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Autism Spectrum Disorders, what a dietitian should know

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Introduction

To know what a dietitian can do to address autism, it is important to first understand what autism is. Autism is not one disorder but a spectrum with varied etiology. A variety of predisposing genetic factors and environmental triggers have been identified. Advanced parental age, medications during pregnancy (SSRI), maternal obesity and environmental pollutants are thought to be contributory. Diagnosis is made by the identification of key behaviors. The relationship of these behaviors to nutrition are:

1. Social impairment may limit a child's ability to learn to eat through modeling. The child may not be motivated by eating with peers or find pleasure in the social interaction of mealtime.
2. Restrictive, *repetitive and rigid* behaviors: can lead to an insistence on sameness in food, including the presentation of food, utensil use, brand and location where to eat. Rigidity may also lead to a preference for foods that are always the same when you eat; for example a potato chip will always have the same flavor and texture but every apple or carrot are slightly different and this may lead to a preference for processed foods over fruits and vegetables.
3. Communication: the ability to communicate hunger, satiety and preference may be impaired. The ability to communicate desires is further compromised by alteration in the understanding of language.

Although not necessary for diagnosis, function may also be impaired in the following areas, and influence nutrition as well:

- Motor planning is the ability to conceive of an action and then physically carry out that action. For example, choosing to eat a spoon of yogurt requires holding the spoon, scooping the yogurt, bringing the yogurt to the mouth, manipulating the yogurt, discerning between the pieces of fruit in the yogurt and the smooth puree and swallowing the yogurt.
- Sleep is often disrupted, potentially influencing appetite and mood and predispose to obesity.
- Sensory processing and integration also may be atypical, including not only difficulty processing of external sensation (touch, sound, taste, etc) but also difficulty processing internal stimuli such as pain, digestion, hunger and satiety. A child may be hypersensitive and therefore want very little stimulation or be hyposensitive and seek out input. This may influence acceptance of different types of food based color, flavor (spicy vs bland) or texture (crunchy vs soft). Sensitivity to sound or smells may limit a child's ability to eat with others. A child can be combination of hypo and hyper sensitive to different stimuli.

In addition to these behaviors nutritional status may also be negatively affected by commonly associated diagnoses such as mitochondrial disorders or Fragile X. Other common comorbid conditions/concerns with an impact on nutrition include:

- Intellectual disability, present in 38%
- Prematurity, 30% of children born prematurely develop autism
- Birth defects, present in 11% of children with autism compared to 6.4% of typically developing children
- Seizure disorder occurs in 10-30% of individuals with autism
- ADHD is present in 30% of children with autism
- Pica is present in 30% of children
- Medication use such as Risperadol which can lead to obesity and metabolic syndrome

Editor's Note

Hello DCPPN Members,

For those of you who missed the annual DC Conference, Patricia Novack presented on Autism Spectrum Disorders, what a dietitian should know! Patricia wrote an article to recap her DC presentation. Patricia is an RD who has worked with children with disabilities and chronic disease for the past 20 years. I would like to thank Patricia for her contributions to the DC conference and our newsletter.

Please remember that we are always looking for your ideas for newsletter topics, or books you'd like to have reviewed! Contact me if you'd be interested in reviewing books or you are interested in writing for our newsletter.

Warm regards,

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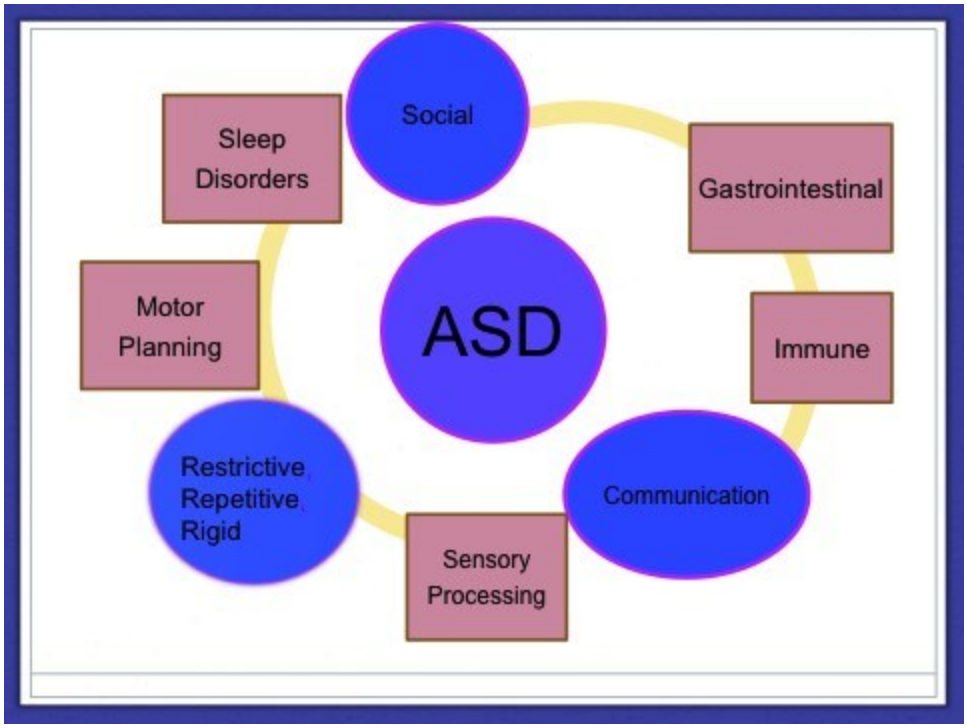
Gastrointestinal disorders and immune disorders, specifically, food allergies and intolerances are more common in children with autism and these areas will be discussed more in depth. The net effect of all of these factors is that there is a fivefold increase in the odds of having a feeding problem in children with autism. Overall fewer foods are accepted within food groups, meaning that their diets tend to be more repetitive with a preference for crispy, crunchy foods. Consistent with varying dietary results, some studies have reported adequate growth and

Figure 1 Interaction of essential and common features of Autism Spectrum Disorders (ASD)



weight gain while others note lower weight in young children and greater risk of obesity in adolescents. Regardless of the study, feeding children with autism is usually hard work for parents, disrupting family mealtime and requiring that the family make significant adaptations to routines.

Allergies or intolerances appear to be more common in children with autism and can decrease food intake in one of three ways. Allergies may limit what can be offered especially for children with multiple food allergies. Allergies may also cause fear of eating (in both child and parent) and may be exacerbated if the child is not able to independently make safe food choices due to communication limitations. Finally, while allergic symptoms such as itchy throat or runny nose may seem innocuous, to a child with sensory processing issues, these irritations may decrease their ability to stay calm and to engage at the meal.

Immune and gastrointestinal issues are closely related, influencing inflammation, intestinal biota and gastrointestinal permeability. One study found that children with autism, have greater use of antibiotics, which may be due to over-prescription related to the difficulty of physical assessment of an anxious or uncooperative child or due to an actual increase in bacterial infections. The increased use may influence intestinal bacteria. Children with autism tend to have a higher level of intestinal bacterial Sutterella and less varied bacteria. The identification of MET gene variants in some individuals with autism, a gene related to gut repair as well as social interactions, provides an additional example of how the GI function may be altered. Increased levels of antibodies and cytokines in individuals with autism, indicate altered immune cellular function potentially leading to inflammation in both gut and brain. One result of the immune and gastrointestinal dysfunction is an increase in reporting of abdominal pain, constipation and diarrhea in children with autism. About 25% of typically developing children have reported gastrointestinal symptoms as compared to 45% of children enrolled in the Autism Treatment Network. Various studies have indicated that between 18-72% of kids with autism report gastrointestinal issues. It is important to consider though that while some children with autism experience significant immune and/or GI dysfunction, many have no related concerns.

The actual extent of gastrointestinal problems is hard to determine. Clinically these issues may not express in usual ways. There is often idiosyncratic expression of pain, such as aggression towards others, social withdrawal, decrease in communication or physically seeking comfort by rolling around on the ground or pressing stomach against furniture. Etiology of discomfort may be difficult to determine as cooperation for testing may be limited and may require sedation which families are understandably reluctant to do. Children with GI symptoms tend to have higher rate of sleep problems (70% as compared to 30% of children without GI issues); higher measures of irritability, anger and social withdrawal; more disruptive and less attentive behavior; and have an overall lower quality of life.

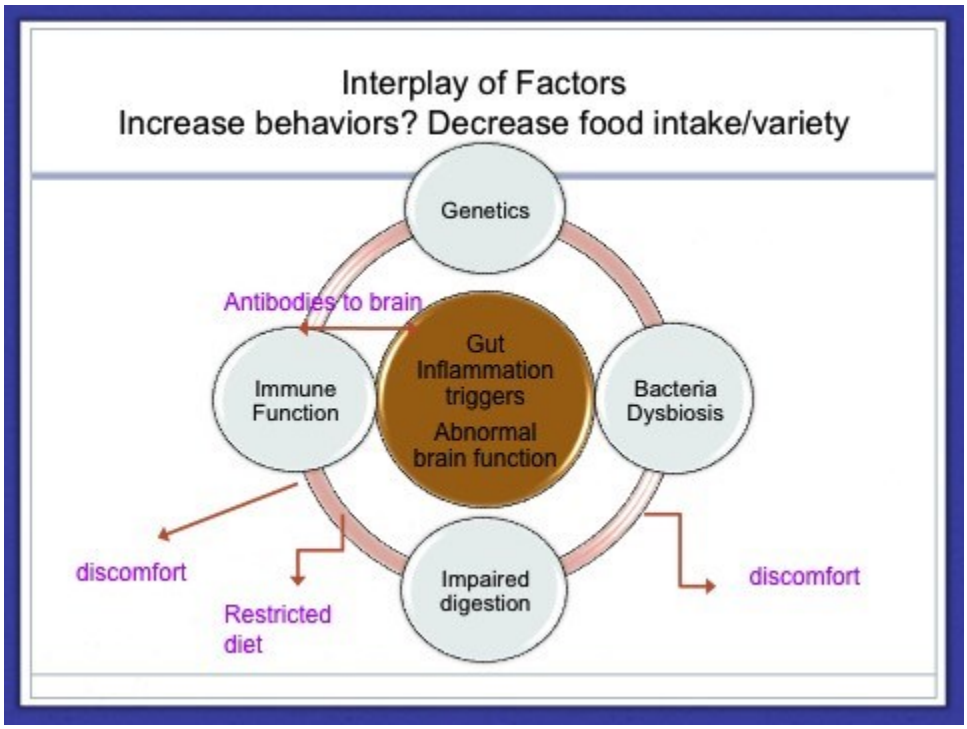
The most common symptom of gastrointestinal dysfunction appears to be constipation. Reasons for this are varied and include;

- Restrictive Diet: diets low in fiber and high in processed foods
- Abnormal Function of GI tract
    - Low muscle tone
    - Altered neurotransmitter function; innate or medication induced
    - Loss of feedback loop between rectum and brain
    - Type and variety of gut bacteria
- Sensory response
    - Withholding due to discomfort with the sensation of defecation

Traditionally, increasing fiber and fluid is recommended to treat constipation but this is not always an effective recommendation. Making dietary change may be a long process and the sense of fullness and discomfort from constipation may decrease a child's willingness to make change. Constipation may prevent making change but making change is necessary to relieve the constipation. Treatment first requires making it safe and comfortable to have bowel movement. Stool softeners or lubricants may be necessary to reduce the potential of pain with defecation. Regular bathroom routines and schedules are needed to reduce anxiety and facilitate normal bowel movements.

Ultimately these gastrointestinal and immune factors interact to decrease food intake, limit food variety and perhaps influence behavior, making the child less engaged in mealtime and more rigid with eating behaviors. See Figure 2

Figure 2 Interplay of Factors Increasing behaviors? Decrease food intake/ variety



These common characteristics suggest that diet may be helpful in treating autism. The most popular diet to try is the gluten-free casein-free (GF CF) diet. The use of diets as treatment is controversial. On the plus side is that it is known that diet can influence brain function and development. Phenylketonuria (PKU), Beri-Beri (Thiamin deficiency), anemia and seizure disorders can be treated with complete or partial amelioration of symptoms (by supplementation Beri-Beri, anemia) or by changing the diet; eliminating a protein (PKU) or changing the fat and carbohydrate ratio (ketogenic diet for seizure disorders). Conversely, a number of dietary studies have been inconclusive for treating autism. Most behavioral changes secondary to diet are insignificant according to study measurements. At best, parents find benefit, often continuing with the diet after the study citing subtle improvements that are not easily measured.

There are a variety of diets that are suggested to treat autism. These include phenol-free, oxalate free, yeast free, additive free, carbohydrate restriction, gluten free and casein free. There is virtually no research to support the use of a phenol free, oxalate free or yeast free diet. Food additives, specifically sodium benzoate and synthetic dyes (Blue 1 and 2, Red 50, Citrus Red 2, Green 3 and Yellow 5 and 6) have been linked to hyperactivity. These can easily be avoided by choosing or-

ganic foods or foods that are "naturally" dyed with carotenes, annatto, capsanthin or beets. "Artificial" colors may be derived from natural sources and are not related to hyperactivity as are the "numbered" colors. This is an easy recommendation to make as it may actually improve nutrient intake and there is virtually no risk in recommending.

Carbohydrate intolerance is something to consider when presented with a child with stomach pain or abnormal bowel movements. Reduced enzyme activity has been noted in children with autism, specifically reduced lactase activity in 58% in autistic children younger then 5 years old and 65% in children greater than 5 years of age. Boys appear to be more likely to have reduced enzyme activity. Supplemental enzymes are not always effective in addressing intolerance. Various carbohydrate restrictive diets such as the Specific Carbohydrate Diet (SCD), have been proposed for autism. Again, there is little research to support these diets specifically for autism. There is some evidence that the FODMAPS diet which minimizes fermentable oligo-, di-, monosaccharides and polyols may be helpful in children with co-morbid GI issues such as colitis, inflammatory bowel disease or carbohydrate intolerance.

The most commonly tried and the most studied diet is the GF CF diet. The theorized rationale for this diet is based on three things:

1. Due to limited enzyme activity, there is incomplete hydrolysis of casein and gluten proteins. Rather than complete breakdown to amino acids, many small peptide chains remain.
2. There is increased permeability of the intestine, which allows for these small peptide chains to be absorbed. This increased permeability is often referred to as a "leaky gut" and is thought to be a result of inflammation.
3. Once these peptides of casein and gluten enter the bloodstream, they cross the blood-brain barrier and enter the brain. These peptides have similar structure to endorphins, (the chemicals we produce when we are in pain, in love or eat chocolate) our body's natural opiates. The peptides bind to receptors in the brain altering brain structure and function .

Prior to starting a gluten free diet, it is important to test for Celiac disease especially if the child exhibits any potential signs or has first degree relatives with Celiac or other auto-immune disorders. The reason this is suggested is that gluten needs to be consumed for the tests for Celiac to be accurate and in case the family chooses to stay on the diet, it is important to test first. Prior to starting the diet, the family requires education regarding foods to avoid, foods to eat and hidden sources of gluten and casein. It is really important to not just focus on what not to eat, but to explore what the child can eat. There are many expensive gluten free products available but there are also many foods that are naturally gluten free and less costly then the specialty products. Assure that all care providers and family members are on board. When starting the diet, it is helpful to eliminate gluten or casein one at a time so that you can assess the effects of each protein. We generally eliminate casein first as it tends to be easier to remove from the diet.

All restrictive diets may increase the likelihood of nutrient insufficiency. When casein is removed, the risk of vitamin D and calcium deficiency is increased and cases of porous bones have been reported in boys with autism on a casein free diet. In addition, dairy foods usually provide a large percentage of calories, fat and protein, especially for the young child. Fortified dairy alternative such as coconut, almond, hemp, soy or rice milk are good sources of vitamin D and calcium, most are poor protein and fat sources with hemp and soy milk the only alternatives that contain protein. Substituting dairy alternatives may significantly reduce the calories in a young child's diet. Fortified wheat products such as pasta and bread are often a major source of iron in children's diet and glu-

ten free products are generally not fortified. To increase the palatability of gluten free products, starchy flours are used which provide refined carbohydrate and not much else, therefore, fiber and B vitamins from grains may also be limited in a GF diet.

The literature suggests that there is a subtype of children who do respond to the GF or CF diet, but a consensus report published in 2010 (Buie 2010) stated that additional data is needed before clinical recommendations are made. A systemic review of the literature (Mulloy 2013) reported that the opioid theory of the GF/CF diet is not supported but rather that reported benefits of diet may be linked to decreased "biological motivating operations" (allergies or GI upset) which cause tantrums, aggression and self stimulatory behaviors. Our clinic's experience is consistent with Mulloy's conclusions. Over the past 12 years, our clinic has seen benefit with limiting gluten or casein BUT in only in a small, select group of children. Generally, we have seen improvements such as decreased constipation, normalized bowel patterns, reduced reflux, better sleep, more attentive and less self stimulatory behaviors. Essentially, changing the diet addressed a source of pain which had caused dysregulation and the dysregulation was contributing to undesirable behavior.

Supplement use is as controversial as dietary change. There are many theories that seem to make sense but very little evidence of success. The etiologies and expression of autism varies greatly and most likely there are different etiologies and therefore different potentially successful treatments. Therefore, there is not one recipe for treatment. Supplement use may be treating an underlying deficiency or disorder that is a fellow traveler to autism rather than the "autism" itself. For example, magnesium supplements may be addressing magnesium deficiency secondary to use of proton pump inhibitors for treatment of reflux. Vitamin B supplementation may be targeting mitochondrial disorder. Children with autism ARE selective eaters and supplement use may just be improving overall nutrient intake. The treatment may provide benefit but may not be "treating" the "autism". While anecdotal reports seem to support the use of many supplements, published studies have not. **Table 1** indicates evidence supported supplement use, with dosage used indicated when available.

Table 1

Not Supported	Potentially Helpful	Positive Results
Vitamin B6 (.6-30 mg/kg/day)	Zinc (varies)	Vitamin B12 (*64.5 mcg/kg injection q 3 days; 500 mcg oral/nasal*)
Magnesium (6-15 mg/kg/day	Iron (varies)	Omega 3 fatty acids (550-1000 IU/ day)
Vitamin A (2500-5000 IU/day)	Vitamin C (120 mg/kg)	Folic Acid (.5-1 mg/kg or methyl folacin per day) specific for those with MTHFR gene mutation
		Probiotics (varies)

When initiating a diet or starting a supplement, it is important to consider the overall risk. This includes nutrient deficiencies, supplement interactions as well as social isolation that can occur when pizza, bread and ice cream are removed from the diet. Children with autism are usually selective in their eating and once a food is removed it may be difficult to add that food back into the diet. Clear benchmarks need to be identified to determine if dietary change or supplement use is helpful so that it can be maintained or discontinued. Objective measurements such as sleep, bowel movements (frequency, consistency), skin rashes, tantrums, attentiveness, verbalization and weight gain should be monitored. If possible, assessment at home and at school is helpful. Four months is sufficient time to see a benefit. It can be very disheartening for parents if dietary change or supplement use is not helpful as many websites and other media tout it as a cure. The greatest benefit may not be derived from a special diet or supplement but rather from a health promoting diet that meets recommendations for fats, proteins, fiber, vitamins and minerals. Making dietary change is a slow process and requires consideration of all factors influencing intake. Often a child's refusal to accept foods is considered controlling and thought of as a negative yet it may be self-protective to avoid the discomfort and should be respected. The consensus report also stated that behavioral intervention should not substitute form medical intervention. For success, complete nutrition assessment with consideration of the big picture is needed. Collaboration between dietitians and gastroenterologists, pediatricians, teachers, occupational therapists, and other interventionists is often necessary to achieve desired results.

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DCPNN Chair Notes

Have you heard that labels on certain products such as Beneprotein and Resource ThickenUp Clear were changed to indicate that they are not approved for use for children under 3 years of age? How has your organization responded when these products are needed for younger children? This is one of the questions that members have posted on our forum. If you are like me you don't remember to check the forum regularly but you do want to know what is going on. Think about subscribing to the DCPNN Forum. You will receive an email notice whenever there is a posting and you can join in on the conversations. You can also easily unsubscribe anytime.

This newsletter's main article comes from our DCPNN sponsored session on Autism and Nutrition presented at the DC National Conference last June. Patricia Novak was a thought-provoking speaker and has provided us with an excellent summary of her presentation. You can also keep an eye out as new presentations from the conference are uploaded to DCs Learning On Demand. DCs Coast to Coast Speaker Series includes a topic close to most pediatric dietitians hearts – allergies. Dr. Janice Joneja, a well know allergy expert, is speaking on "Success with food allergies and intolerance". Check when the presentation will be in your area.

If you have continuing education opportunities in your area and would like to share them let us know and DCPNN can send out an email or post it on our website. In this electronic age the opportunities to share and learn are better than ever. Let's make the most of them.

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