



Impaired sustained attention, focused attention, and vigilance in youths with autistic disorder and Asperger's disorder



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ABSTRACT

The study compared the attention-deficit/hyperactivity disorder (ADHD) related clinical symptoms and a wide-ranging attention performance in 216 youths with autistic disorder (autism), 138 youths with Asperger's disorder (AD) and 255 typically-developing youths. The diagnosis of autism and AD were made based on the clinical assessments according to the DSM-IV criteria and confirmed by the Autism Diagnostic Interview-Revised. All the participants were assessed with the Conners' Continuous Performance Test (CCPT) and the questionnaires about ADHD, oppositional, and autistic symptoms. All indices of the CCPT were analyzed based on a recently developed factor structure, including focused attention, cognitive impulsivity, sustained attention, and vigilance. We found that compared with typically-developing youths, youths with autism and AD showed more inattentive, hyperactive/impulsive, and oppositional symptoms, and performed worse in focused attention and sustained attention as assessed by the CCPT. Youths with AD also showed more oppositional symptoms than youths with autism. Moreover, youths with autism had poorer focused attention than youths with AD; but, youths with AD had more impaired sustained attention. Our results validate different manifestations of ADHD-related symptoms and attention performance between youths with autism and youths with AD and suggest intervention for youths with autism spectrum disorders should consider these specific measures.

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1. Introduction

Autism spectrum disorders (ASDs), characterized by different degree of impaired social interaction, communication deficits, and restricted interests, are a group of complex neurodevelopmental disorders that include autistic disorder (autism), Asperger's disorder (AD), and pervasive developmental disorder not otherwise specified (American Psychiatric Association, 1994). Beyond the core symptoms, attention difficulties and hyperactive behaviors are frequently reported in

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some individuals with ASD (Wing, 1997). It has been theorized that impairments in attention may underlie some of the primary neuropathological functions in autism (Cornblatt & Malhotra, 2001; Courchesne, Lincoln, Yeung-Courchesne, Elmasian, & Grillon, 1989), based on various experiments (e.g., Garretson, Fein, & Waterhouse, 1990; Pascualvaca, Fantie, Papageorgiou, & Mirsky, 1998).

Early investigation by Gillberg (1989) showed that 21% of the ASD youths met the diagnostic criteria of both ADHD and ASD. This early observation was supported by studies based on either structured psychiatric interview (Ghaziuddin, Weidmer-Mikhail, & Ghaziuddin, 1998), or questionnaires (e.g., Fombonne, Simmons, Ford, Meltzer, & Goodman, 2001), showing that a substantial proportion (29–83%) of individuals with ASD have ADHD symptoms. Recent work (sample sizes ranging from 27 to 483) documented that about half (52–78%) of the ASD population also met the diagnostic criteria for ADHD (e.g., Lee & Ousley, 2006; Sinzig, Walter, & Doepfner, 2009; Yoshida & Uchiyama, 2004), despite exclusion of comorbid diagnoses in the DSM-IV-TR. These ADHD symptoms in children with ASD may persist into adolescence (Lee & Ousley, 2006), correlate with autistic symptoms (Sinzig et al., 2009), and may exacerbate executive dysfunction, impaired verbal working memory, and maladaptive behaviors (Murray, 2010), resulting in more severe autistic traits, and externalizing symptoms (Yerys et al., 2009). Despite the high co-occurrence of ADHD and ASD and its impact, few studies have investigated the differential severity of ADHD symptoms between different ASD subtypes (Thede & Coolidge, 2007). In addition, higher prevalence of oppositional defiant disorder, up to 27%, was also noted in children with ASD than typically-developing (TD) children (Gadow, DeVincent, Pomeroy, & Azizian, 2004; Gadow, DeVincent, Pomeroy, & Azizian, 2005). Yet, the severity of oppositional symptoms between children with autism and those with AD were controversial (Thede & Coolidge, 2007; Tonge, Brereton, Gray, & Einfeld, 1999).

Several studies have linked executive function (EF) deficits to ASD with probably different EF patterns between autism and AD. For example, individuals with AD, but not those with autism, had an impaired set-shifting performance (Ozonoff, South, & Miller, 2000), while deficits in response inhibition were found in individuals with high-functioning autism (HFA) but not in individuals with AD (Rinehart, Bradshaw, Brereton, & Tonge, 2002). Other studies, however, did not show such EF deficits either in autism or AD (e.g., Thede & Coolidge, 2007). Whether a more fundamental neurocognitive function, attention performance, differs between autism and AD is largely unknown. Although earlier studies ($n = 10–23$) have shown impaired attention as assessed by one or two indices of the Continuous Performance Test (CPT) in autism (e.g., Garretson et al., 1990; Pascualvaca et al., 1998), no study has compared the CPT performance between autism and AD.

Previous studies of attention research in ASD have mainly recruited Caucasian but not Asian populations. Moreover, the evidence to differentiate autism from AD is lacking with regards to ADHD-related symptoms and a wide range of attention performance (Thede & Coolidge, 2007). Hence, we conducted this study to compare the severity of inattentive, hyperactive/impulsive, and oppositional symptoms, and the attention profiles (focused attention, cognitive impulsivity, sustained attention, and vigilance) as assessed by the Conners' CPT (CCPT) among youths with autism, youths with AD, and TD youths and to examine the correlations between the CCPT performance and autistic and ADHD symptoms among ethnic Chinese youths with ASD in Taiwan.

We hypothesized that youths with ASD may have more ADHD-related symptoms and deficits in several attention dimensions than TD youths but the patterns of attention deficits may not be the same between youths with autism and youths with AD, and may not be compatible with the findings documented in ADHD, in terms of attention profiles as well as the correlations with ADHD and ASD symptoms.

2. Methods

2.1. Participants and procedures

The sample, in the age range of 6–18 years old, consisted of 354 youths with ASD (male, 90%; mean age \pm standard deviation (SD), 11.0 ± 3.2 years), clinically diagnosed with autistic disorder (autism, $n = 216$) or Asperger's disorder ($n = 138$) according to the DSM-IV diagnostic criteria, and 255 TD youths (mean age \pm standard deviation, 11.8 ± 2.3 ; male 80%). Participants who had full IQ below 70 or who could not understand the direction of the task were excluded from the study. The autism and AD groups were recruited from two medical centers (National Taiwan University Hospital and Chang-Gung Memorial Hospital), and several primary and high schools in Taiwan. All the ASD youths were diagnosed by senior board-certified child psychiatrists based on the DSM-IV diagnostic criteria, and were further confirmed by structural interviews using the Chinese version of the Autism Diagnostic Interview-Revised (ADI-R) (Gau et al., 2011; Lord, Rutter, & Le Couteur, 1994). Their parents also received psychiatric interview by using the *Chinese Kiddie epidemiologic version of the Schedule for Affective Disorders and Schizophrenia (K-SADS-E)* interview for the diagnosis of ADHD and other psychiatric disorders. The reliability and validity of the Chinese K-SADS-E is established (Gau, Chong, Chen, & Cheng, 2005), and has been extensively used in assessing childhood mental disorders (Chiang, Huang, Gau, & Shang, 2013; Chien et al., 2012; Gau & Chiang, 2013; Gau & Huang, 2013; Hwang Gu, Gau, Tzang, & Hsu, 2013; Lin et al., 2013; Shang, Gau, Liu, & Hwu, 2011; Shang, Wu, Gau, & Tseng, 2013; Wu, Gau, Lo, & Tseng, 2014).

The 255 TD youths were recruited at schools in the same districts of the ASD groups through the teachers and principals rather than through advertisement. They were clinically assessed by the corresponding author, and their parents received the K-SADS-E interview to exclude ASD and other major neuropsychiatric disorders like ADHD, schizophrenia, mood disorders, anxiety disorders, or developmental disorders.

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