 Theta-band oscillatory activity differs between gamblers and nongamblers comorbid with attention-deficit hyperactivity disorder in a probabilistic reward-learning task.

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doi: 10.1016/j.bbr.2016.06.031. [Epub ahead of print]

Abstract

Problem gambling is thought to be comorbid with attention-deficit hyperactivity disorder (ADHD). We tested whether gamblers and ADHD patients exhibit similar reward-related brain activity in response to feedback in a gambling task. A series of brain electrical responses can be observed in the electroencephalogram (EEG) and the stimulus-locked event-related potentials (ERP), when participants in a gambling task are given feedback regardless of winning or losing the previous bet. Here, we used a simplified computerized version of the Iowa Gambling Task (IGT) to assess differences in reinforcement-driven choice adaptation between unmedicated ADHD patients with or without problem gambling traits and contrasted with a sex- and age-matched control group. EEG was recorded from the participants while they were engaged in the task which contained two choice options with different net payouts and win/loss probabilities. Learning trend which shows the ability to acquire and use knowledge of the reward outcomes to obtain a positive financial outcome was not observed in ADHD gamblers versus nongamblers. Induced theta-band (4-8Hz) power over frontal cortex was significantly higher in gamblers versus nongamblers in all different high-risk/low-risk win/lose conditions. Whereas induced low alpha (9-11Hz) power at frontal electrodes could only differentiate high-risk lose between gamblers and nongamblers but not the other three conditions between the two groups. The results indicate that ADHD nongamblers do not share with problem gamblers underlying deficits in reward learning. These pilot data highlight the need for studies of ADHD in gambling to elucidate how motivational states are represented during feedback processing.