生的抑制功能，且效果优于健步走。（2）8 周太极（八法五步）对自发神经活动的优化具有优势，具体体现在右侧内侧额上回比率低频振幅的增强，左侧背外侧额上回、右侧中央旁小叶比率低频振幅的减弱。（3）太极（八法五步）提升大学生抑制功能的脑机制可能是促进了脑自发神经活动的优化，具体体现在右侧内侧额上回低频振幅的增强。

关键词：太极拳；抑制功能；多模态磁共振；大学生

The brain mechanisms of Bafa Wubu of Tai Chi exercise enhancement on inhibition of college students

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Abstract: Objective: Inhibition refers to the ability to inhibit dominant, automated, or dominant responses, including the use of attentional control to resist interference from stimuli or responses unrelated to the task. As core of executive function, it was an important component of individual cognitive and social functions. inhibition is an important component of learning, reasoning, problem solving and other intellectual activities and crucial to the healthy development of an individual's mind, body and brain. Studies found that inhibition could be changed throughout the life cycle. Therefore, exploring effective ways to improve inhibition has become a focus of researchers in multiple disciplines. Contemporary college students are not only important national talents that are cultivated, but also senior personnel, builders and successors of the country's future. inhibition is very important for college students' social achievement and quality of life. Recent studies in the field of psychology have shown that cognitive training mindfulness training can effectively improve the inhibition of college students. Studies in the field of exercise psychology have found that exercise can improve inhibition, but few of them involve college students. Tai chi Chuan (TCC), which belongs to mindful exercise, is a health and fitness exercise with distinct Chinese traditional cultural characteristics. Recently, to accelerate the implementation of the Healthy China, the General Administration of Sport of China (GASC) has launched the new routine-Bafa Wubu of Tai Chi (BWTC) in order to better promote and popularize TCC and solve

the practical problems such as high threshold and complex structure of the previous TCC routine. Our previous studies found that acute BWTC exercise could improves college students' inhibion, Therefore, to explore whether long term BWTC intervention can improve the inhibition of college students, and whether the effect is better than other sports, and how its brain mechanism can provide theoretical and practical basis for the use of better exercise means to promote the development of college students' inhibition, and provide scientific basis for the popularization of BWTC. This study used psychological measurement and functional multimodal magnetic resonance imaging (fMRI) to explore the long-term BWTC intervention on the inhibiton of college students and on brain functional plasticity. Revealing the brain mechanism of BWTC to enhancement on inhibition in college students. This study consists of two parts. **Method:** Thirty-six college students were grouped into TCC (Bafa Wubu of Tai Chi), general aerobic exercise (brisk walking) and control groups. Analyzed and compared the changes of EF before and after eight weeks exercise intervention. We can conclude that BWTC can improve the processing efficiency of inhibtion and the effect is better than brisk walking. Individuals were assessed with a rs-fMRI scan before and after an eight weeks training period. **Results:** We can conclude that compared with general aerobic exercise, eight weeks of BWTC exercise has a stronger effect on brain plasticity, which is embodied in the increase of the fALFF of right fusiform gyrus and right medial superior frontal gyrus, and decreased fALFF of left dorsolateral superior frontal gyrus and right central parietal lobule. Compared with general aerobic exercise, BWTC significantly increased the fALFF of right medial superior frontal gyrus. There was a significant negative correlation between the response time (RT) change of inhibiton and the change of fALFF in the left medial superior frontal gyrus. The enhancement of fALFF in the left medial superior frontal gyrus could significantly predict the decrease in RT of inhibiton function. **Conclusion:** the results showed that: (1) Long-term BWTC can improve the inhibiton of college students, and the effect is better than brisk walking. (2) Long-term BWTC can effectively promote the brain function. (3) BWTC has advantages in improving the inhibition of college students, And the brain mechanism may promote the optimization of spontaneous neural activity in the brain.

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