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ABSTRACT

Characterizing Goal-Directed Behavior in Children with Attention-Deficit/Hyperactivity Disorder

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Attention-deficit hyperactivity disorder (ADHD) is characterized by symptoms of inattention, impulsivity and hyperactivity. Children with ADHD show impaired motivational behavior. For example, they tend to select small, immediate over large, delayed rewards. They might be unable to predict the consequences of their actions showing a deficit in action-control strategies. Goals and habits are the two behavioral mechanisms that control actions. Balancing these two behaviors leads to normal action-control. In previous studies, we found that rat models of ADHD demonstrated over-reliance on habits and poor goal-directed actions. This deficit was restored by administering methylphenidate (the most commonly used psychostimulant in ADHD treatment), dopamine D2 receptor agonist or dopamine D1 receptor antagonist. Further, in another pilot study, we found that children with ADHD are less reliant on goal-directed behavior compared to healthy children. In this study, we examined action-control patterns in children with ADHD on- and off- methylphenidate. We hypothesize that on-methylphenidate patients will show different patterns of action-control compared to off-methylphenidate patients. We tested 7 off-medication and 7 on-medication, 6-10 years old children with ADHD, and 13 healthy controls. Participants were 6-10 years old and were group matched for age and sex. We tested patterns of action-control using a computer-based task of the outcome devaluation paradigm that consists of three phases; a training phase, a devaluation phase and a choice test. Children with ADHD were successful at acquiring action-outcome associations as well as showing higher tendency on goal-directed responses. However, throughout the task, on- methylphenidate children showed (1) lower number of errors, (2) higher reaction times and (3) no difference in action-control responses (goals vs.

habits). These results indicate that methylphenidate was beneficial in modulating symptoms of ADHD by reducing the number of errors during learning and increasing children's response times; but it was not effective in improving children's cognitive profile, reflected by similar action-control patterns in both on and off-medication states.