

Mealtime feeding behaviors and gastrointestinal dysfunction in children with classic autism compared with normal sibling controls

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Received 1 December 2011; revised 2 March 2012; accepted 20 March 2012

ABSTRACT

Introduction: We compared the frequency and duration of specific mealtime behaviors and GI dysfunction in children with classic autism to typically-developing siblings. **Survey Method:** A 41-item on-line parent survey. **Statistics:** Chi square and binomial logistical regression. **Results:** 79 children with classic autism matched with a normally-developing sibling. **Logistic Regression Analysis Revealed:** Dislike of new foods and bizarre mealtime mannerisms, were more frequent in those with classic autism ($p < 0.01$). They also had higher odds ratio of constipation and fecal incontinence ($p < 0.01$). 40% of children with classic autism had been on GFCF diets ($p < 0.01$). Only 1% of those children on a gluten-free diet had a biopsy-proven diagnosis of celiac disease. **Conclusion:** Children with classic autism had more frequent dislike of new foods, bizarre mealtime behaviors, constipation, and fecal incontinence.

Keywords: Classic Autism; Feeding Behaviors; GI Dysfunction

1. INTRODUCTION

Autistic spectrum disorder (ASD) is a group of neurodevelopmental disorders that includes three major subgroups: Asperger syndrome, pervasive developmental disorder-not otherwise specified (PDD-NOS) which is the most common and has the least precise diagnostic criteria, and classical autism [1,2]. It is estimated that 1 in 110 children in the US and Canada has a diagnosis of ASD [3].

Although opinions differ, a majority of published studies on the subject of childhood autism and gastrointestinal problems report higher rates of feeding problems and GI dysfunction in children with ASD [4-13]. A recent study comparing 48 children (3 to 12 years old) with

ASD, to their matched siblings found that the ASD group had a mean of 13 eating problems, with lack of food variety predomination while the sibling group had a mean of 5 eating problems [11]. Older children tended to have fewer problems than younger children.

Feeding problems include selective food avoidance behaviors and idiosyncratic and entrenched food preferences (selective eating) based on food texture, color, smell, and presentation. These problems, if unchecked in children with ASD, sometimes lead to unbalanced diets, dietary deficiencies, poor weight gain, and infrequently, failure to thrive [6]. The Brief Autism Mealtime Behavior Inventory (BAMBI) [14] and the Screening Tool of Feeding Problems applied to children (STEP-CHILD) [15] were designed to measure mealtime behavior problems observed in children.

GI dysfunction disorders include dysphagia, gastrointestinal reflux (GER), constipation, withholding stool, and fecal incontinence [9].

In 2011, investigators from the University of California in Sacramento and Los Angeles reported that 249 children on the autism spectrum had significantly more GI problems (42%) than 163 siblings (12%). This study was registry-based and the investigators conducted in-home structured medical history interviews by parent recall. Those children with classic autism had increased odds of having GI problems compared to less severely affected children with ASD [12].

Only a few studies provided important semi-quantitative data on the duration and frequency of GI complaints.

In contradistinction to those studies that found a positive relationship between children diagnosed with ASD and gastrointestinal dysfunction, analysis of a database of 211,480 children from the United Kingdom found no difference in gastrointestinal complaints in 96 children diagnosed with ASD compared with 449 nested controls [4]. Except for an increase in symptoms of constipation and unusual feeding behaviors such as food selectivity, investigators from the Mayo Clinic also found no significant

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associations were found between autism case status and overall incidence of gastrointestinal symptoms or any other gastrointestinal symptom category [17]. A recent Australian study concluded that children with early gastrointestinal problems were no more likely to be represented in the upper quartile of scores on the Autism Spectrum Quotient (AQ) scales [18].

The purpose of this investigational survey was to compare the prevalence of feeding difficulties and GI dysfunction in children with classic autism with their typically-developing siblings.

2. METHODS

This was a cross-sectional online survey recruiting parents predominantly from the United States and Canada. The survey instrument was designed by authors and included 41 questions pertaining to demographics, family income, developmental milestones, feeding behavior, meal preferences, and GI dysfunction at the time when the child was between ages of 3 and 12 years (see appendix for copy of survey). The survey contained two mirror-image questions displayed side-by-side—the left-hand questions for the child with ASD, and the mirror image right-hand questions for a typically developing sibling. Both parts contained the same 41 questions, with the exception of the question pertaining to ASD diagnosis. The anonymous and confidential survey was securely posted online at a commercial survey website <http://www.formsite.com> (Vroman Systems Inc., Chicago, IL). For this manuscript we eliminated completed surveys from parents of children with Asperger syndrome or PDD-NOS and those with dual diagnosis of Down syndrome and ASD. Every child with classic autism was required to be diagnosed by a psychiatrist, neurologist, general pediatrician, developmental pediatrician, primary care family physician, or clinical psychologist. The link to the survey https://fs19.formsite.com/vbadalyan/form977322282/secure_index.html was emailed to a contact person at national, regional, state, and large city autism support groups. The survey link contained a statement about the purpose of the survey, assurance that participation was voluntary, information on risks and benefits, and contact information on study investigators and the IRB officer. If a parent had several typically developing children in addition to a child with ASD, he/she was asked to select the sibling closest by age to the ASD child and to complete the other part of the survey on the basis of that child's experience.

The drafts of the survey were pre-tested on 10 parents who had a child on the autism spectrum. The purpose of our survey and the survey instrument itself were reviewed by a small group of specialists in developmental/behavioral pediatrics, pediatric neurology, and pediatric

gastroenterology. The study design and survey instrument were approved by Inova Fairfax Hospital Institutional Review Board (IRB).

2.1. Definitions Used for This Study

A child was defined as having autism if the parent indicated so in the survey and if the diagnosis had been made by a primary care physician, psychologist, or psychiatrist. All participating children had symptoms of serious developmental delay in language and communication, social interaction, and bizarre mannerisms representative of children with classic autism. We did not confirm the diagnosis of classic autism or feeding problems by further testing. We categorized the frequencies of feeding behavior and GI dysfunction into “Never,” “Rarely” (less than 10% of the time), “Sometimes” (10% - 50% of the time), and “Often” (more than 50% of the time).

“Diarrhea” was defined as passing at least three watery, unformed stools in a day. “Constipation” was defined as hard or painful stools passed less than three times per week. “Pica” was defined as the ingestion of unusual non-food items such as dirt or string.

2.2. Statistical Methods

Data were analyzed using SPSS version 16 (SPSS Inc. Chicago, IL). Pearson's chi square test was conducted for nominal variables, and t-test was used for numerical variables. Binomial logistic regression was conducted, with socio-demographic, autism, and developmental milestones as independent variables and feeding and GI variables substituted one-by-one for the dependent variable.

3. RESULTS

Completed evaluable survey responses were received for 79 children with classical autism and their 79 typically developing siblings. Seventy-three percent of responses were from the United States, 11% were from Canada, and 10% were from New Zealand.

Boys comprised 90% of the autism group and 56% of the sibling group. The mean age at time of diagnosis was 3.1 years for the autism group (**Table 1**). The child's average age at the time the survey was completed was 8.2 years in the autism group and 8.9 years in the control group.

Sixty-three percent of the parent responders reported that their household income in 2008 exceeded \$50,000 per year.

The case and control groups differed significantly with respect to prevalence of frequent problematic feeding behaviors, including unusual food preferences (e.g., specific food colors, shapes, textures, presentation, or specific arrangement of food on the plate), insistence on

eating food with specific utensils/dishes, dislike of new foods, fear of new foods, poor mealtime social behavior, unusual posturing during meals, and oral motor problems. No statistically significant differences between the two groups were noted with respect to eating nonfood items (pica) or poor school mealtime behaviors (**Table 2**).

There were significant differences between the two groups in with respect to the frequency of GI dysfunction, including constipation, soiling, diarrhea, and failure to thrive. Children with classic autism did not differ significantly from their sibling controls in rates of vomiting, abdominal pain, reflux, or dysphagia (**Table 3**).

Significant differences were reported between the two groups with respect to rates of food allergies (most of

which were not confirmed by skin prick tests, ImmunoCAP-RAST serological tests, or food challenge tests) and special diets (**Table 4**).

Controlling for key variables, including age, gender, developmental milestones (spoon-fed before age of 3, toilet-trained before age of 4), presence of a medical problem, food allergies, and being on a special diet (gluten-free, Feingold, carbohydrate-free, soy-free), a logistic regression was conducted to estimate the association of autism with increased frequency of feeding problems (defined as problems occurring > 50% of the time). Having autism was statistically significantly associated with an increased frequency of unusual food preferences (**Table 5**).

Table 1. Demographic characteristics of cases and controls.

	Controls		Cases		note
	N	%	N	%	
Females	34	44%	8	10%	a
Males	44	56%	71	90%	a
Age, mean (years)	8.9	7.6 - 10.3	8.2	7.1 - 9.2	NS
Age at diagnosis, mean (years)			3.1	2.7 - 3.5	
Reside in USA	58	73%	58	73%	
Reside in Canada	9	11%	9	11%	
Income > \$50,000/year	50	63%	50	63%	
Medicaid	8	10%	26	33%	a

Note: a: chi square statistically significant at $p < 0.01$ level; b: chi square statistically significant at $p < 0.05$ level; NS: not statistically significant.

Table 2. Prevalence of problematic feeding behavior among cases and controls.

	Controls		Cases		Notes
	N	%	N	%	
Unusual food preferences	4	5%	40	51%	a
Dislike of new foods	7	9%	37	47%	a
Fear of new foods	15	19%	48	61%	a
Insistence of specific presentation	8	10%	23	29%	a
Unusual mealtime mannerisms	4	5%	70	89%	a
Oral motor problems	6	8%	16	20%	b
Pica (defined on survey)	6	8%	9	11%	NS
Mealtime posturing	6	8%	15	19%	b
Poor home mealtime behavior	5	6%	30	38%	a
Poor school mealtime behavior	6	8%	10	13%	NS

Note: a: chi square statistically significant at $p < 0.01$ level; b: chi square statistically significant at $p < 0.05$ level; NS: not statistically significant.

Table 3. Prevalence of gastrointestinal problems among cases and controls.

	Controls		Cases		Notes
	N	%	N	%	
Vomiting	11	14%	6	8%	NS
Abdominal pain	7	9%	11	14%	NS
Constipation	13	16%	28	35%	a
Fecal incontinence	10	13%	34	43%	a
Diarrhea	6	8%	15	19%	b
Gastroesophageal Reflux	10	13%	17	22%	NS
Failure to thrive	6	8%	18	23%	a
Dysphagia	7	9%	6	8%	NS
Celiac disease	0	0%	1	1%	NS
Eosinophilic esophagitis	0	0%	1	1%	NS
Taking GI medication	13	16%	37	47%	a
Food allergy	14	18%	32	41%	a
Dietary restriction	15	19%	41	52%	a

Note: a: chi square statistically significant at $p < 0.01$ level; b: chi square statistically significant at $p < 0.05$ level; NS: not statistically significant.

Table 4. Prevalence of food allergies and restricted diets among cases and controls.

	Controls		Cases		Notes
	N	%	N	%	
At least one food allergy	14	18%	32	41%	a
Milk allergy	9	11%	24	30%	a
Wheat	3	4%	19	24%	a
Yeast	1	1%	10	13%	a
At least one special diet	15	19%	41	52%	a
Dairy free	13	16%	38	48%	a
Gluten free	3	4%	32	41%	a
Soy free	5	6%	16	20%	a

Note: a: chi square statistically significant at $p < 0.01$ level; b: chi square statistically significant at $p < 0.05$ level; NS: not statistically significant.

Table 5. Odds ratios of exhibiting problematic mealtime behavior among children with autism compared to their typically developing siblings.

Behavior	OR	95% CI	note
Unusual food preferences	5.6	1.4 - 22.5	b
Dislike of new foods	4.5	1.3 - 16.3	b
Fear of new foods	10.4	3.1 - 34.6	a
Insistence of specific presentation	2.2	0.6 - 8.3	NS
Strange Table Mannerisms	57.6	12.7 - 261.3	a
Oral motor problems	2.6	0.5 - 13	NS
Pica	0.4	0.1 - 2.7	NS
Mealtime posturing	1.1	0.2 - 7.6	NS
poor mealtime behavior	3.9	0.8 - 18.2	NS
poor school mealtime behavior	0.5	0.1 - 3.7	NS

Using similar models, we substituted the dependent variable with each of the problematic feeding behaviors. We determined that some abnormal feeding behaviors were associated with autism (**Table 5**). After we had controlled for other variables, differences in insistence on specific food presentation, oral motor problems, posturing, and poor mealtime behavior ceased to achieve statistical significance.

We controlled for age, gender, and dietary restriction, to identify the impact of autism on differences in GI dysfunction between the two groups (**Table 6**).

4. DISCUSSION

The survey is based on a convenience sample of parents who were members of varied national, regional, state, and large city parent autism support groups. We agree that on-line surveys tend to capture respondents who have strong opinions on the subject, those with higher socioeconomic status, and those who are computer literate. Parents who responded to the survey may have been the most motivated by concerns about feeding issues or GI dysfunction with their children on the autism spectrum which can bias the results of a survey-based study. The strength of such a study is the greater geographic representation of survey participants, including capture of children with classic autism from small towns throughout the USA.

Is the diagnosis of classic autism accurate? The ratio of 9:1, boys:girls in our study is consistent with the expected sex ratio range of autistic children to their normally developing siblings. We are convinced that middle-class parents of children with autism, such as those that we included in our survey, consulted large city and

state resources. Specialists in pediatric psychiatry, neurology, and developmental medicine were consulted by the majority of parents who responded to our survey. Parents also joined local, state, and national autism support groups. Children with classic autism had more severe disabilities in communication, language, socialization, compared to their sibling control and to children with less severe manifestations of autism such as Asperger syndrome [10]. We chose to exclude a standardized diagnostic test for classic autism in order to limit the time required to complete the questionnaire to less than 30 minutes. The inclusion of such a questionnaire such as Gilliam would have lengthened the survey to one hour. We recognize that some researchers in autism are likely to criticize this study because the diagnosis of autism may not have been made by standardized testing.

Some advantages of our study include 1) Inclusion of specific questions on specific developmental and social milestones and bizarre behaviors and insistence on professionally-diagnosed ASD; 2) Age-matched sibling controls; 3) Geographic distribution (no state contributed more than 30% of the US total); and 4) Large number of responses from families in small towns and cities in the United States and Canada.

We included questions about mealtime mannerisms and behaviors and specific G.I. dysfunction when children were between age 3 and 12 years. This age range was chosen by us for two reasons. Prior to the child's third birthday, classic autism may be initially classified as pervasive developmental disorder-NOS. Feeding patterns and behaviors of children change often before the age of 3 but afterward remain relatively stable until adolescence.

Table 6. Odds ratios of having gastrointestinal problems among children with autism compared to their typically developing siblings.

Gastrointestinal problem	OR	95% CI	note
Vomiting			NS
Abdominal pain			NS
Constipation	2.8	1.1 - 6.8	b
Fecal incontinence	6.3	2.4 - 16.5	b
Diarrhea			NS
Reflux			NS
Failure to thrive			NS
Dysphagia			NS
Celiac disease			NS
Eosinophilic esophagitis			NS
Intestinal pathology			NS
Taking GI medication	3	1.2 - 7.2	a
At least 1 food allergy			NS
At least 1 restricted diet	5.2	2.3 - 11.5	a

Previous surveys on this subject have limitations in study design. The well-regarded study from the Mayo Clinic was limited to children diagnosed with ASD who lived in Olmstead County, MN [17]. Information, culled from records of primary care physicians, was not provided whether the G.I. complaints of autistic children in the Mayo study were acute or chronic and we are not told if the problems were mild and transient or severe. Like those in the Mayo Clinic study, children with autism in our survey were more likely than their siblings to have feeding disorders, food selectivity, and constipation [17]. There was no increase in celiac disease in children with autism who resided in Rochester, MN and we also found no difference in this survey.

A multidisciplinary panel of experts recently reviewed the medical literature on the diagnostic evaluation and management of G.I. problems in children with ASD (20). Statement 12 of their consensus notes: "available research data do not support the use of a casein-free diet, a gluten-free diet, or combined gluten-free, casein-free (GFCF) diet as a primary treatment for individuals with ASDs" [19]. In our survey, more than 40% of children with classic autism had been on (or currently are on) casein-free, gluten-free, or GFCF diets, which is statistically significant ($p < 0.01$) compared to the sibling control group. Only 1% of those children on a gluten-free diet had a biopsy-proven diagnosis of celiac disease.

5. CONCLUSION

Children between the ages of 3 and 12 years with autism have a higher prevalence of selected abnormal feeding behaviors and GI problems compared with their typically-developing siblings. These behaviors include strange table mannerisms, fear of trying new foods, constipation, and fecal incontinence. More than 40% of children with classic autism had been on gluten-free, or GFCF diets. This is statistically significant ($p < 0.01$), compared to the sibling control group. Only 1% of those children on a gluten-free diet had a biopsy-proven diagnosis of celiac disease.

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APPENDIX

Survey Instrument

****SURVEY OF FEEDING AND OTHER DIGESTIVE PROBLEMS IN CHILDREN WITH AUTISM SPECTRUM DISORDERS**

By filling out the following survey, you can help pediatricians and other health professionals learn more about certain problems in children with autism spectrum disorders (ASDs). Such problems include unusual food preferences; aversion to certain food colors, textures, and types; ingestion of non-food items; very restricted choices of foods; special diets; sensory processing disorders; oral-motor swallowing problems; vomiting, diarrhea, or constipation; and symptoms of gastroesophageal reflux (GERD) and its complications, such

as erosive esophagitis, and food allergies.

Questions in Column “A” pertain to your child with ASD when he/she was ages 3 - 12 years, even if he/she is older now. In Column “B”, we ask the same questions for a sibling of your ASD child, closest to him/her in age. Please check the applicable box below and follow the instructions.

<input type="checkbox"/> I have at least one child with ASD and at least one child who is ASD-free	→	Complete both columns “A” and “B”
<input type="checkbox"/> I have at least one child with ASD, and no children who are ASD-free	→	Complete column “A” only
<input type="checkbox"/> I have no children with ASD, and at least one child who is ASD-free	→	Complete column “B” only

Please FILL IN the blanks or CHECK the best choice of the following questions:

	Column A Child with Autism Spectrum Disorder	Column B Child without Autism Spectrum Disorder (control child)
1. Please provide the last 4 digits of your phone number for tracking purposes.	_ _ _ _	_ _ _ _
2. City and state of your home		
3. Current age and gender of your child	___years <input type="checkbox"/> Male <input type="checkbox"/> Female	___years <input type="checkbox"/> Male <input type="checkbox"/> Female
4. What is your child’s diagnosis? <i>(Please check all that apply)</i>	a <input type="checkbox"/> Autism b <input type="checkbox"/> Pervasive developmental disorder, NOS c <input type="checkbox"/> Sensory integration disorder d <input type="checkbox"/> Asperger syndrome e <input type="checkbox"/> Static encephalopathy f <input type="checkbox"/> Other (please specify) _____	Child without Autistic Spectrum Disorder → Proceed to the next question
5. Age at the time of diagnosis	_____ years	Child without Autistic Spectrum Disorder → Proceed to the next question

	Column A Child with Autism Spectrum Disorder	Column B Child without Autism Spectrum Disorder (control child)
6.	Was the diagnosis made by a child neurologist, child psychiatrist, psychologist, general pediatrician, family physician, or developmental pediatrician? a <input type="checkbox"/> Yes b <input type="checkbox"/> No (who diagnosed your child? ____) c <input type="checkbox"/> Uncertain	Child without Autistic Spectrum Disorder → Proceed to the next question
7.	Check all that apply to your child a <input type="checkbox"/> Met developmental milestones b <input type="checkbox"/> Speaking and understanding appropriately by 4 years of age. c <input type="checkbox"/> Never spoke fluently d <input type="checkbox"/> Difficulty with sustained meaningful interactive play with same-age child by the age of 4 years e <input type="checkbox"/> Unusual mannerisms or demanding same routine over and over	a <input type="checkbox"/> Met developmental milestones b <input type="checkbox"/> Speaking and understanding appropriately by 4 years of age. c <input type="checkbox"/> Never spoke fluently d <input type="checkbox"/> Difficulty with sustained meaningful interactive play with same-age child by the age of 4 years e <input type="checkbox"/> Unusual mannerisms or demanding same routine over and over
8.	Does (did) your child have any of the following neurological/developmental/genetic conditions? (<i>Please check all that apply</i>) a <input type="checkbox"/> Seizures b <input type="checkbox"/> Down syndrome c <input type="checkbox"/> Hearing disability d <input type="checkbox"/> Mental retardation e <input type="checkbox"/> Other (please specify) _____ f <input type="checkbox"/> Not applicable	a <input type="checkbox"/> Seizures b <input type="checkbox"/> Down syndrome c <input type="checkbox"/> Hearing disability d <input type="checkbox"/> Mental retardation e <input type="checkbox"/> Other (please specify) _____ f <input type="checkbox"/> Not applicable
9.	Does (did) your child have any other medical conditions? a <input type="checkbox"/> Yes (please specify _____) b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Yes (please specify _____) b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain
10.	At what age did your child learn to use spoon/fork? ____ years <input type="checkbox"/> not yet using spoon / fork	____ years <input type="checkbox"/> not yet using spoon / fork
11.	Restricted diet at ages 3 - 12 years? (<i>Please check all that apply</i>) a <input type="checkbox"/> Gluten-free b <input type="checkbox"/> Soy-free c <input type="checkbox"/> Dairy d <input type="checkbox"/> (casein)-free e <input type="checkbox"/> Carbohydrate diet f <input type="checkbox"/> Candida diet g <input type="checkbox"/> Feingold diet h <input type="checkbox"/> Rotation diet i <input type="checkbox"/> No j <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Gluten-free b <input type="checkbox"/> Soy-free c <input type="checkbox"/> Dairy d <input type="checkbox"/> (casein)-free e <input type="checkbox"/> Carbohydrate diet f <input type="checkbox"/> Feingold diet g <input type="checkbox"/> Rotation diet h <input type="checkbox"/> No i <input type="checkbox"/> Uncertain
12.	Duration of typical dinnertime with family at ages 3 - 12 years? a <input type="checkbox"/> ≤30 minutes b <input type="checkbox"/> 31 - 45 minutes c <input type="checkbox"/> 46 - 60 minutes d <input type="checkbox"/> 61 - 90 minutes e <input type="checkbox"/> >90 minutes	a <input type="checkbox"/> ≤30 minutes b <input type="checkbox"/> 31 - 45 minutes c <input type="checkbox"/> 46-60 minutes d <input type="checkbox"/> 61 - 90 minutes e <input type="checkbox"/> >90 minutes
13.	Marked preference for specific food colors, shapes, textures, presentation, or specific arrangement of food on the plate at ages 3 - 12 years? (<i>please answer both Frequency and Duration headings</i>) Frequency a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain Duration a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	Frequency a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain Duration a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain
14.	Insistence on eating with specific utensils/dishes at ages 3 - 12 years? (<i>please answer both Frequency and Duration headings</i>) Frequency a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain Duration a <input type="checkbox"/> Never b <input type="checkbox"/> < 6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> > 1 year e <input type="checkbox"/> Uncertain	Frequency a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain Duration a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain
15.	Marked aversion/fear of specific food colors, shapes, textures, presentation, or specific arrangement of food on the plate at ages 3 - 12 years? (<i>please answer both Frequency and Duration headings</i>) Frequency a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain Duration a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	Frequency a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain Duration a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain

		Column A Child with Autism Spectrum Disorder		Column B Child without Autism Spectrum Disorder (control child)		
		Frequency	Duration	Frequency	Duration	
16.	Fear of ingestion of new foods at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	
17.	Ingestion of non-food items, such as paper, string, dirt, hair, at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	
18.	Poor social mealtime behaviors (would not sit with family, temper tantrum during meal time, throwing food) at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	
19.	Behavior outbursts during school lunch, requiring intervention by the teacher or other school personnel at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	
20.	Eating at the same table with other children who do not have behavioral problems? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	
21.	Unusual posturing (neck or trunk turning/bending/arching) during or after meals at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	
22.	Oral-motor coordination problems (difficulty moving solid food inside mouth) at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	
23.	At what age did your child get toilet training for daytime bowel movements? _____ years <input type="checkbox"/> Not yet toilet trained			_____ years <input type="checkbox"/> Not yet toilet trained		
24.	Vomiting at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> Rarely (<10%) c <input type="checkbox"/> Sometimes (10% - 49%) d <input type="checkbox"/> Often (>50%) e <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Never b <input type="checkbox"/> <6 months c <input type="checkbox"/> 6 months - 1 year d <input type="checkbox"/> >1 year e <input type="checkbox"/> Uncertain	

		Column A Child with Autism Spectrum Disorder				Column B Child without Autism Spectrum Disorder (control child)			
25.	Diarrhea (more than 3 watery bowel movements per day) at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	<u>Frequency</u>		<u>Duration</u>		<u>Frequency</u>		<u>Duration</u>	
		a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never
		b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months	b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months
		c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year	c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year
		d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year	d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year
		e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain
26.	Constipation (more than 3 days between bowel movements) at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	<u>Frequency</u>		<u>Duration</u>		<u>Frequency</u>		<u>Duration</u>	
		a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never
		b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months	b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months
		c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year	c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year
		d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year	d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year
		e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain
27.	Soiling in underpants or withholding stool? <i>(please answer both Frequency and Duration headings)</i>	<u>Frequency</u>		<u>Duration</u>		<u>Frequency</u>		<u>Duration</u>	
		a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never
		b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months	b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months
		c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year	c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year
		d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year	d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year
		e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain
28.	Inadequate/under weight or failure to thrive at ages 3 - 12 years?	a	<input type="checkbox"/> Yes	a	<input type="checkbox"/> Yes	a	<input type="checkbox"/> Yes	a	<input type="checkbox"/> Yes
		b	<input type="checkbox"/> No	b	<input type="checkbox"/> No	b	<input type="checkbox"/> No	b	<input type="checkbox"/> No
		c	<input type="checkbox"/> Uncertain	c	<input type="checkbox"/> Uncertain	c	<input type="checkbox"/> Uncertain	c	<input type="checkbox"/> Uncertain
29.	Difficulty swallowing solid food at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	<u>Frequency</u>		<u>Duration</u>		<u>Frequency</u>		<u>Duration</u>	
		a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never
		b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months	b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months
		c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year	c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year
		d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year	d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year
		e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain
30.	Reflux/indigestion/GERD/esophagitis at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	<u>Frequency</u>		<u>Duration</u>		<u>Frequency</u>		<u>Duration</u>	
		a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never
		b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months	b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months
		c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year	c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year
		d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year	d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year
		e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain
31.	If you selected "b", "c", or "d" in the previous question, what tests did your child have a test to confirm Reflux/indigestion/GERD/esophagitis at the age of 3 - 12 years? <i>(please check all that apply)</i>	a	<input type="checkbox"/> Barium swallow	f	<input type="checkbox"/> Other _____	a	<input type="checkbox"/> Barium swallow	f	<input type="checkbox"/> Other _____
		b	<input type="checkbox"/> pH probe	b	<input type="checkbox"/> pH probe	b	<input type="checkbox"/> pH probe	b	<input type="checkbox"/> pH probe
		c	<input type="checkbox"/> Endoscopy	g	<input type="checkbox"/> No tests	c	<input type="checkbox"/> Endoscopy	g	<input type="checkbox"/> No tests
		d	<input type="checkbox"/> Biopsy	h	<input type="checkbox"/> Not applicabl.	d	<input type="checkbox"/> Biopsy	h	<input type="checkbox"/> Not applicabl.
		e	<input type="checkbox"/> Videofluoroscopy	i	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Videofluoroscopy	i	<input type="checkbox"/> Uncertain
32.	Food allergies at ages 3 - 12 years? <i>(please check all that apply)</i>	a	<input type="checkbox"/> Milk	e	<input type="checkbox"/> Yeast	a	<input type="checkbox"/> Milk	e	<input type="checkbox"/> Yeast
		b	<input type="checkbox"/> Eggs	f	<input type="checkbox"/> Corn	b	<input type="checkbox"/> Eggs	f	<input type="checkbox"/> Corn
		c	<input type="checkbox"/> Citrus	g	<input type="checkbox"/> Other _____	c	<input type="checkbox"/> Citrus	g	<input type="checkbox"/> Other _____
		d	<input type="checkbox"/> Wheat	h	<input type="checkbox"/> No allergies	d	<input type="checkbox"/> Wheat	h	<input type="checkbox"/> No allergies
				i	<input type="checkbox"/> Uncertain	i	<input type="checkbox"/> Uncertain	i	<input type="checkbox"/> Uncertain
33.	Abdominal pain requiring a doctor visit at ages 3 - 12 years? <i>(please answer both Frequency and Duration headings)</i>	<u>Frequency</u>		<u>Duration</u>		<u>Frequency</u>		<u>Duration</u>	
		a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never	a	<input type="checkbox"/> Never
		b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months	b	<input type="checkbox"/> Rarely (<10%)	b	<input type="checkbox"/> <6 months
		c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year	c	<input type="checkbox"/> Sometimes (10% - 49%)	c	<input type="checkbox"/> 6 months - 1 year
		d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year	d	<input type="checkbox"/> Often (>50%)	d	<input type="checkbox"/> >1 year
		e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain	e	<input type="checkbox"/> Uncertain

	Column A Child with Autism Spectrum Disorder	Column B Child without Autism Spectrum Disorder (control child)
34.	Celiac disease, proven by blood tests or by intestinal biopsy at ages 3-12 years? a <input type="checkbox"/> Yes b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Yes b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain
35.	Eosinophilic esophagitis proven by biopsy at ages 3 - 12 years? a <input type="checkbox"/> Yes b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Yes b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain
36.	Diseases of small or large intestine at ages 3 - 12 years? a <input type="checkbox"/> Yes b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain	a <input type="checkbox"/> Yes b <input type="checkbox"/> No c <input type="checkbox"/> Uncertain
37.	Medications for gastrointestinal problems that your child took for at least 1 month at ages 3 - 12 years <i>(check all that apply)</i> a <input type="checkbox"/> Zantac b <input type="checkbox"/> Pepcid c <input type="checkbox"/> Prevacid d <input type="checkbox"/> Prilosec e <input type="checkbox"/> Flagyl f <input type="checkbox"/> Laxatives (e.g. Miralax, Milk of Magnesia, etc.) g <input type="checkbox"/> Other _____ h <input type="checkbox"/> Not applicable	a <input type="checkbox"/> Zantac b <input type="checkbox"/> Pepcid c <input type="checkbox"/> Prevacid d <input type="checkbox"/> Prilosec e <input type="checkbox"/> Flagyl f <input type="checkbox"/> Laxatives (e.g. Miralax, Milk of Magnesia, etc.) g <input type="checkbox"/> Other _____ h <input type="checkbox"/> Not applicable
38.	Who did your child see for his/her gastrointestinal problems at ages 3 - 12 years? <i>(check all that apply)</i> a <input type="checkbox"/> Gastroenterologist b <input type="checkbox"/> Dietician c <input type="checkbox"/> Nutritionist d <input type="checkbox"/> Homeopathic practitioner e <input type="checkbox"/> Integrative medicine specialist f <input type="checkbox"/> Herbalist g <input type="checkbox"/> Other (please specify): _____	a <input type="checkbox"/> Gastroenterologist b <input type="checkbox"/> Dietician c <input type="checkbox"/> Nutritionist d <input type="checkbox"/> Homeopathic practitioner e <input type="checkbox"/> Integrative medicine specialist f <input type="checkbox"/> Herbalist g <input type="checkbox"/> Other (please specify): _____
39.	Is your child on Medicaid? <input type="checkbox"/> yes <input type="checkbox"/> no	<input type="checkbox"/> yes <input type="checkbox"/> no
40.	Estimate the total out-of-pocket (medical, drug, education, P.T., O.T., and speech therapy) expenditures in the year 2012 for your ASD child. a <input type="checkbox"/> Less than \$1,000 b <input type="checkbox"/> \$1,000 - \$5000 c <input type="checkbox"/> \$6,000 - \$10,000 d <input type="checkbox"/> \$11,000 - \$25,000 e <input type="checkbox"/> >\$25,000	a <input type="checkbox"/> Less than \$1,000 b <input type="checkbox"/> \$1,000 - \$5000 c <input type="checkbox"/> \$6,000 - \$10,000 d <input type="checkbox"/> \$11,000 - \$25,000 e <input type="checkbox"/> >\$25,000
41.	What is your total household income? a <input type="checkbox"/> Less than \$25,000 b <input type="checkbox"/> \$25,000 - \$50,000 c <input type="checkbox"/> \$50,000 - \$75,000 d <input type="checkbox"/> >\$75,000	a <input type="checkbox"/> Less than \$25,000 b <input type="checkbox"/> \$25,000 - \$50,000 c <input type="checkbox"/> \$50,000 - \$75,000 d <input type="checkbox"/> >\$75,000

THANK YOU VERY MUCH FOR YOUR TIME AND EFFORT.
If you would like to receive a summary of these survey results, please write in your e-mail address _____.