A single dose of methylphenidate does not affect the contextual visual perception of children with ADHD, shows study

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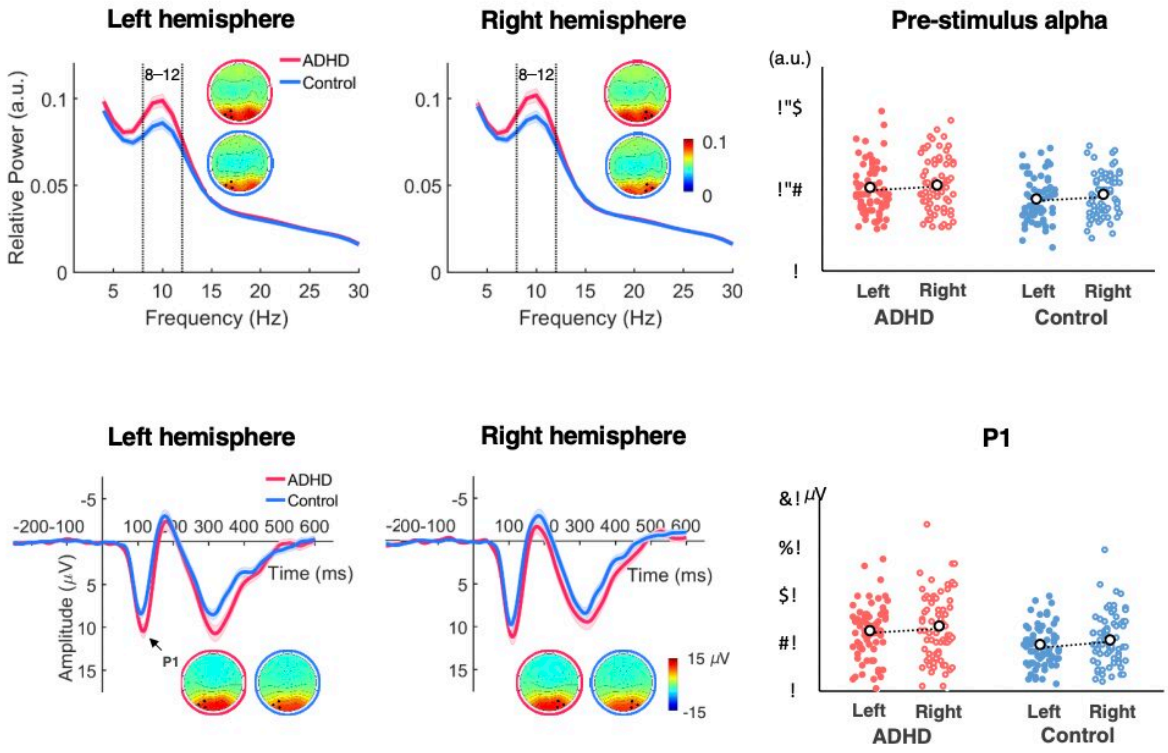

Credit: Luo et al

Attention-deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder estimated to affect approximately 2.5% of

children and adults worldwide. The disorder is characterized by the inability to pay attention to stimuli for prolonged periods of time, along with hyperactive and impulsive behavior.

While there is now extensive neuroscience literature focusing on ADHD, the biological mechanisms underpinning its genesis and development are still poorly understood. Past findings suggest that the visual perception of patients with ADHD is overactivated, particularly while they are completing cognitive tasks.

A few studies also found that long-term stimulants can improve visual acuity in children with ADHD, which could in turn help them to selectively focus on particular visual stimuli for a longer period of time. This evidence remains scarce and the therapeutic value of these stimulants yet to be confidently ascertained.

Researchers at Peking University Sixth Hospital & Peking University Institute of Mental Health, the NHC Key Laboratory of Mental Health & National Clinical Research Center for Mental Disorders and Beijing Normal University have recently carried out a study looking at how the contextual visual perception of children diagnosed with ADHD differs from that of children without ADHD.

Their paper, published in the *European Archives of Psychiatry and Clinical Neuroscience*, also assesses the effects of a single dose of methylphenidate, a central nervous system (CNS) stimulant also sold under the brand names Ritalin and Concerta, on the brains of children with ADHD diagnoses.

"The pathogenesis of overactivated visual perception in ADHD remains unclear, which is interpreted as a cognitive compensation," Xiangsheng Luo, Chen Dang and their colleagues wrote in their paper. "Existing studies have proposed that perceptual abnormalities in

neurodevelopmental disorders are associated with dysfunction of the contextual knowledge system, which influences the development and formation of perception. We hypothesized that alterations in contextual states may also be responsible for inducing perceptual abnormalities in ADHD."

Luo, Dang and their colleagues hypothesized that children with ADHD would visually perceive their surrounding context or environment differently than control children (i.e., children without an ADHD diagnosis). To test this hypothesis, they conducted an experiment involving 135 children from China of similar ages, 70 of whom were diagnosed with ADHD.

The children were asked to complete questionnaires, take part in a semi-structured interview and complete a visual search task. This task consisted in reporting the position of a target (i.e., a circle) while ignoring 11 distracting stimuli (i.e., diamonds) surrounding it.

As the children completed this task, the researchers used an electroencephalogram (EEG) to measure the electrical activity in their brain. This also allowed them to detect event-related potentials (ERPs), small voltages generated in response to specific stimuli.

Luo, Dang and their colleagues also conducted a second experiment involving 19 children with ADHD. These children were asked to complete the same visual task used in the first experiment, but before and after they had been administered a single dose of methylphenidate.

"The present study evaluated the characteristics of pre-stimulus alpha and its response to a single dose of methylphenidate (MPH)," Luo, Dang and their colleagues explained in their paper. "Pre-stimulus alpha oscillations and P1 activity were significantly greater in children with ADHD than in the controls. Overactivated pre-stimulus alpha positively

predicted P1. Both pre-stimulus alpha and P1 overactivation have beneficial effects on cognitive performance in children with ADHD. No intervening effect of a single dose of MPH on the compensatory activation of pre-stimulus alpha and P1 were observed."

Overall, the recent work by Luo, Dang and their colleagues suggests that when children with ADHD are tackling cognitive tasks, their contextual visual perception is over-activated, prompting them to be more easily distracted by other environmental stimuli that are unrelated to the task. In addition, the team found that while a single dose of methylphenidate improved the children's ability to visually search for target objects and increased the speed and consistency of their responses during the visual task, it did not affect these "abnormalities" in contextual visual perception, perhaps highlighting the need to develop additional interventions targeting them.

"Our findings extended the perceptual activation to the contextual knowledge system, suggesting that compensatory perception in children with ADHD is more likely to be a top-down regulated cognitive operational process," Luo, Dang and their colleagues wrote in their paper. "Furthermore, perceptual abnormalities in children with ADHD are insensitive to a single dose of methylphenidate, which may be closely related to neurodevelopmental alterations, necessitating the development of related interventions."

More information: Xiangsheng Luo et al, Overactivated contextual visual perception and response to a single dose of methylphenidate in children with ADHD, *European Archives of Psychiatry and Clinical Neuroscience* (2023). DOI: 10.1007/s00406-023-01559-0