Gastrointestinal Tract Symptomatology in Adults with Pica and Autism

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This study investigated pica behavior in those with and without autism in relation to gastrointestinal (GI) tract symptomatology and disease. A chart review of 64 residential adults with developmental disabilities indicated that individuals with pica had more GI tract diseases, and those with autism and pica had a higher rate of GI diseases compared to those with autism and no pica behavior. These data suggest that individuals with both autism and pica disorders may be a phenotypic subgroup in the autistic spectrum characterized by GI symptomatology, requiring a clinical algorithm for categorization and effective treatment. A behavior-analytic model is presented that conceptualizes pica as part of a chain of events that begins with exploratory behavior and culminates in GI symptomatology and disease. Issues of sensory processing are addressed within this model. Individuals exhibiting pica may benefit from gastrointestinal evaluation, including assessment of the microbiome, and, if indicated, microbiota transfer therapy to normalize gut-brain signaling.

**Keywords:** pica, autism spectrum disorder, GI diseases, microbiome, microbiota transfer therapy, comorbidity, prevalence, phenotype, sensory processing.

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Желудочно-кишечная симптоматика у взрослых с пикацизмом и аутизмом

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В настоящей работе исследовался феномен пикацизма у людей с аутизмом и без него, а также связь данного феномена с симптоматикой и заболеваниями желудочно-кишечного тракта (ЖКТ). Анализ данных 64 взрослых испытуемых с нарушениями развития, проживающих в интернате, показал, что у людей с пикацизмом чаще встречались заболевания желудочно-кишечного тракта, а у людей с аутизмом и пикацизмом был более высокий уровень заболеваний желудочно-кишечного тракта по сравнению с людьми, имеющими аутизм без пикацизма. На основании полученных данных можно предположить, что люди с аутизмом и пикацизмом могут составить фенотипическую подгруппу в спектре аутизма, характеризующуюся симптоматикой ЖКТ, требующей клинического алгоритма для диагностики и эффективного лечения. Представленная поведенческая аналитическая модель, которая концептуализирует пикацизм как элемент цепи событий, начинаящейся с исследовательского поведения и завершающейся симптоматикой и заболеваниями желудочно-кишечного тракта. В рамках данной модели решаются проблемы, связанные с сенсорной обработкой. Лицам, у которых наблюдается пикацизм, может помочь обследование пищеварительной системы, включающее микробиотическую оценку, и, при показаниях, трансплантация микробиоты для нормализации передачи сигналов от кишечника к мозгу.

Ключевые слова: пикацизм, расстройства аутистического спектра, заболевания ЖКТ, микробиота, трансплантация микробиоты, коморбидность, распространенность, фенотип, сенсорная обработка.

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Introduction

Pica behavior refers to the persistent ingestion of non-food items, a behavior that can be life-threatening for many individuals. A recent study supported by the Centers for Disease Control (CDC) reported that 23.2% of those on the autism spectrum exhibit pica behavior. In contrast, pica behavior is seen in 4.5% in children with developmental disabilities other than autism spectrum disorder (ASD) and 3.6% in neurotypical controls [15]. In a study of adults with autism, the percentage identified with a comorbid pattern of pica jumps to 60% [24].

Literatures on pica and autism have focused on GI symptomatology and diseases as sequelae of these disorders. GI problems common in autism include constipation, diarrhea, GERD, bloating, excessive gas, abdominal pain, vomiting, and nausea [13; 18; 43]. In addition, Horvath [19] found approximately 70% of autistic children suffered from esophagitis and duodenitis.
Pica has long been linked to gastritis/helicobacter pylori (H. pylori) [40], colitis [12], and celiac disease [25]. Other researchers have reported pica to result in intestinal perforation and blockage, parasites, surgery to remove objects from the stomach, lead poisoning, and death for individuals who are intellectually challenged as well as neurotypical [1; 10; 16]. With respect to those who are intellectually challenged, Matson [28] described pica as the most dangerous type of self-injurious behavior, as well as the least researched of all types of aberrant behavior.

Studies noted by Xu et al. have shown that “patients with ASD had alterations of the gut microbiota. These alterations were potentially relevant to behavioral and GI symptoms that are correlated with the severity of ASD, suggesting that the gut-brain axis participates in the pathogenesis of ASD” [46, pp. 6, 7]. Krajmalnic-Brown et al. [26] reported a lack of diversity in bacteria strains, while Xu’s meta-analysis revealed the percentage and relative abundance of bacterial genera, both harmful and beneficial, in children with ASD and matched controls. Kang and her associates postulated that harmful bacteria can excrete dangerous, disruptive metabolites that can affect the gut, the body, and the brain. Microbiota Transfer Therapy produced significant improvements in GI symptoms, autism-related symptoms, and gut microbiota that persisted for at least two years for children with ASD and GI problems [22]. Pangborn and Baker [35] suggested that maldigestion and malabsorption can foster growth of dysbiotic gut flora, inflammation, and increased gut permeability that can allow entry of toxins and casomorphins. That is, protein, fats, and carbohydrates are not properly broken down so that they can be absorbed across the gut wall. Multiple nutritional deficiencies (e.g., zinc, magnesium, vitamin B6) are common in individuals with autism and may make it difficult for them to metabolize and utilize essential fatty acids [39].

Co-morbidity of autism and pica has been documented in numerous research studies. Kinnell [24] regarded pica to be a diagnostic feature of autism based on a study where pica was far more common in individuals with autism (60%) than in people with Down’s syndrome (4%)(n = 70 in each group). As noted earlier, Fields et al. [15] found a lower (but still alarming) prevalence rate of pica for ASD children ranging in age from three-to-five years (23.2%).

These findings led us to two unanswered questions:
1. What are the relative prevalence rates of specific GI symptoms and diseases with respect to pica, autism, and autism/pica for adults residing at a developmental center?
2. Do the prevalence rates of GI problems for an adult sample of people with autism approximate the rates reported in the recent literature for children with autism?

### Method

#### Participants

Data were obtained from a Medical Staff Quality Assurance (QA) study conducted at Lanterman Developmental Center to improve services for persons exhibiting pica. The resident population pool of clients included those with diagnoses of autism, autism/pica, and pica. Research groups were matched on gender and age (see Table 1) as well as level of cognitive functioning (severe and profound intellectual disabilities). The clients were on similar diets throughout the Center. Names of individuals were not included in the data set.

Client demographics were available to the authors via the center’s computerized client records as well as reports from staff at the residences. Sixteen cases were originally selected in each of four groups. During the course of the study one person in the autism group was discovered to have pica and was subsequently reassigned to the autism/pica group. Group assignment was based upon the following inclusion criteria:

1. Autism: Clients were included if they met the diagnostic criteria of Autistic Disorder [11]. Diagnoses were made prior to the study by both a clinical psychologist and a psychiatrist. Clients with pica were excluded.
2. Pica: These clients were identified to the first author through a survey and a report as having ongoing problems of pica. Items ingested included beads, buttons, clothing tags, rubber gloves, socks, strings, cigarette butts, crayons, paper, plastic items, pop tops, trash, small rocks, bark, dirt, feces, grass, leaves, mushrooms, twigs, and indiscriminate small items. Clients with autism were excluded.
3. Autism and Pica: Fourteen of the 16 clients received a diagnosis of autism by both a clinical psychologist and a psychiatrist. In two cases, there was one diagnosis of autism and a second of PDD. All 16 clients met criteria for Pica (see above).
4. Control Group: These clients were matched on gender, age, and level of cognitive functioning to the Pica Group.

#### Measurement

The dependent variables for this study included GI-related symptoms and diseases. A list of GI symptoms/diseases was assembled from medical textbooks, conference proceedings, and intake histories from private practitioners (see Appendix A). This checklist was reviewed for validity by the Quality Assessment and Improvement Committee of the Center’s Medical Staff.

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**Table 1: Gender and Age by Diagnostic Group**

|         | Autism | Autism/Pica | Pica | Control |
|---------|--------|-------------|------|---------|
| Male    | 12     | 12          | 10   | 10      |
| Female  | 3      | 5           | 6    | 6       |
| Age Mean| 38.9   | 42.2        | 43.7 | 44.5    |
| Age SD  | 9.7    | 10.8        | 7.6  | 7.8     |
| Age Range| 24–56 | 24–58       | 30–58| 31–58   |

* standard deviation.
Data collection was accomplished by two UCLA pre-doctoral psychology interns at the Center who were trained to search through a 10-year period of clients’ medical records. They were blind to the purpose of the study. Inter-rater reliabilities were calculated by dividing the number of agreements between raters by the number of agreements plus disagreements for four randomly selected charts. The mean ratio for the GI checklist (signs/symptoms/diseases) was 94% which indicated strong agreement between the raters.

The QA study was approved by the Quality Assessment and Improvement Committee of the Center’s Medical Staff and by the Lanterman Quality Management Council.

Results

An analysis of the distributions of each of the variables revealed an outlier and positive skew for the number of GI signs/symptoms. A log (base e) transformation was performed, which normalized that variable for use in subsequent analyses. However, the results were substantively the same if the data were left untransformed, or if an outlier in the autism/pica group was dropped or Winsorized.

The mean frequencies for GI diseases and GI signs/symptoms, with respect to the autism/pica, pica, autism, and control groups are shown in Table 2.

A multivariate analysis was utilized to examine the two outcome variables with regard to Pica, Autism, and their interaction in a two-by-two factorial design. The Pica condition included both Pica and Autism/Pica groups whereas the No Pica condition included both Autism and Control groups. The Autism condition included both Autism and Autism/Pica groups whereas the No Autism condition included both Pica and Control groups.

The multivariate analysis indicated that Pica was the only significant factor, Wilks’ Lambda = .816, $F(2, 59) = 6.65, p = .002$. Univariate analyses indicate that both dependent variables significantly differentiated between Pica and No Pica conditions. GI diseases were greater for the Pica condition, $F(1, 60) = 13.34, p = .001$, as were GI signs/symptoms, $F(1, 60) = 4.18, p = .045$. There were no significant effects for the Autism condition or for the interactions between Pica and Autism with the multivariate analysis. However, the univariate analyses of the interactions indicated that the interaction for GI symptoms was significant, $F (1, 60) = 4.96, p = .030$.

Figures 1 and 2 display the means for the four groups for GI diseases and GI signs/symptoms respectively. Both Figures 1 and 2 reflect the high incidence of GI problems for the Autism/Pica group but not for the Autism group.

An analysis of all GI diseases for adults in the Pica vs. No Pica conditions shows much greater co-morbidity of diseases in the Pica condition (see Figure 3).

Table 2

|                      | Autism (n = 15) | Autism/Pica (n = 17) | Pica (n = 16) | Control (n = 16) |
|----------------------|-----------------|----------------------|--------------|-----------------|
|                      | Mean            | SD                   | Mean         | SD              |
| GI Diseases          | 0.53            | .92                  | 2.88         | 2.37            |
|                      | 2.25            | 2.02                 | 1.31         | 1.45            |
| GI Signs/Symptoms   | 0.93            | 0.45                 | 1.41         | 0.53            |
|                      | 1.14            | 0.34                 | 1.16         | 0.46            |

* log transformation (base e)
Those individuals with three or more diseases were identified as severely affected. Almost half of those in the Pica condition can be so identified.

An analysis of the specific types of diseases reveals a predominance of chronic inflammatory diseases: gastritis, esophagitis, GERD, duodenitis, and colitis (see Table 3).

In the Pica condition \((n = 33)\), 64% of the persons had at least one of these chronic inflammatory diseases, and 58% had at least two. A comparison of Pica and No Pica conditions reflects higher incidence in the Pica condition across all of these diseases: gastritis, esophagitis, GERD, duodenitis, colitis, hiatal hernia, ulcer, H. pylori, intestinal blockage, and aerophagia.

No significant difference between Pica and No Pica conditions were seen for most frequently occurring GI signs/symptoms. Table 4 shows that vomiting, history of weight loss/difficulty gaining weight, and GI bleeding occurred with about equal frequency in the two conditions.

![Fig. 2](image1.png)

Fig. 2. Mean log (base e) transformed number of gastrointestinal (GI) signs/symptoms by pica and autism conditions with standard error.

![Fig. 3](image2.png)

Fig. 3. Prevalence of gastrointestinal (GI) diseases by pica condition.
However, the significant interaction between Pica and Autism conditions suggests that adults with both Pica and Autism have an especially high rate of GI symptoms, including signs/symptoms such as alternating diarrhea/constipation, night awakening, abdominal cramps, and chronic/seasonal diarrhea (see Figure 2). A post hoc t-test (LSD) showed that the average number of symptoms for the Autism/Pica group (1.41) was significantly greater than the average for the Autism only group (0.93), \( t(30) = 3.02, p = .004 \).

### Discussion

GI disease showed a significant overall effect associated with pica, but not with autism. Those persons diagnosed with pica had 2.8 times as many GI diseases, and 4.8 times as many were severely affected. Persons with pica had 2.6 GI diseases on average compared to 0.9 for those without pica. As shown in Table 3, adults with pica showed higher prevalence of each of the 10 most frequently recorded GI diseases.

In their conclusions Valicenti-McDermott et al. [44, p. S135] stated: “Gastrointestinal symptoms seem to be a common comorbidity of autism. Specific GI symptoms may help identify a phenotypic subgroup within the heterogeneous group of individuals who meet behaviorally defined criteria for autism”. Of note, Valicenti-McDermott et al. found that the settings in which individuals were recruited were not biased toward GI symptoms, thus supporting generalizability of the findings. However, their study did not address pica. The significant interaction observed in the current study between autism and pica on GI signs and symptoms suggests that it is important to distinguish Autism and Autism/Pica diagnostic groups. On the types of indicators used by Valicenti-McDermott et al. the autism/pica group in the current study had higher rates of GI dysfunction than the autism-only group; that is, GERD (35% vs. 7%), vomiting (41% vs. 27%), abdominal pain (29% vs. 0%), constipation (94% vs. 80%), and alternating diarrhea/constipation (29% vs. 7%). The data strongly suggest that the high rate of GI symptoms observed among people with autism can be accounted for by pica.

Ousley and Cermak noted that the “study of gastrointestinal disorders [...] has begun to provide insights into the pathophysiology of well-defined ASD medical/genetic subgroups” [33, p. 23]. Indeed, our study suggests that individuals with both autism and pica may be a phenotypic subgroup. In their comprehensive consensus report, Buie et al. noted “Given the heterogeneity of persons with ASDs and the many inconsistent research findings regarding ASDs, it is imperative that the phenotype (biological, clinical, and behavioral features) of future study subjects be well defined [5, p. s13]. Coury et al. included “behavior phenotypes related to poor nutritional status” [8]. They pointed to the establishment of clinical algorithms for categorization and effective treatment.

From a behavior-analytic viewpoint that tentatively but promisingly reaches across to new research on the autistic gut and microbiome, we suggest conceptualizing pica here primarily as part of a chain of events: (1) persistent exploratory mouthing of environments associated with or governed by sensory reinforcement, sensory sensitivity [38; 41], sensory hyper-responsivity, sensory craving, and sensory processing disorder [13; 14], (2) the ingestion of harmful bacteria, the metabolites of which may affect the body and brain [22; 23; 26; 46], (3) mal-digestion and malabsorption or faulty metabolism [19; 35], (4) nutritional deficiencies [38] and micronutrient deficiencies [30], (5) pica disorder, (6) GI symptomatology and inflammation (worsening over time), and (7) GI disease. A more comprehensive model would no doubt incorporate feedback loops, e.g., pica behavior impacting digestion and absorption. We suggest that nutritional deficiencies and imbalance be conceptualized as an “establishing operation,” ibid for pica, and that individuals exhibiting pica may benefit from nutritional and gastrointestinal evaluation.

Pica may be only the “tip of the iceberg” because this behavior may serve as a marker for GI symptomatology and disease. The risks associated with these underlying dysfunctions and dysbiosis may be greater than the risks posed by most physical acts of ingestion. In contrast to earlier research on the prevalence of health conditions

### Table 3

| Disease            | Pica (n = 33) % | No Pica (n = 31) % |
|--------------------|----------------|-------------------|
| Gastritis          | 58             | 26                |
| Esophagitis        | 39             | 13                |
| GERD*              | 30             | 23                |
| Duodenitis         | 27             | 13                |
| Colitis            | 15             | 6                 |
| Hiatal Hernia      | 15             | 6                 |
| Ulcer              | 15             | 3                 |
| Helicobacter Pylori| 15             | 0                 |
| Aerophagia         | 12             | 0                 |
| Intestinal Blockage| 9              | 3                 |

* gastroesophagitis reflux disease

### Table 4

| Signs and Symptoms | Pica (n = 33) % | No Pica (n = 31) % |
|--------------------|----------------|-------------------|
| Constipation       | 97             | 81                |
| Vomiting           | 39             | 35                |
| Weight Loss        | 21             | 23                |
| GI Tract Bleeding  | 21             | 19                |
associated with pica [9; 10], the current study specifically calls attention to the occurrence and co-occurrence of diseases of chronic inflammation. In this study, the higher means for both GI diseases and GI signs/symptoms for the Autism/Pica group versus the Pica group as shown in Table 2 may suggest that the pathophysiology of autism, while not wholly understood, further contributes interactively to disease processes. Adults with pica (with and without autism), but not autism-only, compare with the seriously affected children in the recent autism literature. In view of this literature a replication of the current study that focuses on children with pica-only, autism-only, and autism/pica is indicated. Other research designs should consider including these groups for comparison purposes, along with individuals with autism with and without GI disorders. Both the pica and autism literatures have advanced promising specific and broad spectrum nutritional interventions to modify biochemical imbalances and patterns of aberrant behavior. Investigators were able to reduce pica through supplementation with iron [17], a liquid multivitamin, Polyvisol [34], and also with Standard Vivonex, a product containing all essential nutrients in a readily absorbable form [4]. In the autism literature, clinical improvement is reported using antioxidant therapy (Vitamin C, E, B-6, magnesium, and manganese if warranted) and zinc supplementation (as Zn picolinate) [39], and using folic acid, betaine, and methyl B-12 to address issues of increased oxidative stress and impaired methylation [21]. These findings are particularly important in view of Coury et al.’s [8] conclusion for 12 studies of nutritional quality for children on the autism spectrum: “Collectively to date, these indicate a trend for clinically significant suboptimal nutrient intake in children with ASDs…” More recently, Ristori et al. [38] investigated autism, GI symptoms, and modulation of gut microbiota by nutritional interventions. Their emphasis on pronounced sensitivities to the smell, taste, texture, visual appearance of food, and food selectivity may correlate with specific cravings associated with pica [41; 43]. For example, do pronounced food sensitivities/selectivities such as texture preferences (e.g., hard candies, hard objects; chewy foods, plastics, foam materials, or rubber) predict pica preferences? Earlier literature raises the possibility that pica may represent an early, if not the earliest, pattern of addiction [27]. Recent literature on pica and substance abuse addresses possible linkage [20]. The physiological description of addiction provided by Ratey and Hagerman [37, p. 172], may be explanatory here: “…the basal ganglia goes on autopilot when you see/hear/smell/feel the stimuli, and the prefrontal cortex cannot override your actions even though you may know better...”. Stated differently, pica may be a “failure to inhibit ‘abnormal’ stimulation rather than a choice to obtain particular stimuli” [31, p. 143]. If this is the case, we are clearly pointing to early identification efforts to reduce the effect on developmental trajectory [2].

Finally, a promising new intervention based on microbiota transfer to alter the gut ecosystem may be directed not only to children with ASD, but also to those with pica. “Bacterial and phagedeep sequencing analyses revealed successful partial engraftment of donor microbiota and beneficial changes in the gut environment” [23, p. 1] (see also [22]). In the current study H. Pylori bacterial infection and ulcer each occurred in 15% of the combined Pica group versus 0% and 3% of the combined No Pica group. Gastritis was identified through chart review in 38% of the Pica group versus 26% of the No Pica group, i.e., more than twice as frequent. Microbiota Transfer Therapy may then be an option for dysbiotic gut ecosystems associated with pica.

Conclusions

Although this study was limited to chart reviews, it raises both research and treatment issues regarding pica and autism. The gap in comorbidity prevalence between 23.2% for children and 60% for adults should be addressed by cross-sectional and longitudinal study [15; 24; 32]. Although reported prevalence of GI disorder in children with ASDs ranges from 9% to 70% or higher, potential problems with pica are not routinely considered in ASD evaluations [8]. Adult and child survey analyses are needed to accurately determine the prevalence of autism, pica, and autism/pica within specific populations. An online toolkit for professionals described a multi-faceted approach to diagnosing, treating, and preventing pica [29]. Based on the findings in this study and the current research literature, we suggest including additional neurometabolic measures, such as copper/zinc ratios, trace minerals, essential fatty acids, GABA, dopamine-beta hydroxylase, serotonin, epinephrine, and norepinephrine. The critical “gut-behavior axis” involves neural, hormonal, immune, and metabolic pathways [3; 42]. A personalized metabolic therapy approach to intestinal microbiota may have import [36]. Also, we suggest a behavior-analytic framework for considering the development of pica within a multidimensional chain of events with feedback loops. Furthermore, the development of any comprehensive treatment strategy should include a review of medical history as one component and behavioral history as another [8].

In consonance with Buie’s GI Consensus Statement [5], the present authors recommend gastroenterology referral for new diagnoses of autism, pica, or comorbidity. Diagnostically, pica may alert to undiagnosed GI symptoms or disease, or vice versa, or they may present co-morbidly. Thus, pica can be viewed as a behavioral indicator important in identification of risk factors for GI problems. Trace mineral evaluation can also be included in medical screening. If the results are out of range or out of balance, nutritional intervention is essential as part of a complete treatment strategy. Such intervention may augment, if not replace, more rapidly introduced behav-
Clinical Signs and Symptoms of Dysfunction and Diseases of the Gastrointestinal (GI) Tract

Please check those that apply to this client

| Signs and Symptoms                                      | Diseases                                      |
|---------------------------------------------------------|-----------------------------------------------|
| ( ) Abdominal pain or cramps                            | ( ) GERD (gastroesophagitis reflux disease)   |
| ( ) Abnormal posturing (that puts pressure on the abdomen) |                                               |
| ( ) Night-awakening                                     | ( ) Gastritis                                 |
| ( ) Rumination                                          | ( ) Esophagitis                               |
| ( ) Vomiting                                            | ( ) Duodenitis                                |
| ( ) 3 or more large BMs per day                         | ( ) Colitis or Enterocolitis                  |
| ( ) Excessive belching                                  | ( ) Visceral hyperplasia or ileocolonic       |
|                                                        | lymphnodular hyperplasia                      |
| ( ) Excessive gassiness or bloating                      | ( ) Leaky Gut Syndrome / increased intestinal permeability |
| ( ) Abnormal stools (malodorous or poorly formed or shiny or black or containing mucus) | ( ) Ulcers                                    |
|                                                        | ( ) Crohn’s disease                           |
|                                                        | ( ) Kidney infections or kidney stones        |
|                                                        | ( ) Intestinal polyps                         |
|                                                        | ( ) Irritable Bowel Syndrome                  |
|                                                        | ( ) Diverticulitis                            |
|                                                        | ( ) Gall bladder disease                      |
|                                                        | ( ) Celiac disease (coeliac)                  |
|                                                        | ( ) H. Pylori (Helicobacter Pylori)           |
|                                                        | ( ) Hiatal Hernia                             |
|                                                        | ( ) Intestinal blockage                       |
|                                                        | ( ) Aerophagia                                |

Altered bowel flora microbial growth

- ( ) fungal overgrowth / hypersensitivity
- ( ) bacteria
- ( ) parasites
- ( ) viral
- ( ) Malabsorption
- ( ) Food allergies / sensitivities

Литература/References

1. Ausman J., Ball T.S., Alexander D. Behavior therapy of pica in a profoundly retarded adolescent. Mental Retardation, 1974, vol. 12, no. 6, pp. 16—18.
2. Barhrick L.E., Todd J.T. Multisensory Processing in Autism Spectrum Disorders: Intersensory Processing Disturbance as a Basis for Atypical Development. In B. Stein (ed.) The New Handbook of Multisensory Processing. Cambridge: The MIT Press, 2012. 840 p. ISBN 978-0-26201712-1.
3. Berding K., Donovan S.M. Microbiome and nutrition in autism spectrum disorder: Current knowledge and research needs. Nutrition Reviews, 2016, vol. 74, no. 12, pp. 723—736. DOI:10.1093/nutrit/nw048
4. Bugle C., Rubin H.B. Effects of a nutritional supplement on coprophagia: A study of three cases. *Research in Developmental Disabilities*, 1993, vol. 14, no. 6, pp. 445—456. DOI:10.1016/0961-4487(93)90037-K
5. Bai T., Campbell D.B., Fuchs G.J. et al. Evaluation, diagnosis, and treatment of gastrointestinal disorders in individuals with ASDs: A consensus report. *Pediatrics*, 2010, vol. 125, no. Supplement 1, pp. S1—S18. DOI:10.1542/peds.2009-1878C
6. Bai T., Fuchs G.J., Furuta G.T. et al. Recommendations for evaluation and treatment of common gastrointestinal problems in children with ASDs. *Pediatrics*, 2010, vol. 125, no. Supplement 1, pp. S19—S29. DOI:10.1542/peds.2009-1878D
7. Carbone P.S. Moving from research to practice in the primary care of children with autism spectrum disorders. *Academic Pediatrics*, 2013, vol. 13, no. 5, pp. 390—399. DOI:10.1016/j.acap.2013.04.003
8. Coury D.L., Ashwood P., Fasano A. et al. Gastrointestinal conditions in children with autism spectrum disorder: Developing a research agenda. *Pediatrics*, 2012, vol. 130, no. Supplement 2, pp. S160—S168. DOI:10.1542/peds.2012-0900N
9. Danford D.E., Huber A.M. Pica among mentally retarded adults. *American Journal of Mental Deficiency*, 1982, vol. 87, no. 2, pp. 156—166.
10. Danford D.E., Smith J.C., Huber A.M. Pica and mineral status in the mentally retarded. *The American Journal of Clinical Nutrition*, 1982, vol. 35, no. 5, pp. 958—967. DOI:10.1093/ajcn/35.5.958
11. Diagnostic and statistical manual of mental disorders: DSM-IV. 4th ed. Washington: American Psychiatric Association, 1994. 866 p. ISBN 978-0-89042-061-4.
12. DiCagno L., Castello D., Savio M.T. A case of ulcerative colitis associated with pica: Psychological and clinical study. *Minerva Pediatrica*, 1974, vol. 26, no. 35, pp. 1768—1777.
13. Edelson S.M. Research issues involving the biology of autism. *Autism and Developmental Disorders (Russia)*, 2019, vol. 17, no. 1, pp. 4—14. DOI:10.17759/autdd.2019170102
14. Edelson S.M., Johnson J.B. (eds.) Understanding and treating self-injurious behavior in autism. London: Publ. Jessica Kinsley Publishers, 2016. 302 p. ISBN 978-1-78450189-1.
15. Fields V.L., Soke G., Reynolds A. et al. Pica associated with autism and other disabilities, study to explore early development. *Pediatrics*, in press.
16. Greenberg M., Jacobziner H., McLaughlin M.C. et al. A study of pica in relation to lead poisoning. *Pediatrics*, 1958, vol. 22, no. 4, pp. 756—760.
17. Gutelias M.F., Millican F.K., Layman E.M. et al. Nutritional studies of children with pica. *Pediatrics*, 1962, vol. 29, no. 6, pp. 1012—1023.
18. Holingue C., Newell C., Lee L.C. et al. Gastrointestinal symptoms in autism spectrum disorder: A review of the literature on ascertainment and prevalence. *Autism Research*, 2018, vol. 11, no. 1, pp. 24—36. DOI:10.1002/aur.1854
19. Horvath K., Papadimitriou J.C., Rabsztyn A. et al. Gastrointestinal abnormalities in children with autism. *The Journal of Pediatrics*, 1995, vol. 135, no. 5, pp. 559—563. DOI:10.1016/s0022-3476(99)70052-1
20. Hull M. (ed.) Pica // The Recovery Village Drug and Alcohol Rehab [Web resource]. 2020. URL: https://www.therecoveryvillage.com/mental-health/pica/ (Accessed 3.12.2020).
21. James S.J., Cutler P., Melnyk S. et al. Metabolic biomarkers of increased oxidative stress and impaired methylation capacity in children with autism. *American Journal of Clinical Nutrition*, 2004, vol. 80, no. 6, pp. 1611—1617. DOI:10.1093/ajcn/80.6.1611
22. Kang D.W., Adams J.B., Coleman D.M. et al. Long-term benefit of Microbiota Transfer Therapy on autism symptoms and gut microbiota. *Scientific Reports*, 2019, vol. 9, article no. 5821. DOI:10.1038/s41598-019-42183-0
23. Kang D.W., Adams J.B., Gregory A.C. et al. Microbiota transfer therapy alters ecosystem and improves gastrointestinal and autism symptoms: An open-label study. *Microbiome*, 2017, vol. 5, article no. 10, pp. 1—16. DOI:10.1186/s40168-016-0225-7
24. Kinnell H.G. Pica as a feature of autism. *British Journal of Psychiatry*, 1985, vol. 147, no. 1, pp. 80—82. DOI:10.1192/bjp.147.1.80
25. Korman S.H. Pica as a presenting symptom in childhood celiac disease. *The American Journal of Clinical Nutrition*, 1990, vol. 51, no. 2, pp. 139—141. DOI:10.1093/ajcn/51.2.139
26. Krajmalnik-Brown R., Lozupone C., Kang D. et al. Gut bacteria in children with autism spectrum disorders: challenges and promise of studying how a complex community influences a complex disease. *Microbial Ecology in Health and Disease*, 2015, vol. 26, no. 1, article no. 26914. DOI:10.3402/mehd.v26.26914
27. Lourie R.S., Layman E.M., Milhican F.K. et al. A study of the etiology of pica in young children, and early pattern of addiction. In *Hoch P.H., Zubin J. (eds.) Problems of addiction and habituation*. New York: Publ. Grune & Stratton, 1958. pp. 282—292.
28. Matson J.L., Belva B., Hattier M.A. et al. Pica in persons with developmental disabilities: Characteristics, diagnosis, and assessment. *Research in Autism Disorders*, 2011, vol. 5, no. 4, pp. 1459—1464. DOI:10.1016/j.rasd.2011.02.006
29. McAdam D., Cole L., Howell L. Provider’s Guide to Managing Pica in Children with Autism / Autism Speaks Autism Treatment Network [Web resource]. 2014. 7 p. URL: http://www.autismspeaks.org/sites/default/files/docs/sciencedocs/atn/pica_professionals_guide.pdf (Accessed 3.12.2020).
30. Miao D., Young S.L., Golden C.D. A meta-analysis of pica and micronutrient status. *American Journal of Human Biology*, 2015, vol. 27, no. 1, pp. 84—93. DOI:10.1002/ajhb.22598
31. Miller L.J., Misher K. Sensory processing disorder and self-injurious behavior. In *Edelson S.M., Johnson J.B. (eds.) Understanding and treating self-injurious behavior in autism*. London: Publ. Jessica Kinsley Publishers, 2016. pp. 138—150. ISBN 978-1-78450189-1.
32. Morozov S.A. On the issue of comorbidity in autism spectrum disorders. *Autism and Developmental Disorders (Russia)*, 2018, vol. 16, no. 2, pp. 3—8. DOI:10.17759/autdd.2018160201
33. Ousley O., Cermak T. Autism spectrum disorder: Defining dimensions and subgroups. Current Developmental Disorders Reports, 2014, vol. 1, no. 1, pp. 20–28. DOI: 10.1007/s40474-013-0003-1
34. Pace G.M., Tager E.A. The effects of a vitamin supplement on the pica of a child with severe mental retardation. The Journal of Applied Behavior Analysis, 2000, vol. 33, no. 4, pp. 619–622. DOI: 10.1901/jaba.2000.619-619
35. Pangburn J.B., Baker S.M. Autism: Effective biomedical treatments: Have we done everything we can for this child?: Individuality in an autism epidemic. Boston, 2005. 118 p. ISBN 978-0-97403609-0.
36. Poljakova S.I. The pathophysiological rationale for personalized metabolic therapy of ASD: Promising treatments. Autism and Developmental Disorders (Russia), 2019, vol. 17, pp. 55–70. DOI: 10.17759/autdd.2019170106
37. Ratey J.J., Hagerman E. Spark: The revolutionary new science of exercise and the brain. New York: Publ. Little, Brown & Co., 2008. 303 p. ISBN 978-0-31611350-2.
38. Ristori M.V., Quaggiaierrelio A., Redal S. et al. Autism, gastrointestinal symptoms and modulation of gut microbiota by nutritional interventions. Nutrients, 2019, vol. 11, no. 11, pp. 1–21. DOI: 10.3390/nu11112812
39. Russo A.J., deVito R. Analysis of copper and zinc plasma concentration and the efficacy of zinc therapy in individuals with Asperger’s Syndrome. Pervasive Developmental Disorder-Not Otherwise Specified (PDD/NOS) and autism. Biomarker Insights, 2011, vol. 6, pp. 127–133. doi: 10.4137/BMI.S7286
40. Sayar S.N., Sarlatti R., Naficy M. Studies on clinical, haematological aspects and pathological changes of gastric mucosa in geophagia [Web resource]. Acta Medica Iranica, 1975, vol. 18, no. 3-4, pp. 137–147. URL: https://acta.tums.ac.ir/index.php/acta/article/view/4197 (Accessed 3.12.2020).
41. Spek A.A., van Rijnsoever W., van Laarhoven L. et al. Eating problems in men and women with an autistic spectrum disorder. Journal of Autism and Developmental Disorders, 2020, vol. 50, pp. 1748–1753. DOI: 10.1007/s10803-019-03931-3
42. Srikantha P., Mohajeri M.H. The possible role of the microbiota-gut-brain-axis in autism spectrum disorder. International Journal of Molecular Science, 2019, vol. 20, no. 9, article no. 2115. DOI: 10.3390/ijms20092115
43. Toguleva V.K. Current Correction Techniques of Food Selectivity in Children with Autism Spectrum Disorders (ASD). Autism and Developmental Disorders (Russia), 2018, vol. 16, no. 4, pp. 21–27. DOI: 10.17759/autdd.2018160404
44. Valicenti-McDermott M., McVicar K., Rapin I. et al. Frequency of gastrointestinal symptoms in children with autistic spectrum disorders and association with family history of autoimmune disease. Journal of Developmental and Behavioral Pediatrics, 2006, vol. 27, no. 2, pp. S128–S136. DOI: 10.1097/00004703-200604002-00011
45. Williams D.E., McAdam D. Assessment, behavioral treatment, and prevention of pica: Clinical guidelines and recommendations for practitioners. Research in Developmental Disabilities, 2012, vol. 33, no. 6, pp. 2050–2057. DOI: 10.1016/j.ridd.2012.04.001
46. Xu M., Xu X., Li J. et al. Association between gut microbiota and autism spectrum disorder: A systematic review and meta-analysis. Frontiers in Psychiatry, 2019, vol. 10, pp. 1–11. DOI: 10.3389/fpsyt.2019.00473

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