Research in Autism Spectrum Disorders 13–14 (2015) 1–7

Contents lists available at ScienceDirect

Research in Autism Spectrum Disorders

Journal homepage: http://ees.elsevier.com/RASD/default.asp

Sex differences in cognitive and symptom profiles in children with high functioning autism spectrum disorders

Hirokazu Kumazaki [a,b,c,*], Taro Muramatsu [b], Hirotaka Kosaka [a], Takashi X. Fujisawa [a], Kazuhiko Iwata [c], Akemi Tomoda [a], Kenji Tsuchiya [d], Masaru Mimura [b]

[a] Research Center for Child Mental Development, Fukui University, 23-3 Matsuokashimoaizuki, Eiheiji-cho, Yoshida-gun, Fukui 910-1193, Japan
[b] Department of Neuropsychiatry, Keio University School of Medicine, 35 Shinanomachi, Shinjuku-ku, Tokyo 160-8582, Japan
[c] Department of Child and Adolescent Medicine, Osaka Psychiatric Medical Center, 3-16-21 Miyanosaka, Hirakata, Osaka 573-0022, Japan
[d] Research Center for Child Mental Development, Hamamatsu University School of Medicine, 1-20-1 Handayama, Higashi-ku, Hamamatsu city, Shizuoka 431-3192, Japan

ARTICLE INFO

Article history:
Received 21 September 2014
Received in revised form 12 December 2014
Accepted 13 December 2014
Available online 6 March 2015

Keywords:
High functioning autism spectrum disorders
Sex differences
Narrow age range
Before adolescence
CARS-TV
Taste, Smell, Touch Response and Use

ABSTRACT

Although a small number of studies have investigated sex differences in the associated features of high-functioning autism spectrum disorders (HFASDs), they have failed to provide consistent findings. We sought to examine sex differences in 5–9-year-old females and males with HFASDs within a narrow range of ages before adolescence in order to identify the noticeable autistic profile of females compared to males. Using the Japanese version of the Wechsler Intelligence Scale for Children-Third Edition (WISC-III) and the Childhood Autism Rating Scale-Tokyo Version (CARS-TV), 20 females with HFASDs were compared with 26 males with HFASDs. Although females and males with HFASDs share similar cognitive profiles in WISC-III, females demonstrated a different symptom profile from males in CARS-TV. Although the female subjects scored significantly lower than the male subjects on "Body Use," "Object Use," and "Activity Level," female subjects scored significantly higher than males on "Taste, Smell, and Touch Response and Use" in the CARS-TV. This finding can be useful for the early identification of females with HFASDs who have typically been underdiagnosed. Future research should focus on elucidating the possible behavioral, neurological, and genetic links to these sex differences.

1. Introduction

Epidemiological studies have consistently shown that autism spectrum disorders (ASDs) affect more males than females. However, it has been debated whether this male predominance might be, at least in part, derived from under-diagnosis of this disorder in females. Rivet and Matson (2011) have reported that females with ASD have experienced misdiagnosis, delayed diagnosis, greater difficulty in the diagnostic process, and a lack of diagnosis. In high functioning autism spectrum

* Corresponding author at: Research Center for Child Mental Development, Fukui University, 23-3 Matsuokashimoaizuki, Eiheiji-cho, Yoshida-gun, Fukui 910-1193, Japan. Tel.: +81 776 61 8677; fax: +81 776 61 8678.
E-mail addresses: kumazaki@tiara.ocn.ne.jp (H. Kumazaki), muramatsu@a8.keio.jp (T. Muramatsu), hirotakakosaka@gmail.com (H. Kosaka), fujisawa_jr@hotmail.com (T.X. Fujisawa), iwatak@mh-opho.jp (K. Iwata), atomoda@gmail.com (A. Tomoda), tsuchiya@hama-med.ac.jp (K. Tsuchiya), mimura@a7.keio.jp (M. Mimura).

http://dx.doi.org/10.1016/j.rasd.2014.12.011
1750-9467/

disorders (HFASDs), a relative failure to diagnose female patients is emphasized because of differences in clinical presentation (Baron-Cohen, Knickmeyer, & Belmonte, 2005). For example, it has been reported that females with HFASDs have a different behavioral phenotype than males with HFASDs, with a lower frequency of challenging comorbid behaviors and fewer abnormal special interests (McLennan, Lord, & Schopler, 1993). They are less likely to show stereotypic behavior during play and have better superficial social skills and language (Gillberg & Coleman, 2000). They also have less externalizing and social problems (Mandy et al., 2012) and present fewer socio-communication symptoms (Lai et al., 2011). Another proposed explanation for the possible under-diagnosis of females with HFASDs is their ability to camouflage their autistic symptoms (Atwood, 2006, 2007; Lai, Lombardo, & Baron-Cohen, 2014). In other words, females with HFASDs may be more motivated and put more effort into developing compensatory skills that help them to appear "socially typical" (Kopp & Gillberg, 1992). That the reported sex ratio of ASDs remarkably differs according to the subjects' intelligence quotient (IQ) supports this view. For children with ASDs who have above-average intellectual abilities, the male to female ratio increases to 5.5:1 but is 1.95:1 in those with intellectual disability (Fombonne, 2003).

These confounding factors should be minimized if younger subjects within a narrow age range are studied. It is well known that brain development undergoes significant alteration in adolescence, and that there are sexual differences in postnatal brain development and aging (Craig et al., 2007; Giedd et al., 1999; Gur, Gunning-Dixon, Turetsky, Bilker, & Gur, 2002; Murphy et al., 1996). After adolescence, the developmental effects of sexual differences are increased. Adolescents (Holtmann, Bolte, & Poustka, 2007; Koyama, Kamio, Inada, & Kurita, 2009; McLennan et al., 1993) and adults (Lai et al., 2011) have participated in previous studies, yet to the best of our knowledge, in none were male and female subjects with HFASDs restricted to early ages compared. Hsu, Chiang, Lin, and Lin (2012) and Worley and Matson (2011) have emphasized the importance of assessing specific age cohorts.

Thus, epidemiological, clinical, and neurodevelopmental findings support the importance of examining sex differences in early age subjects with HFASDs. Such study may help to distinguish the *primary* features associated with the disorder as opposed to the secondary effects associated with compensatory efforts and other factors.

This is the first study, to our knowledge, to examine the sex differences in subjects with HFASDs restricted to early ages. We predicted that our results could reflect the *primary* features of HFASDs. The measures used in the present study were the Wechsler Intelligence Scale for Children-Third Edition (WISC-III) (Wechsler, 1991) and the Childhood Autism Rating Scale-Tokyo Version (CARS-TV) (Kurita, Miyake, & Katsuno, 1989). The latter includes subtests for somatic items such as near receptor (taste, smell, and touch) sensitivity.

2. Methods

2.1. Participants and procedures

The present study was conducted as part of a comprehensive study approved by our local ethics committee. All subjects whose relevant data were collected from their clinical records were recruited from our institute, well known in Japan for its specialty in developmental disorders and related conditions. From a total of 321 children and adolescents who met the International Classification of Diseases version 10 (ICD-10) (World Health Organization, 1993) research criteria for ASD diagnosis, we selected 5–9-year-old HFASD children ($N = 46$; $n = 26$ males; $n = 20$ females) who had a Full Scale Intelligence Quotient (FIQ) score of 70 or higher on the WISC-III, and a formal clinical diagnosis of Autistic disorder ($n = 4$ males; $n = 3$ females) or Asperger syndrome ($n = 22$ males; $n = 17$ females) using Diagnostic and Statistical Manual of Mental Disorders version IV (DSM-IV) criteria (American Psychiatric Association, 2000). Subjects were free of neurological or psychiatric problems other than those associated with HFASDs (i.e., ADHD, anxiety, etc. which are commonly associated with ASD), and none was taking any medication.

The subjects' first medical examination occurred between April 2011 and March 2012. Children were diagnosed by consensus among a clinical team comprised of experienced professionals (i.e., child psychiatrists, clinical psychologists, psychiatric social workers, and pediatric neurologists) based on a detailed clinical examination on the first visit, follow-up observations, and parent-completed questionnaires regarding the children's development and symptoms. The diagnoses were confirmed by the first author using diagnostic instruments and screening questionnaires including the Pervasive Developmental Disorder-Autism Society Japan Rating Scale (PARS), 20 which is a diagnostic interview scale for ASD developed in Japan (PARS Committee, 2008). Primary assessment took approximately 5 h and included interviews regarding the developmental history and symptoms of the children and behavioral observation. Clinical psychologists collected information from parents regarding developmental milestones (i.e., joint attention, social interaction, pretend play, and repetitive behaviors, with onset prior to age 3 years) and episodes (e.g., behavior throughout school). Information from detailed observation of their interaction with people (particularly non-family members), as well as repetitive behavior (i.e., obsessive-compulsive traits and stereotyped behavior), was provided by other professionals (i.e., teachers and social workers).

2.2. Instruments

2.2.1. Japanese version of the WISC-III

The Japanese version of the WISC-III used in this study was standardized among 1125 Japanese children aged 5–16, and was found to have good reliability and validity (Japanese WISC-III Publication Committee, 1998). The WISC-III consists of