GAVIN PUBLISHERS

# Archives of Pediatrics

Margarita Stankova and Polina Mihova. J Arch Pedia 2: JPED-105.

DOI:10.29011/2575-825X.100005

Research Article

# Gastrointestinal Symptoms, Food Selectivity and Food Refusal in Children with ASD

**Margarita Stankova* and Polina Mihova**

Health care and Social work Department,New Bulgarian University, Sofia, Bulgaria.

***Corresponding author:** Stankova M, Health Care and Social work Department,New Bulgarian University, Sofia, Bulgaria. Tel: ++359888996114,++35928110588,Email : mstankova@nbu.bg

**Citation:** Stankova M and Mihova P (2017) Gastrointestinal symptoms, food selectivity and food refusal in children with ASD. J Arch Pedia 2: 105. DOI:10.29011/2575-825X.100005

**Received Date:** 23 November, 2016; **Accepted Date:** 10 January, 2017; **Published Date:** 19 January, 2017

**Abstract:**

**Background:** The research on gastrointestinal symptoms in children with autistic spectrum disorders (ASD) could lead to a better understanding of the etiology, occurrence and therapy. The implementation of an integrated therapy approach requires a careful investigation of all the aspects of that disorder.

**Aims:** The study compared parents' reports of gastrointestinal symptoms and eating behaviors, food selectivity and food refusal of children with ASD and children with typical development.

**Material and Methods:** Review of the medical records, clinical observation and structured interview had been used in the study. The interview included three parts – developmental history, medical history, family history, and questions about gastrointestinal problems, questions related to eating behaviors, selection of specific foods, and selection of groups of foods, food refusal, grimaces and behavioral reactions towards foods.

**Results:** Results indicate that children with ASD had significantly more GI problems when compared to the controls group. Two of the symptoms, constipation and bloating, also showed significantly higher levels in the ASD group. Food selectivity was also found to be significantly prevalent among. Furthermore, the numbers of the children with ASD who grimace while eating or who behave differently when see, touch or taste a particular food were significantly higher than within the group of children with typical development . Finally, the refusal of every new food was found to be significantly higher in the group of the ASD children.

**Conclusion:** More research is needed on the biological mechanisms of ASD to detect and validate possible relationships between the symptoms of ASD and the manifestations of other disorders.

**Keywords:** Autistic spectrum disorders; Gastrointestinal symptoms; Food behaviors

## Introduction:

### Gastrointestinal symptoms in children with ASD

Gastrointestinal symptoms and eating behaviors in children with autism are a subject of interest because of the reported high rates of their manifestations, the potential link between the symptoms of autism and nutritional problems and just as importantly, because the possible etiological link can lead to opportunities for therapeutic interventions which will adversely affect the prognosis of the disorder. The most common gastrointestinal symptoms found in individuals with Autistic Spectrum Disorders (ASDs) are: chronic constipation, abdominal pain with or without diarrhea, and encopresis as a consequence of constipation. Other gastrointestinal abnormalities include – gastro esophageal reflux disease (GERD), abdominal bloating, and disaccharidase deficiencies,Buie, et al., 2010 [1]. The reported levels of available gastrointestinal symptoms in children with ASD vary widely which is probably due to many factors, including the heterogeneity of ASD, the criteria used for the diagnosis, the evaluation methods of the detection of the symptoms and their interpretation, when there is no option for direct observation. The assessment methods for the study of gastrointestinal symptoms range from medical records and documents of inpatient and outpatient treatments and examinations, questionnaires to the parents, and standardized interviews and observation. The disadvantage of the most of the studies is that the children who follow special diets usually are not separated from the children who eat regular food, and that in itself could change the reported

levels of the gastrointestinal symptoms and eating behaviors.

Some studies indicate a high rate of gastrointestinal symptoms in children with ASD – 91.4% of ASD patients suffered from gastrointestinal problems compared to 25% of the sibling group, Parracho, et. al., 2005 [2]. This study showed the following distribution of gastrointestinal symptoms in the ASD group - diarrhoea - 75.6%, excess wind - 55.2 %, abdominal pain - 46.6%, constipation - 44.8 % and abnormal faeces - 43.0%. Another study that used structured interview to three groups of children – autism, other developmental disabilities and typical development showed a history of gastrointestinal symptoms in 70% of children with ASD compared with 28% of children with typical development and 42% of children with Developmental disabilities. The same study found also higher food selectivity in children with ASD (60%) compared with those with typical development (22%) and Developmental disabilities (36%), Valicenti-McDermott, et al., 2006 [3]. Relatively high presence of gastrointestinal symptoms /76% of the autistic patients had at least one GI symptom as compared with 30% of the healthy siblings/ reported Horvath, & Perman, 2002 [4]. Most of the children with ASD (64%) in this study had two or more symptoms. Smith et al., 2009 [5] found that 35% of parents of the children with ASD had concerns about their child's bowels, compared with 4% of parents of mainstream children. The parents of the children with ASD also expressed concerns about the variety of food that their children consumed. As regards to the particular symptoms – diarrhea was the most common (27%), followed by - constipation (25%) and excessive flatulence (24%). It was noted that 18% of the children with ASD were following a specialized diet and had visited a dietician. Gorrindo et al. 2012 [6], found that functional constipation was the most common type of gastrointestinal disorder in children with ASD - 85.0%. They also reported that cases of constipation were associated with younger age, increased social impairment, and lack of expressive language.

The study of Wang et al. showed that parents reported significantly more gastrointestinal problems in children with ASD (42%) compared with their unaffected siblings (12%). The most common gastrointestinal problems in children with ASD were constipation and chronic diarrhea. This study also showed that the increased autism symptom severity was associated with higher odds of gastrointestinal problems, Wang et. al., 2011 [7].

Lower percent of children - 22.7% positive for gastrointestinal problems are reported in the study of Nikolov, et al., 2009 [8]. The children with gastrointestinal problems in this study were no different from subjects without gastrointestinal problems in autism symptom severity and showed greater symptom severity on measures of irritability, anxiety, and social withdrawal.

Some of the researchers find no differences in the prevalence of the gastrointestinal symptoms in the groups of the ASD children with emphasis on the food selectivity and eating behaviors or focusing on a single symptom. An interesting study found that 9% /9 of 96/ of children with a diagnosis of autism and 9% /41 of 449/ of children without autism had a history of gastrointestinal disorders /using the General Practice Research Database/, but the information concerned the time before the date of first recorded diagnosis of autism.Black, et. al., 2002 [9].

The study of Ibrahim et al. 2009 [10],didn't find significant association between autism case status and overall incidence of gastrointestinal symptoms,diarrhea,gastroesophageal reflux/vomiting, and abdominal bloating/discomfort/irritability.They found significant differences between autism cases and controls in the cumulative incidence by age 20 of constipation (33.9% versus 17.6%) and feeding issues/food selectivity (24.5 % versus 16.1%).

## Evaluation problems of Gastrointestinal symptoms in children with ASD

Many authors conclude that the methodologies used to study gastrointestinal symptoms in children with autism are problematic. One of those issues is the fact that many children are nonverbal. Outside the visible gastrointestinal symptoms, parents can sometimes suggest that children experience discomfort related to nutrition and digestion. Horvath, & Perman, 2002 [4] suggest that some of them can be associated with the demonstrations of sudden irritability manifested as unexplained crying and aggressiveness in these nonverbal children with autistic disorder. More than one third of the parents reported these symptoms in their children. Many individuals with ASD cannot express pain or discomfort, Buie, et. al., 2010 [1]. The language and speech disabilities in children can lead to difficulties in parental perception of pain in children. The insistence on sameness can lead to stereotyped diets with insufficient intake of fiber, liquid, and other ingredients in foods, which in turn can cause gastrointestinal problems. The other reason, which must be taken into account, is the side effects of medications, Kuddo, Nelson, 2003 [11].

## Selective eating and food refusal

Extreme faddy/picky eating that persists into middle childhood and beyond has been termed as selective eating.The key features of selective eating are a highly limited range of foods and extreme reluctance to try new foods. Selective eating can be defined as primary - the child was never weaned to a full range of foods and textures, and secondary - typically following a choking,gagging,or vomiting event,Bravender et al., 2007 [12].

Nicholls et al. 2001 [13], suggest the following criteria for primary selective eating:

a range of 10 foods or fewer;

- a normal range of foods for age has never been eaten;
- persistence over the age of 7, or developmental equivalent;

- avoidance or refusal of new foods;
- no physical illness sufficient to account for food avoidance.

Bandini, et al., 2010 [14] operationalize food selectivity to include three domains: 1) food refusal; 2) limited food repertoire; and 3) high frequency single food intake. These authors hypothesize that children with ASDs exhibit more food selectivity than typically developing children and food selectivity decline with age in typically developing children but is not associated with age in children with ASD.

Children with autism have significantly more feeding problems - 72% of the children with autism were reported to eat a narrow variety of foods. In the study of Kimberly, et. al., 2004 [15], parents reported their children with autism exhibited more feeding problems - refusing foods, requiring specific presentations of foods and specific utensils, eating only low texture foods, and eating a narrow variety of foods than children without autism.

Children with autism eat fewer foods within each food group than typically developing children. Many children have a preference for food or avoiding and refusing certain foods, especially in early childhood. Parents of young children often describe their children as "picky eaters", refusing to try or eat a variety of foods, but pickiness in children with ASD may be even more restrictive and may extend beyond the early childhood period,Cermak, et. al., 2009 [16].

Selective eating is a frequently detected symptom in children with ASD. Different models are trying to determine why these children select food to a greater extent than expected to children of the same age. These behaviors usually are attributed to a particular sensitivity /excessive sensitivity to strong taste, smell, color, temperature, texture/, fear of novelty /refusal to try foods that look different/ or repetative behaviors and rituals /desire for adherence to certain detail - color, smell, appearance/. Many of the children with ASD do not treat sensory input, particularly olfactory, auditory, visual, and tactile information in the same manner as their typically developing peers of the same age, Nadon, et. al., 2011 [17]. Nicholls, et al., 2001 [13] hypothesized that the selective eating in children with developmental disabilities can be attributed to rigidity of behaviour, and difficulty adjusting to new experiences, sensory integration difficulties, oromotor dyspraxia, mediated by difficulties with textures and swallowing discoordination and phobic anxiety.

Bandini et al. 2010 [14] found that children with ASD displayed more food refusal and exhibited a more limited food repertoire than did typically developing children.

Children with autism had significantly more feeding problems and chose a significantly narrower range of foods than children without autism, Schreck, et. al., 2004 [18]. This study found that 72% of children with autism eat a narrow variety of foods.

While discussing selective eating and food refusal one must take into account that both phenomena occur in children with ASD and in children with typical development. The experience of gastrointestinal symptoms can change the eating habits and some of the children with ASD follow special diets, which further complicates the profile of food behaviors.

## Materials and Methods

### Participants:

Children /n = 72/ with diagnosis of Childhood autism, Pervasive developmental disorder, unspecified and Pervasive developmental disorder not otherwise specified diagnosed according to ICD 10, aged 4-10 were eligible for this study. They were registered and included in a therapy program in one of the three special rehabilitation centers for children with ASD in Sofia. All the children had medical records and detailed assessment - medical, psychological and speech therapy and were assessed as appropriate to inclusion in specialized therapeutic programs. Further evaluation and observation - neurologic and psychiatric had been carried out to confirm the inclusion of the children in the group of ASD. Exclusion criteria were the following diagnoses - childhood disintegrative disorder, Rett syndrome, Neurofibromatosis, cerebral palsy. Three of the children followed special diets – milk-free and gluten-free and they were also excluded from the study.

The controls with typical development /n = 70/ were recruited from public schools and kindergartens. The controls with typical development were matched to subjects by age and sex.

The family history of any disease, including gastrointestinal, had been collected for the controls and for the ASD children.

All the children, included in the study were Caucasian and Bulgarian origin and families had no particular preference for a specific cuisine and special rituals of eating.

## Methods:

**Review of the medical record:** The information was used to confirm the diagnosis, a review of available medical examinations and genetic tests results that could be used as exclusion criteria, or a review of available information on family history.

**Clinical observation:** The children included in the study had a medical records and they had been examined in a clinical setting by experts - psychiatrist, clinical psychologist and speech therapist. All of the children had a medical history documented by the children's psychiatric clinic, diagnosis and recommendations for psychosocial rehabilitation. Clinical evaluation was realized by the criteria of ICD – 10 /Version 2016/ as following:

1. Childhood autism is considered as a type of pervasive developmental disorder defined by: (a) the presence of abnormal or impaired development that is manifest before the age of three years, (b) the characteristic type of abnormal functioning in all the three areas of psychopathology: reciprocal social interaction, communication, and restricted, stereotyped, repetitive behaviour and a range of other nonspecific problems can exist, such as phobias, sleeping and eating disturbances, temper tantrums, and (self-directed) aggression.
2. Pervasive developmental disorder, unspecified is defined as a disorder that fits the general description for pervasive developmental disorder but contradictory findings or lack of adequate information mean that the criteria for any of the other codes cannot be met.
3. Pervasive developmental disorder not otherwise specified classification is used when there is severe and pervasive impairment in the development of reciprocal social interaction associated with impairment in either verbal or nonverbal communication skills or with the presence of stereotyped behavior, interests, and activities, but the criteria are not met for a specific pervasive developmental disorder.

**Structured interview:** Parents of children with ASD and children with typical development were subjected to a structured interview that collects information on available gastrointestinal symptoms and eating behaviors. The parents answered questions about nutrition, gastrointestinal symptoms, eating behaviors of the children. The interview was constructed using information from literature and expert opinions about the symptoms reported in ambulatory examinations and regular treatments of children with ASD in day-center programs.

The interview included the following parts: First part - developmental history: pregnancy/birth history including birth weight, medical history – any history of illnesses, frequent infections of the upper respiratory tract, allergies to environment (e.g., pollen, dust, foods, medications), asthma, anemia, problems with weight gain, toilet training, language milestones, motor skills. Family history included: relatives with psychiatric diseases, relatives with gastrointestinal diseases, immune diseases and any other diseases.

The second part of the interview allowed the identification of the gastrointestinal problems – reflux, frequent vomiting, frequent abdominal pain, chronic constipation, diarrhea, bloating, gurgling, nausea. The parents reported the frequency of the symptoms - times per day/week/month. The symptoms had been estimated according to the following criteria:

- "GER - Gastroesophageal reflux that required medical treatment reportedly diagnosed by gastroenterologist/pediatrician;
- Frequent vomiting - Once per week in 3 months;
- Frequent abdominal pain - At least 3 episodes of abdominal pain that occurs during at least 3 months, not associated with diarrhea/constipation;
- Chronic constipation - Infrequent or painful defecation, < 2 times per week for > 2 months, hard pebblelike stools (Rome criteria)", Valicenti-McDermott, 2006 [3]
- Diarrhea - at least 3 episodes that occurs during at least 3 months
- Bloating - at least 3 episodes that occurs during at least 3 months
- Naushea - at least 3 episodes that occurs during at least 3 months

The third part of the interview included questions related to eating behaviors: selection of specific foods, selection of groups of foods, food refusal, grimaces during meals, and behavioral reactions towards foods.

Food selectivity is defined as: "Consumption of a limited variety of food items and rejection of most novel food items; this pattern is not intermittent nor transient, present for at least 6 months", Valicenti-McDermott, 2006 [3]

The perants had been asked to describe the selectivity – foods, kinds of gourps of foods, special preferences to the color, taste, smell, texture, not mixing food, and they described in details the food refusal – every new food, any kind of foods.

The analysis compared the children with autism to the controls with typical development. Categorical data were analyzed using the Fisher's Exact Test. Statistical significance was defined as p of less than .05. All analyses were performed using SPSS software.

## Ethical considerations:

The study was carried out with strict protection of personal data and confidentiality. The parents consented to voluntarily participate in the study. The information obtained from patients have been used only for the purposes of the study.

## Results and discussion:

The demographic characteristics and information about medical history of low birth weight, other diseases, including frequent infections of the respiratory tract, anemia, and history of allergies are summarized in Table. 1. Three of the ASD children had been diagnosed with gastrointestinal diseases – one had gastritis and two had enterocolitis. None of the tested characteristics showed significant differences bet ween groups.

**Table 1.** Demographic Characteristics and data of the medical history of the children with (ASD) and typical development

| | ASD n = 72 | Typical development n = 70 | P* |
|---|---|---|---|
| **Mean age** | 6.47 | 6.13 | NS |
| **Sex, male/female** | 56/16 | 54/16 | NS |
| **Low birth weight, n (%)** | 14 (19%) | 8 (11%) | NS |
| **Co morbidity total, n (%)** | 12 (17%) | 5 (7%) | NS |
| Asthma, n | 5 | 3 | |
| Gastritis, n | 1 | 0 | |
| atopic dermatitis, n | 4 | 2 | |
| enterocolitis, n | 2 | 0 | |
| anemia, n | 1 | 1 | |
| **Frequent infections of the respiratory tract, n (%)** | 17 (24%) | 16 (23%) | NS |
| **History of Allergies total, n (%)** | 17 (24%) | 22 (31%) | NS |
| medicines, n | 4 | 4 | |
| foods, n | 5 | 4 | |
| animals, n | 3 | 2 | |
| dust, n | 2 | 5 | |
| food additives, n | 0 | 2 | |

*p values for the Fisher's Exact Test, comparison of group of children with ASD versus group of children with typical development. Statistical significance was defined as p of less than .05

The information about family history of psychiatric and neurological diseases, thyroid diseases, diabetes, allergies, asthma, immune disease and gastrointestinal diseases is summarized in Tabl. 2. Significantly higher rates of family history of psychiatric and neurological diseases /p = .003/ and family history of ASD /p = .007/ were detected using Fisher exact test.

**Table 2.** Family history of the children with (ASD) and typical development

| | ASD n = 72 | Typical development n = 70 | P* |
|---|---|---|---|
| **Family history of psychiatric and neurological diseases total, n (%)** | 11 (15%) | 1 (14%) | **.003** |
| • Parkinson's disease, n | 0 | 1 | NS |
| • ASD, n | 7 | 0 | **.007** |
| • ADHD, n | 4 | 0 | NS |
| **Family history of Thyroid diseases, n** | 2 | 2 | NS |
| **Family history of Diabetes, n** | 3 | 2 | NS |
| **Family history of Allergies, n** | 4 | 6 | NS |
| **Family history of Asthma, n** | 0 | 1 | NS |
| **Family history of Immune disease, n** | 1 | 0 | NS |
| **Family history GI disease, n (%)** | 24 (33%) | 17 (24%) | NS |
| • Gastritis and ulcer, n | 14 | 8 | NS |
| • Colitis, n | 2 | 3 | NS |
| • Crohn's disease, n | 2 | 0 | NS |

*p values for the Fisher's Exact Test, comparison of group of children with ASD versus group of children with typical development. Statistical significance was defined as p of less than .05

## Gastrointestinal Symptoms

There were 38 /53%/ ASD children with at least one gastrointestinal symptom while only 19 /27%/ in the controls group. The rates of the reported gastrointestinal symptoms in the ASD group were significantly higher /p = .002/ - Tabl. 3. Despite overall higher levels of general evidence of at least one gastrointestinal symptom, the incidence, (17%), of having exactly one symptom in the children with typical development was found to be not statistically significant when compared to that in the ASD children, 19%. When considering children with exactly Two gastrointestinal symptoms, we found that those rates were significantly different, /p = .017/, between the groups of the ASD and children with typical development, 10 /14 %/ of the ASD children and 2 /3%/ of the controls respectively. Similarly, when considering children with three or more Gastrointestinal symptoms, the difference between the two groups of children was found to be statistically significant, 14 /19 %/ of the ASD children and 5 /7 %/ of the controls, /p = .027/. Two of the reported symptoms had significantly higher levels in the ASD group – constipation and bloating /p = .004, p = .009/, when compared to the group of children with typical development.

**Table 3.** Gastrointestinal Symptoms of the children with (ASD) and typical development

| | ASD n = 72 | Typical development n = 70 | P* |
|---|---|---|---|
| **N (%) of children with at least 1 GI sy** | 38 (53%) | 19 (27%) | **.002** |
| **N (%) of children with 1 symptom** | 14 (19%) | 12 (17%) | NS |
| **N (%) of children with 2 symptoms** | 10 (14%) | 2 (3%) | **.017** |
| **N (%) of children with ≥ 3 symptoms** | 14 | 5 | **.027** |
| • Abdominal pain, n | 13 | 9 | NS |
| • Gastroesophageal reflux, n | 8 | 5 | NS |
| • Diarrhea, n | 9 | 2 | NS |
| • Constipation, n | 24 | 9 | **.004** |
| • Bloating, n | 12 | 2 | **.009** |

| | | | |
|---|---|---|---|
| • Vomiting, n | 1 | 0 | NS |
| • Nausea, n | 1 | 1 | NS |

*p values for the Fisher's Exact Test, comparison of group of children with ASD versus group of children with typical development. Statistical significance was defined as p of less than .05

## Food Selectivity

Many children with typical development go through different phases of refusing to eat certain foods. The food preferences and food refusal usually vary with age. Food selectivity had been reported in 65% of the children of the ASD group and in 27% of the children with typical development, Table 4 which was found to be statistically significant, /p < 001/. The number of chidlren from the ASD group who were fixed with 1-2 groups of foods was also signifcuntly higher from what was found in the group of children with typical development. Some of the children with ASD had selectivity with color, smell and texture; however, those numbers were not significantly different from the respective incidence in the group of children with typical development. Significantly higher was the number of the children with ASD who make grimaces while eating /p < 001/ and who behaved differently when see, touch or taste a particular food, /p = .002/. The refusal of every new food was found to be significantly higher in the group of the ASD children, /p < .001/.

**Table 4.** Food selectivity and food refusal in children with (ASD) and typical development

| | **ASD n = 72** | **Typical development n = 70** | **P*** |
|---|---|---|---|
| **Selectivity, n (%)** | 47 /65%/ | 19 /27%/ | **< .001** |
| • Fixed with one 1-2 groups of foods, n | 33 | 9 | **< .001** |
| • Fixed with one type of food, n | 3 | 1 | NS |
| • Restricted repertoire, but 1-2 kinds of every group, n | 11 | 8 | NS |
| • Selectivity with color, n | 3 | 1 | NS |
| • Selectivity with texture, n | 1 | 0 | NS |
| • Selectivity with smell, n | 2 | 0 | NS |
| • Not mixing foods, n | 1 | 0 | NS |
| **Problems with weight gain, n (%)** | 10 (14%) | 3 (4%) | NS |
| **Makes grimaces while eating, n (%)** | 12 (17%) | 0 | **< .001** |
| **Behaves different when sees, touches or tastes a particular food, n (%)** | 26 (36%) | 9 (13%) | **.002** |
| Reacts affectively on smell or taste, n | 22 | 8 | **.006** |
| Becomes hyperactive after eating sweets, n | 4 | 1 | NS |
| **Refuses every new food, n (%)** | 28 (39%) | 1 (1%) | **< .001** |

*p values for the Fisher's Exact Test, comparison of group of children with ASD versus group of children with typical development. Statistical significance was defined as p of less than .05

Interesting behaviors and reactions to some types of food had been reported by the parents of children in both groups, e.g.. "The child becomes inadequate when eating milk", "the child becomes very anxious when the food smells different", "the child becomes nervous when eating sour foods".

The reported refusal of special kinds of food included: potatoes, grains, sausages, milk and dairy products, red colored foods, green colored vegetables, raw vegetables, tomatoes, fruits, strange appearance foods, liquid foods, fish. Five of the children with ASD refused meat. Furthermore, 4 children with ASD and 4 children with typical development refused to eat cooked food.

Concerning food selectivity and food refusal, the parents of children with ASD more frequently used "refuses to eat, never eats, ", while the parents of the children with typical development reported that their children "doesn't want to eat, doesn't like". Both groups reported changes over time both in the types of preferred foods, and the types of the foods that are completely refused. Some of the reports of the parents of the children with ASD included the following: "eats only sweets and milk, two kinds of fruits", "eats only bananas, crackers", "eats only bananas, spinach and junk food", "never eats new food, eats only milk and biscuits, bread, fruits", "eats only red vegetables, meat and milk", "never eats fruits and vegetables", "eats only bread and milk", "eats only sandwiches with special kind of sausage", "eats only French fries and corn", "eats only bread and milk, soup", "eats only bread and butter", "eats only bread and chocolate, cheese", "eats only bread and meat, two kinds of fruits", "eats only bread, sweets, grain", "eats only meat and sweets", "eats only milk, bread, sausages", "eats only 1 color foods", "eats only bread and milk, three kinds of fruits", "eats only grains, boiled vegetables, bread", "eats only rice, cheese, bread, two kinds of vegetables, two kinds of fruits", "eats only potatoes, beans, vegetables", "doesn't eat any red colored foods, any vegetables, and fruits", "eats only milk, sweets, cheese, potatoes", "eats only milk and bakery foods". One of the parents' reports included a description of an educational method and the effect of it on changing the food selectivity behavior in a child with ASD. After several conversations and discussion of facts concerning the healthy eating the child stopped refusing every new food and started choosing different healthy foods, continuing with preoccupation with facts about healthy eating.

Some of the most interesting reports of the parents of the typical developed children included: "eats only fruits and vegetables", "eats only sweets and pasta", "eats only sweets", "eats only

meat and meat products", "eats only chocolate, sweets, bakery", "doesn't eat fruits and vegetables", "eats mostly sweets, milk and minced meat".

## Discussion:

Half of the children with ASD in this study had at least one gastrointestinal symptom compared to the incidence of one third in the group of the children with typical development. Only constipation and bloating were the symptoms that had significantly higher rates in the ASD group. The difference between the two groups of children was significant in food selectivity and behaviors associated with eating - grimaces while eating, affective reactions on smell, taste or texture and hyperactive behavior after eating sweets. The listed gastrointestinal symptoms that distinguish the group of children with ASD of the controls can be related to the anxiety and stereotyped behaviors that could also seek to reduce anxiety. We hypothesize that these differences could be a direct consequence of high anxiety and stereotyped behaviors, while selective eating and other eating behaviors then could be a result of fear of every new event, situation and subject, and the adherence to sameness. Perhaps, anxiety in children with ASD is not expressed in exactly the same behaviors and symptoms as it is realized usually in adults and most of the children with typical development. The atypical development of communication in terms of understanding of the information around and with regard to the difficulties in expression of emotions, feelings, desires and demands could be a major obstacle to the same manifestation. Further studies could be performed to reveal the possible connection between the gastrointestinal symptoms and eating behaviors incidence and communication competence, ASD severity and ASD groups of symptoms.

## Limitations of the study:

The detection of the gastrointestinal symptoms is typically implemented with uncertain methods that are not based on objective examination. The method that is used in this study was an interview to the parents, i.e. the symptoms were not observed and examined directly. A limitation of the study is the potential uncertainty of the data provided by the parents. However, parents usually succeed in answering very precisely questions related to the behaviors of their children. Moreover, the issues related to food and eating behaviors concern everyday activities that can be described with high accuracy by the adults living with the child. It is well established that the parents are considered to be a reliable source of information about the child's behavior. Furthermore, our sample is not homogeneous in terms of a single diagnosis and severity of the ASD. Another limitation is related to the fact that food behaviors, food preferences, food selectivity and food refusal vary over time, and this study does not monitor these variations.

## References

1. Buie T, Campbell DB, Fuchs GJ, III Furuta, GT, Levy J, et al. (2010) Evaluation, diagnosis, and treatment of gastrointestinal disorders in individuals with ASDs: a consensus report. Pediatrics 125: S1– S18.
2. Parracho HMRT, Bingham MO, Gibson GR, McCartney AL (2005) Differences between the gut microflora of children with autistic spectrum disorders and that of healthy children. J Med Microbiol. 54(pt 10): 987–991.
3. Valicenti-McDermott M, McVicar K, Rapin I, Wershil BK, Cohen H, et al. (2006) Frequency of gastrointestinal symptoms in children with autistic spectrum disorders and association with family history of autoimmune disease. J Dev Behav Pediatr 27 (suppl 2): S128–S136.
4. Horvath K and Perman JA (2002) Autistic disorder and gastrointestinal disease. Current Opinion in Pediatrics 14: 583–587.
5. Smith RA, Farnworth H, Wright B, Allgar V (2009) Are there more bowel symptoms in children with autism compared to normal children and children with other developmental and neurological disorders?: A case control study. Autism 13(4): 343–355.
6. Gorrindo P, Williams KC, Lee EB, Walker LS, McGrew SG, et al. (2012) Gastrointestinal Dysfunction in Autism: Parental Report Clinical Evaluation & Associated Factors. Autism Research 5(2): 101–108.
7. Wang LW, Tancredi DJ, Thomas DW (2011) The prevalence of gastrointestinal problems in children across the United States with autism spectrum disorders from families with multiple affected members. J Dev Behav Pediatr 32(5): 351–360.
8. Roumen N Nikolov, Karen E Bearss, Jelle Lettinga, Craig Erickson, Maria Rodowski, et al. (2009) Gastrointestinal symptoms in a sample of children with pervasive developmental disorders. J Autism Dev Disord 39(3): 405–413.
9. Black C, Kaye JA, Jick H (2002) Relation of childhood gastrointestinal disorders to autism: nested case-control study using data from the UK General Practice Research Database. BMJ 325(7361): 419–421
10. Ibrahim SH, Voigt RG, Katusic SK, Weaver AL, Barbaresi WJ (2009) Incidence of gastrointestinal symptoms in children with autism: a population-based study. Pediatrics 124(2): 680–686.
11. Kuddo T and Nelson KB (2003) How common are gastrointestinal disorders in children with autism? Current Opinion in Pediatrics 15 339–343.
12. Bravender T, Bryant-Waugh R, Herzog D, Katzman D, Kreipe RD, et al. (2007) Classification of Child and Adolescent Eating Disturbances, International Journal of Eating Disorders 40: S117–S12.
13. Nicholls D, Christie D, Randall L, Lask B (2001) Selective eating: symptom, disorder, or normal variant Clin. Child Psychol. Psychiatry 6: 257–270.
14. Bandini LG, Anderson SE, Curtin C, Cermak S, Evans EW, et al. (2010) Food Selectivity in Children with Autism Spectrum Disorders and Typically Developing Children .The Journal of Pediatrics 157(2): 259–264.
15. Schreck KA1, Williams K, Smith AF (2004) Smith Comparison of Eating Behaviors between Children with and without Autism Journal of Autism and Developmental Disorders 34 (4): 433-8.
16. Cermak SA, Curtin C, Bandini LG (2010) Food selectivity and sensory sensitivity in children with autism spectrum disorders Journal of the American Dietetic Association 110(2): 238–246.
17. Nadon G, Feldman DE, Dunn W, Gisel E (2011) Association of Sensory Processing and Eating Problems in Children with Autism Spectrum Disorders. Autism Research and Treatment: 541926.
18. Schreck KA1, Williams K, Smith AF (2004) Smith Comparison of Eating Behaviors between Children with and without Autism Journal of Autism and Developmental Disorders 34(4): 433-8.