Enhanced neural activity in frontal and cerebellar circuits after cognitive training in children with attention-deficit/hyperactivity disorder.


Source

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Abstract

The brain is a plastic entity that can undergo dynamic changes throughout the lifespan as a result of training. Attention-deficit/hyperactivity disorder (ADHD) is commonly treated with psychostimulant medication, and the prevalence of ADHD medication prescription is a topic of heated scientific debate. In addition, cognitive training is frequently provided to patients with ADHD. Although psychostimulant effects have been thoroughly investigated, no previous studies have assessed the neural effects of cognitive training in ADHD. We applied fMRI-paradigms of response inhibition and selective attention to chart the effects of a 10-day cognitive training program in 19 unmedicated ADHD children receiving either cognitive or control training. The two resulting longitudinal datasets were analyzed using whole-brain random-effects general linear models. Although we observed no increases of activity in the control group, both fMRI-datasets revealed enhanced activity after cognitive training in neural structures closely related to ADHD pathophysiology. On the inhibition paradigm, our results indicated increases in orbitofrontal, superior frontal, middle temporal, and inferior frontal cortex. The attentional task was characterized by increased activity in the cerebellum, which correlated with improvement on in-scanner measures of attention. Our findings provide preliminary evidence that cognitive training enhances activity in neural structures typically affected by the disorder. Similar results have been obtained following methylphenidate administration, suggesting that training of cognitive functions may mimic the effects of psychostimulant medication on the brain. These findings postulate a neural account for the potency of cognitive training in ADHD, and hold clinical implications, supporting the inclusion of training programs in standard ADHD-treatment.