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Disfluency characteristics of children with attention-deficit /hyperactivity disorder symptoms

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ABSTRACT

The purpose of the current study was to investigate the characteristics of speech disfluency in 15 children with attention-deficit/hyperactivity disorder (ADHD) symptoms and 15 age-matched control children. Reading, story retelling, and picture description tasks were used to elicit utterances from the participants. The findings indicated that children with ADHD symptoms produced significantly more stuttering-like disfluencies (SLD) and other disfluencies (OD) when compared to the control group during all three tasks. Further statistical analysis showed that children with ADHD symptoms produced more OD during the story retelling task than the other two tasks, whereas no significant differences in OD were observed among the three tasks in the control children. Finally, children with ADHD symptoms exhibited a higher proportion of SLD in total disfluencies (TD) than the control children. These results are consistent with previous studies that children with ADHD are disfluent in their verbal production. Furthermore, children with ADHD symptoms seem to be more vulnerable to a speaking task that places greater demands on their attentional resources for language production, resulting in increased speech disfluencies.

1. Introduction

Attention-deficit/hyperactivity disorder (ADHD) is a neurobehavioral disorder characterized by a persistent pattern of inattention, impulsivity, and/or hyperactivity that interferes with normal functioning or development (American Psychiatric Association, 2013). The prevalence of ADHD has been estimated at between 5.29% and 7.1% in children and adolescents (Willcutt, 2012) and at 4.4% in the general adult population (Montes, Garcia, & Ricardo-Garcell, 2007). Specifically, it affects between 3% and 6% of school-aged children (Im & Jo, 2004; Rowland, Lesesne, & Abramowitz, 2002). Many empirical studies have reported that a substantial number of children with ADHD have difficulties in the domains of receptive and expressive language and pragmatics (Barkley, 1997; Bental & Tirosh, 2007; Kim & Kaiser, 2000; Purvis & Tannock, 1997; Tirosh & Cohen,

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1998). Speech-language difficulties may be due to higher-order cognitive deficits in executive function[1] (Bental & Tirosh, 2007; Green, Johnson & Bretherton, 2014; Purvis & Tannock, 1997).

Evidence has built up suggesting an association between ADHD and stuttering. The comorbidity of ADHD and stuttering ranges between 4% (Arndt & Healey, 2001) and 26% (Riley & Riley, 2000). For example, Biederman et al. (1993) carried out structured self-report interviews with 84 adults with a clinical diagnosis of ADHD. Eighteen percent of adults with ADHD reported a significant history of stuttering. Alm and Risberg (2007) used the Wender Utah Rating Scale for retrospective diagnosis of ADHD in 32 stuttering adults and 28 non-stuttering controls, and found that traits of childhood ADHD were observed in the stuttering group and not in the nonstuttering group. Donaher and Richels (2012) suggested both disorders "share many commonalities". For instance, both disorders have a much higher concordance in monozygotic than dizygotic twins (Andrews, Morris-Yates, Howie, & Martin, 1991; Godai, Tatarelli, & Bonanni, 1976) and occur in boys more than girls by a ratio of roughly 5:1 (Donaher & Richels, 2012). When functional and structural neural differences in the brain of children with ADHD and those who stutter were examined, the structural difference as well as functional anomaly in the basal ganglia seem to be associated with both ADHD (Aylward et al., 1996; Hart et al., 2013; Teicher et al., 2000) and stuttering (Alm, 2004; Giraud et al., 2008; Tani & Sakai, 2011). Similarly, Ratcliff-Baird (2002) investigated differences in theta and alpha activity measured by electroencephalography (EEG) at frontal sites between 22 male stutterers and 22 male non-stutterers during focused attention tasks. They then compared their study's findings with previous findings on neural activity in ADD/ADHD individuals. The findings prompted the authors' suggestion that stutterers and individuals with ADHD share strong similarities in the EEG results, morphology, and behavior.

Attentional processes in children who stutter (CWS) have been studied in relation to stuttering (e.g., Anderson & Wagovich, 2010; Eggers, De Nil, & Van den Bergh, 2010; Eggers, De Nil, & Van den Bergh, 2012; Felsenfeld, Van Beijsterveldt, & Boomsma, 2010). For example, based on a parental questionnaire (i.e., *Children's Behavior Questionnaire*, CBQ, Putnam & Rothbart, 2006), Anderson and Wagovich (2010) found no difference between CWS and children who do not stutter (CWNS) in attentional focusing, impulsivity, and inhibitory control. In addition, no significant relationships were evident between timed tasks of linguistic performance (i.e., computerized picture naming task) and focused attentional skills. In contrast, based on parental reports, Felsenfeld et al. (2010) suggested that young CWS and those who are highly nonfluent may experience challenges with attention regulation. Likewise, based on a Dutch version of the CBQ (CBQ-D; Van den Bergh & Ackx, 2003), Eggers et al. (2010) found that CWS differ from CWNS in the scales of self-regulatory behavior (i.e., inhibitory control and attentional shifting), suggesting a possible role of self-regulatory behavior for attentional processes in developmental stuttering (Eggers et al., 2012).

Although the association between ADHD traits and stuttering has received considerable research attention, relatively little is known about whether children with ADHD produce more stuttering-like-disfluencies (SLD) than children without ADHD. Most previous studies have focused on other disfluencies (OD, e.g., interjections, revisions, whole-word repetitions, pauses and revisions) and one type of SLD (i.e., part-word repetitions) excluding other types of SLD (i.e., prolongations and blocks) (Baker & Cantwell, 1992; Engelhardt, Corley, Nigg, & Ferreira, 2010; Healey & Reid, 2003; Im & Hwang, 2009; Kim & Kaiser, 2000; Purvis & Tannock, 1997; Redmond, 2004). Additionally, Redmond (2004) investigated maze behavior (which included false starts, fillers, revisions, and repetitions) and reported that children with ADHD produced significantly more and longer mazes than age-matched controls. Findings suggested that the maze behavior observed in ADHD may reflect their deficits in linguistic processing and speech formulation. Im and Hwang (2009) investigated maze behavior (which included fillers, repetitions, repairs, and pauses) and reported that children with ADHD produced more mazes than control group. These authors suggested that the frequent production of mazes in children with ADHD may reflect their underlying difficulties in linguistic planning and producing discourse. Engelhardt et al. (2010) also investigated production of three types of disfluencies (e.g., filled pauses, repetitions, and repairs) in adolescents and adults with ADHD and reported that a group difference was observed only for repair disfluencies. They further suggested that deficit in inhibitory control affected participants' ability to detect and prevent inappropriate speech plans prior to articulation. As mentioned above, however, most studies examined OD rather than SLD in children with ADHD, which hinders the understanding of speech disfluencies in children with ADHD. The present study sought to assess whether there is quantitative and/or qualitative differences in speech disfluencies (both OD and SLD) between children with ADHD symptoms and a control group.

In addition, given the studies that investigated the effects of different situations with varying cognitive stress on stuttering in CWS, we were interested to assess whether there are any speaking situations in which children with ADHD symptoms are more likely to stutter or be disfluent compared to other situations. Indeed, for CWS, a significant change in stuttering frequency has been noted across different speaking situations in a number of studies. For example, Yaruss (1997) examined variability in the frequency of disfluencies produced by 45 preschool CWS in five different speaking situations and found significant differences in the frequency of "less typical" disfluencies among these situations. The results of that study emphasized the importance of using different speaking situations when evaluating CWS for speech disfluencies (Yaruss, 1997). Similarly, Trautman, Healey, Brown, Brown, and Jermano (1999) reported that the story retelling task produced a

[1] Executive function (EF) is a theoretical term that refers to four executive abilities (i.e., working memory, internalization of speech, self-regulation of affect-motivation-arousal, and reconstitution). EF is essential for various tasks that demand accurate and efficient communication of information (Barkley, 1997).

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