Int. J. Devl Neuroscience 53 (2016) 68–74

Contents lists available at ScienceDirect

International Journal of Developmental Neuroscience

journal homepage: www.elsevier.com/locate/ijdevneu

Feeding behavior and dietary intake of male children and adolescents with autism spectrum disorder: A case-control study

Kamila Castro[a,b,c,*], Larissa Slongo Faccioli[c], Diego Baronio[b], Carmem Gottfried[b], Ingrid Schweigert Perry[c,d], Rudimar Riesgo[a,b,e]

[a] Postgraduate Program in Child and Adolescent Health, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
[b] Translational Research Group in Autism Spectrum Disorder (GETTEA), Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
[c] Food and NutritionResearch Centre (CESAN), Hospital de Clínicas de Porto Alegre, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil
[d] Postgraduate Program in Collective Health, Academic Unit of Health Sciences, Universidade do Extremo Sul Catarinense, Criciúma, Brazil
[e] Child Neurology Unit, Hospital de Clínicas de Porto Alegre, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil

ARTICLE INFO

Article history:
Received 4 May 2016
Received in revised form 17 June 2016
Accepted 14 July 2016
Available online 16 July 2016

Keywords:
Autism spectrum disorder
Feeding behavior
Dietary intake
Children and adolescents

ABSTRACT

Autism spectrum disorder (ASD) is a neurodevelopmental disorder associated with restrictive or repetitive behaviors and difficulties with verbal and interpersonal communication, in which some problems involving nutrition may be present. This study aims to evaluate dietary intake and identify feeding behavioral problems in male children and adolescents with ASD when compared to matched controls, as well as parents or caregivers' feelings about strategies for dealing with eating problems. A 3-day food record was performed and nutrient intake was compared to the Dietary Reference Intake according to age. To evaluate children feeding behavior and parents or caregivers' feelings, the Behavior Pediatrics Feeding Assessment Scale (BPFA) was used. ASD patients consumed in average more calories than controls (though with a high patient's frequency above and below calorie range references), had a limited food repertoire, high prevalence of children with inadequate calcium, sodium, iron vitamin B5, folate, and vitamin C intake. BPFA scores were also higher in the ASD group when compared to controls for all frequencies (child behavior, parents and total). These findings lead us to endorse the importance of evaluating feeding problems in the clinical routine, considering also the singular features of the patients.

1. Introduction

In autism spectrum disorder (ASD), a neurodevelopmental disorder associated with restrictive or repetitive behaviors and difficulties with verbal and interpersonal communication (American Psychiatric Association, 2013; Rapin and Tuchman, 2008), some problems that can affect nutrition may be present (Sharp et al., 2013). An important meta-analysis reported children with ASD had more feeding problems when compared with peers, pointing to a high food selectivity among them (Sharp et al., 2013). Mealtime behavioral problems, food refusal and preference for specific texture or smell (Bandini et al., 2010; Evans et al., 2012; Zimmer et al., 2012) are described. Approximately 80% of young children with ASD had problems such as picky eaters and 95% of these children resist trying new foods (Lockner et al., 2008).

The dietary intake in these patients may be affected by feeding behaviors. Different results are reported when the dietary intake of children with ASD is analyzed; in few studies these children have similar intake when compared with controls even if food selectivity was present (Levy et al., 2007). Other authors suggested poor intake especially for micronutrients (Herndon et al., 2009; Xia et al., 2010). In addition, the overlapping between organic problems and problematic eating behaviors may elevate the risk of these children to inadequate nutritional status (Postorino et al., 2015). Since early ages, the nutritional status needs attention for this population. A recent study suggests children with ASD may be at elevated risk for unhealthy weight when compared to the general population (Hill et al., 2015).

Families with ASD children report that establishing a routine is a challenge (Bagatell et al., 2014), and, sometimes, this fact can influence negatively in the quality of life of these families (DeGrace, 2004; Marquenie et al., 2011) and may lead to an increased risk for parental stress (Curtin et al., 2015). Some feeding behaviors, such as

* Corresponding author at: Hospital de Clínicas de Porto Alegre, Centro de Pesquisa Clínica – Prédio 21 – Sala 21307, Rua Ramiro Barcelos, 2350, Porto Alegre, Rio Grande do Sul, 90035-903, Brazil.
E-mail address: kamilacastro@hotmail.com.br (K. Castro).

http://dx.doi.org/10.1016/j.ijdevneu.2016.07.003
0736-5748/

food selectivity may affect all family members, increase the risk of familiar stress (Bagatell et al., 2014) and can be a chronic problem unlikely to change without treatment (Postorino et al., 2015).

This indicates the hypothesis that children with ASD could have a higher prevalence of feeding problems as well as possible deficiencies of nutrients. Thus, the objective of this case-control study was to evaluate dietary intake and identify feeding behavioral problems in children and adolescents with ASD when compared to matched controls, as well as parents or caregivers' feelings about strategies to deal with eating problems.

2. Material and methods

2.1. Study design and sample

This is a case-control study with male children and adolescents with ASD, aged 4–16 years, consecutively recruited from Neuropediatrics Service at Hospital de Clínicas de Porto Alegre; controls were recruited from the community in the same area, which followed routine visit to Basic Health Unit, both between 2014 and 2015. The controls were selected according to socioeconomic status and age (exact year and a permitted deviation of ±4 months), in addition all of the controls did not use medications, in order to avoid variations in characteristics. Diagnosis of ASD was confirmed using Diagnostic and Statistical Mental Disorder IV criteria (American Psychiatric Association, 1994). This study was approved by the Research Ethics Committee of Hospital de Clínicas de Porto Alegre-Protocol number 13-0321 and parents/guardians signed informed consent forms. Exclusion criteria were patients with diagnosis from genetics syndromes or metabolic disorders, for example, Fragile X-Syndrome, Down's Syndrome and Tuberous Scleroses.

2.2. Clinical parameters

The medical records were verified for clinical parameters (age of onset of symptoms and age of diagnosis).

2.3. Anthropometric measurements

To characterize the nutritional status, height was measured with a wall-mounted stadiometer (Holtain®) to the nearest 0.1 cm and weight was obtained using a digital platform scale with a resolution of 0.1 kg (Toledo®, Model 2096PP/2, São Paulo, Brazil), while subjects were barefoot and wearing lightweight clothes. Body mass index (BMI) was provided using World Health Organization (WHO) Anthro Plus software (WHO, 2009), and the participants were classified through z-score.

2.4. Dietary intake

A 3-day food record for consecutive days, which included a weekend day, was completed. A nutritionist trained and instructed parents/guardians to complete the food record and quantify the food consumption in real time. All records were verified in order to capture possible missing details. The consumption of nutrients was calculated using the software Nutribase® Clinical Edition version 7.18 (USDA, 2006). Intake of nutrients was compared to the Dietary Reference Intake (Dietary Reference Intake-DRIs) according to age.

Macronutrients analysis: the percentage of calories from protein, carbohydrate and total fat were analyzed according to Acceptable Macronutrient Distribution Range (AMDR); protein (g/day), carbohydrate (g/day) and total fat (g/day) were analyzed according to the Recommended Dietary Allowances (RDA); and fibers (g/day), w3 and w6 fatty acids (g/day) were analyzed according to Adequate Intake (AI). Micronutrient analysis: micronutrients were analyzed according to Estimated Average Requirements (EAR) except vitamin B5, potassium and sodium that were compared to Adequate Intake (AI). The sodium was classified as inadequate when higher than the value of reference.

Food selectivity was evaluated through the number of food items according to the dietary intake. Food items were counted regardless of their food groups (e.g. milk and cheese were counted as two items) and the specific food preparations were considered as one item.

2.5. Behavior pediatrics feeding assessment scale

The Behavior Pediatrics Feeding Assessment Scale (BPFA) is a widely parent-report measure of intake and feeding behavior. Consists of 35 items (25 questions about child behavior and 10 questions about parents' attitude and behavior). Greater scores indicate higher levels of problematic mealtime and feeding behavior throughout 5 factors (picky eaters, toddlers refusal – general, toddlers refusal – texture foods, older children refusal – general, stallers) (Crist and Napier-Phillips, 2001). This questionnaire also evaluates parents' or caregivers feelings about strategies for dealing with eating problems.

In addition, a recent study proposed a three factors model (food acceptance, medical/oral motor and mealtime behavior) to analyze BPFA as a methodology for children with ASD (Allen et al., 2015). Therefore, we used this model to describe feeding behavior in ASD children.

2.6. Statistical analyzes

All the analysis were conducted using the Statistical Package for Social Sciences 21.0 (SPSS® Inc, Chicago, IL). The data were showed in mean ± standard deviation or median (interquartile range). Comparisons between children with ASD and controls were made using paired Student *t*-test or Mann-Whitney for continuous variables and chi-square test for categorical variables. A p-value of 5% was set for statistical significance.

3. Results

3.1. The sample characterization

Forty-nine males with ASD and matched controls were included; the mean age was 10.06 ± 3.82 and 10.02 ± 2.83 years, respectively. The median age of onset of symptoms was 1.5 years (0–7) for ASD children.

The nutritional status of our sample is shown in Table 1. Most ASD and controls were classified as adequate according to height-to-age; in contrast, according to BMI-to-age, the ASD group presented an association with obesity and controls with adequate

Table 1
Classification according to WHO through z-score for anthropometric data*.

Variable	Controls n (%)	ASD n (%)	p value
Height-for-age			
Adequate height-for-age	46 (93.87)	41 (83.67)	0.734
Low height-for-age	3 (6.12)	8 (16.32)	
BMI-for-age			
Thinness	3 (6.12)	11 (22.44)	0.032
Adequate	**25 (51.02)**	15 (30.61)	
Overweight	12 (24.48)	5 (10.20)	
Obesity	9 (18.36)	**18 (36.73)**	

ASD: Autism spectrum disorder. BMI:Body mass index.
Bold value indicates the association (*chi square test*).
* Height/age (n = 49) and BMI/age (n = 40), according to WHO (2009).