



ELSEVIER

Contents lists available at ScienceDirect

# Research in Developmental Disabilities



## Nutritional deficiencies and overweight prevalence among children with autism spectrum disorder



Yael Shmaya<sup>a,b,\*</sup>, Sigal Eilat-Adar<sup>b,c</sup>, Yael Leitner<sup>d</sup>, Shimon Reif<sup>d</sup>, Lidia Gabis<sup>a</sup>

<sup>a</sup> Child Development Center, Edmond and Lily Safra Children Hospital, Tel Hashomer, Israel

<sup>b</sup> Department of Epidemiology and Preventive Medicine, Sackler Medical Faculty, Tel Aviv University, Tel Aviv, Israel

<sup>c</sup> Zinman College for Physical Education & Sports, Wingate Institute, Netanya, Israel

<sup>d</sup> Department of Pediatrics, Dana-Dwek Children's Hospital, Tel Aviv Sourasky Medical Center, Tel-Aviv, Israel

### ARTICLE INFO

#### Article history:

Received 8 August 2014

Received in revised form 25 November 2014

Accepted 28 November 2014

Available online 20 December 2014

#### Keywords:

Autism spectrum disorder

Dietary intake

Nutritional deficiencies

Eating difficulties

### ABSTRACT

Children with autism spectrum disorder (ASD) are at risk of developing nutritional deviations. Three to six year old children with ASD were compared to their typically developing siblings and to a typically developing age and gender matched control group, in order to evaluate their intake and body mass index.

Nutrient intake was compared to the Dietary Reference Intake using three-day diet diaries completed by the parents. The sum percentage of nutritional deficiencies in the ASD group compared to the typical development group was 342.5% ( $\pm 122.9\%$ ) vs. 275.9% ( $\pm 106.8\%$ ), respectively ( $P = 0.026$ ). A trend toward higher deficiency in the ASD group was observed as compared to the sibling group 363% ( $\pm 122.9\%$ ) vs. 283.2% ( $\pm 94.7\%$ ) ( $P = 0.071$ ). A higher body mass index was found in the ASD group compared to their counterparts, despite their nutritional deficiencies. In conclusion, children with ASD are more likely to suffer from nutritional deficiencies despite higher body mass index.

© 2014 Elsevier Ltd. All rights reserved.

## 1. Introduction

Dietary habits and preferences of children with Autism Spectrum Disorder (ASD) have been investigated in recent years and have become a recognized clue for diagnosis (American Psychiatric Association, 2013). Most studies support the presence of feeding difficulties in ASD children and the additional challenges these difficulties add to the familial burden of care. These difficulties often include: nutritional consumption lower than the recommendations (Zimmer et al., 2012; Lockner, Crowe, & Skipper, 2008) and food refusal (Cornish, 1998), pica disorder (Emond et al., 2010) a limited variety, not using specific utensils (Schreck, Williams, & Smith, 2004), variance in amounts consumed from different food groups, such as less dairy products and more protein-rich products (Herndon, DiGuiseppi, Johnson, Leiferman, & Reynolds, 2009), throwing food, rejecting or preferring foods according to texture, color or temperature (Johnson, Handen, Mayer-Costa, & Sacco, 2008; Ahearn, Castine, Nault, & Green, 2001) and oral motor impairments (Williams, Gibbons, & Schreck, 2005). There are several case reports of children with ASD who suffered from various unrecognized nutrient deficiencies, with a degree of severity to subsequently cause health risks such as scurvy (Niwa et al., 2012; Cole, Warthan, Hirano, Gowen, & Williams, 2011; Duggan, Westra, & Rosenberg, 2007), rickets, and vitamin A deficiency related ophthalmological conditions (Clark, Rhoden, & Turner,

\* Corresponding author at: Child Development Center, Edmond and Lily Safra Children Hospital, Tel Hashomer, Israel. Tel.: +972 524209480; fax: +972 46524946.

E-mail address: [yael.shmaya@gmail.com](mailto:yael.shmaya@gmail.com) (Y. Shmaya).

1993; Steinemann & Christiansen, 1998). In previous studies, the average nutrient consumption was used to calculate deficiencies: Johnson et al. (2008) found that children with ASD had a lower average vitamin K consumption as compared to children with typical development, (6.8 mg/day vs. 8.9 mg/day, respectively  $P < 0.025$ ). However, more children with typical developmental did not meet the recommended dietary intake (RDA) for magnesium, (using average intake) compared to ASD children (53% vs. 6%, respectively,  $P < 0.025$ ). Herndon et al. (2009) found children with ASD had a lower average calcium consumption (747 mg/day vs. 894 mg/day, respectively  $P < 0.05$ ), a higher average vitamin B6 consumption (1.5 g/day vs. 1.2 g/day, respectively  $P < 0.05$ ) and a higher average vitamin E consumption (8 mg/day vs. 4 mg/day, respectively  $P < 0.05$ ) as compared to their counterparts. Emond et al. (2010) also analyzed average nutrients' consumption. Compared with controls, children with ASD consumed less vitamin C ( $P = .007$ ) and vitamin D ( $P = .004$ ) and more iodine ( $P = .01$ ). Zimmer et al. (2012) found lower consumption of protein (72.77 g/day vs. 92.64, respectively  $P < 0.05$ ), calcium (945.18 mg/day vs. 1221.98 mg/day  $P < 0.05$ ), magnesium (314.89 mg/day vs. 265.93 mg/day, respectively  $P < 0.05$ ), vitamin B12 (4.69  $\mu\text{g/day}$  vs. 6.66  $\mu\text{g/day}$ , respectively  $P < 0.05$ ), and vitamin D (198.62 IU/day vs. 319.86 IU/day, respectively  $P < 0.05$ ). Therefore, there is paucity of evidence-based data to establish recommendations and guidelines for treatment (Raiten & Massaro, 1986; Schreck et al., 2004; Schmitt, Heiss, & Campbell, 2008; Lockner et al., 2008; Bandini et al., 2010).

In the current analysis we investigated the nutritional status of 3–6 year old children with ASD and herein report our preliminary findings. We addressed the nutritional assessment using a different approach which may better reflect the nutritional status of these children.

## 2. Methods

This study was conducted during 2009–2012 as a case–control, multi-center research. 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 3 and 6 years were treated at two Child Development Centers. The diagnosis was made by a multidisciplinary team (comprising neurodevelopmental pediatricians, psychologists, occupational therapist and speech pathologists), according to the criteria of the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) (American Psychiatric Association, 2000) using Childhood Autism Rating Scale (CARS) (Schopler, Reichler, DeVellis, & Daly, 1980) diagnostic questionnaire and corroborated by Autism Diagnostic Observation Schedule-Generic (ADOS) (Lord et al., 1989) and evaluation of intelligence using IQ measures. The ASD group includes children with subtypes of ASD: Autistic Disorder, Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS), Asperger's Syndrome, but not with Rett syndrome or Childhood Disintegrative disorders. Families of children with ASD were recruited regardless of whether there were other siblings in the family. Response rate in this group was 60% (50 out of 84 families). Six families of the 84 families who enrolled their children were excluded from the current analysis due to consumption of food supplements.

#### 2.1.2. First control group

First control group defined as *Siblings group* comprised of same household and closest in age sibling, between 3 and 12 years old, with typical development. The response rate in this group was 76% (16 out of 21 siblings). A total of four siblings were excluded due to ASD screening failure and/or incomplete questionnaires. The final number of siblings was 12.

#### 2.1.3. Second control group

Second control group defined as *Typical development group* included children matched for age and gender, (recruited using advertisements in popular online forum and parenting groups), with typical development according to parent's reports. Response rate in this group was 72% (29 out of 40 families).

#### 2.1.4. Exclusion criteria for all groups

Exclusion criteria for all groups included consumption of food supplements, metabolic disease, diabetes mellitus or celiac disease and the use of a gluten-free and casein-free diet, for any reason.

### 2.2. Questionnaires

#### 2.2.1. Screening for ASD

Children were screened using Autism Screening Questionnaire (ASQ) with sensitivity of 0.85, specificity of 0.75, positive predictive value (PPV) of 0.93 and negative predictive value (NPV) of 0.55 (Berument, Rutter, Lord, Pickles, & Bailey, 1999).

#### 2.2.2. Weight, height, body mass index (BMI)

Data for weight (kg) and height (metrics) were reported by parents. BMI ( $\text{kg/m}^2$ ) was calculated. Comparison of weight, height and BMI between groups was calculated using World Health Organization (WHO) AnthroPlus software (World Health Organization, 2009). Due to many out-layers from normal scores, calculated Z-scores were used in the analyses.

متن کامل مقاله

دریافت فوری ←

**ISI**Articles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات