

Feedback Timing Modulates Probabilistic Learning in Adults with ADHD

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Abstract

Attention deficit hyperactivity disorder (ADHD) has been associated primarily with executive function deficits. Emerging findings suggest, however, that procedural learning may be compromised as well. To this effect, we recently showed that feedback-based procedural learning is selectively impaired in ADHD, results that coincide with dopaminergic alterations associated with ADHD. Key questions, however, remain unresolved, among which are the learning conditions that may improve procedural learning in ADHD. Here we examined feedback-based probabilistic learning during conditions that engage procedural and declarative learning systems to different degrees, depending on feedback timing. ADHD and control participants carried out a probabilistic learning task in which they were required to learn to associate between cues and outcomes, where outcomes were presented either immediately or with a short/long delays. Whereas performance in probabilistic learning in ADHD participants was comparable to controls in delayed feedback conditions, during both learning and test phases, their performance diminished when feedback was immediate. Furthermore, ADHD symptom severity was negatively correlated with the ability to learn from immediate feedback. These results suggest that feedback-based probabilistic learning can be improved in ADHD, provided appropriate conditions. By shifting the load from midbrain/striatal systems to declarative memory mechanisms, behavioral performance in ADHD populations can be remediated.