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# Meal time behavior difficulties but not nutritional deficiencies correlate with sensory processing in children with autism spectrum disorder

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ABSTRACT

*Background:* Food aversion and nutritional difficulties are common in children with autism spectrum disorder.

*Aim:* To compare meal time behavior of children with autism to their typically developing siblings and to typical controls and to examine if sensory profiles can predict meal time behavior or nutritional deficiencies in the autism group.

Methods and Procedures: Fifty children with autism spectrum disorder, age three to six years, were compared in a case-control study to their typically developing siblings and typically developing age- and gender-matched control group. We examined the nutritional intake and mealtime behavior and compared between groups and the findings within the autism group were compared to their sensory profile assessment.

Outcomes and results Mealtime behavior difficulties were significantly more prevalent in the autism group as compared to siblings as well as controls, and associated with various sensory regulation difficulties, but not to nutritional deficiencies.

## What this paper adds

This paper explores the possible link between nutritional risks, feeding difficulties, and sensory processing in children with autism spectrum disorder. In addition to typical controls, we assessed the siblings group, in order to discern between familial habits and ASD related deficits. The paper emphasizes the difference between feeding difficulties and nutritional deficiencies. Limited variety and specific behavioral difficulties at meal time as well as abnormal sensory profile should be assessed separately from the mandatory nutritional assessment.

The paper implies that behavior or sensory aversions do not necessarily cause nutritional deficiencies and vice versa. An individual comprehensive approach when addressing the issues of nutritional risks and feeding difficulties of ASD children is warranted.

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## 1. Introduction

In children with autism spectrum disorder (ASD), adherence to specific dietary habits and preferences as well as atypical behaviors at meal time, have been recognized as behavioral criteria for diagnosis (Association, 2013), as well as a common comorbidity and a target for treatment. Atypical behaviors at meal time are also causing significant concerns as possible causes of nutritional deficiencies.

Most studies support the presence of feeding difficulties in ASD children and recognize its familial impact. The difficulties include: specific nutritional deficits (Lockner, Crowe, & Skipper, 2008; Shmaya, Eilat-Adar, Leitner, Reif, & Gabis, 2015; Zimmer et al., 2012), food refusal (Cornish, 1998), PICA disorder (Emond, Emmett, Steer, & Golding, 2010), limited variety, atypical use of utensils, food preparation preferences (Schreck, Williams, & Smith, 2004), difference in food- group consumption such as less dairy products and more protein-rich products (Herndon, DiGuiseppi, Johnson, Leiferman, & Reynolds, 2009), throwing food, rejecting/preferring food by texture, color, or temperature (Ahearn, Castine, Nault, & Green, 2001; Johnson, Handen, Mayer-Costa, & Sacco, 2008), and oral motor impairments (Williams, Gibbons, & Schreck, 2005). In regards to nutritional difficulties, there are several case reports of children with ASD who suffered from severe consequences such as scurvy (Cole, Warthan, Hirano, Gowen, & Williams, 2011; Duggan, Westra, & Rosenberg, 2007; Niwa et al., 2012), rickets, and vitamin A deficiency-related ophthalmological conditions (Clark, Rhoden, & Turner, 1993; Steinemann & Christiansen, 1998). Besides nutritional deficiencies, children with ASD showed a predisposition to overweight (Shmaya et al., 2015).

Behaviors related to meals were also linked to sensory processing difficulties in children with ASD, resulting in increased anxiety with regards to nutritional consequences, causing more stress at mealtime (Rogers & Ozonoff, 2005; Tomchek & Dunn, 2007). Eating disorders may be linked to sensory issues. Increased or diminished sensitivity to textures, smell, colors or taste of food, or different behaviors around mealtime that might be influenced by senses. (Twachtman-Reilly, Amaral, & Zebrowski, 2008) Twachtman-Reilly et al. (2008) reviewed various factors that might influence eating difficulties in children with ASD. The authors noted that it is possible that the lack of ability to regulate the sensory input affects their eating habits.

Prior studies that examined different ASD symptoms, such as sensory profile in relationship to eating habits and preferences, showed contradictory results (Cermak, Curtin, & Bandini, 2010; Hubbard, Anderson, Curtin, Must, & Bandini, 2014; Johnson et al., 2014; Paterson & Peck, 2011)

It is possible that some of the prior findings were confounded by household preferences. In order to neutralize the household confounder, we explored the feeding difficulties of children with ASD compared to two control groups: their siblings who share the same household and to a gender- and age-matched control group. We further evaluated associations between mealtime behavior, nutritional deficiencies, and sensory profile in children with ASD.

Adding more knowledge to this issue can help clinicians to build a tailored multidisciplinary assessment and intervention program.

## 2. Material and methods

This study is a case control, multi-center study conducted during 2009–2012. The study was approved by the Helsinki ethics committees of each center.

### *2.1. Subjects*

#### *2.1.1. ASD group*

Eighty-four children between the ages of three and six years treated at two Child Development Centers were prescreened for inclusion in the study. The diagnosis was made by a multidisciplinary team that includes neurologists, psychologists, and speech therapists, according to the criteria of the *Diagnostic and Statistical Manual of Mental Disorders-IV* (DSM-IV) (Association, 2000) and Childhood Autism Rating Scale (CARS) (Schopler, Reichler, DeVellis, & Daly, 1980), diagnostic questionnaire rating autism, corroborated by psychological evaluation using the Autism Diagnostic Observation Schedule-Generic (ADOS) (Lord et al., 1989), and evaluation of intelligence using IQ measures. Response rate in this group was 56 out of 84 families and additional six families were excluded due to consumption of food supplements. The final study group comprised of 50 children with ASD.

#### *2.1.2. First control group*

defined as the *Siblings group* was comprised of same household and closest-aged sibling, between three and twelve years old, with typical development. The response rate in this group was 16 out of 21 siblings (76%). Four siblings were excluded due to ASD screening failure and/or incomplete questionnaires. The final number of siblings was 12 children.

#### *2.1.3. Second control group*

defined as the *Typical Development group* (TD), included children matched for age and gender (recruited using advertisements in a popular online forum and parents groups), with typical development as reported by the parents. This group was comprised of 29 children out of 40 prescreened.

#### *2.1.4. Exclusion criteria for all groups included*

Food supplements use, metabolic disease, diabetes mellitus, or celiac disease, and the use of a gluten-free and casein-free diet, for