

Autism Spectrum Disorder — Research Suggests Good Nutrition May Manage Symptoms

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Decades ago, autism spectrum disorder (ASD), a group of developmental disabilities in which patients have significant social, communication, and behavioral difficulties, was considered rare, and the prognosis of those who had it usually wasn't good. Many individuals were committed to institutions for the rest of their lives because of their inability to function in society. But times have changed.

The prevalence of ASD among adults and children has skyrocketed over the last several years. Much more research on the etiology of the disorder and the different ways to treat and manage it has become available. Today there's evidence showing how nutrition therapy can play a significant role in managing various symptoms that prevent ASD patients from living productively.

This continuing professional education course will define ASD, discuss its prevalence and possible causes based on the latest research, and evaluate the critical role good nutrition may play in helping individuals function optimally. Dietitians will learn about the various nutrition therapies available and be able to apply them to practice.

Defining Autism

The word "autism" comes from the Greek word *autos*, meaning "self." It's been used for about 100 years to describe a condition in which people can't engage in social interaction. Originally, it was thought to be associated with schizophrenia. In 1943, Leo Kanner, MD, known as the father of child psychiatry for his pioneering work related to autism, first identified the disorder at The Johns Hopkins University in Baltimore.¹ Also in the early 1940s, German scientist and pediatrician Hans Asperger, MD, identified patients with similarly withdrawn behavior, now known as Asperger's syndrome.²

Today, autism is better defined by the term "autism spectrum disorder," which describes a grouping of various developmental disabilities. Symptoms of ASD usually begin before the age of 3 and continue throughout a person's life. In some infants, there are early signs of the disorder, such as not wanting to cuddle, lack of eye contact, or abnormal responses to touching and affection. Other early signs include the inability to follow objects visually, not responding to his or her name being called, and lack of facial expressions, such as smiling.³ Some children with ASD develop normally until the age of 1 or 2, then stop learning new skills or lose the ones they already have learned.³

There are three main classifications of ASD and understanding the difference among them will help to better focus treatment. The first classification of ASD is autistic disorder, which is considered the classic form of autism. Patients usually have significant delays in language, social skills, and the ability to communicate. Some have unusual behaviors and interests, and have a measurable intellectual disability.

The second form of autism is Asperger's syndrome, usually a milder form of autism. Patients still have delays in social abilities and communication skills, and have unusual behaviors and interests.⁴ Many individuals have a specific interest that encompasses much of their time and thought. People with Asperger's may spend much of their time devoted to a hobby (eg, trains, computers). They usually don't have issues with language skills or intellectual development. In fact, many are intelligent, especially when it comes to their own special interests. Some experts liken patients with Asperger's to little professors in their areas of interest; they can have near genius IQs.

The third form of autism is pervasive developmental disorder, not otherwise specified, or atypical autism. These individuals meet only some of the criteria for classic autism or Asperger's. They have fewer, milder symptoms and may experience delays only in the areas of social skills and communication.⁴

Current ASD Statistics

The number of children diagnosed with ASD has increased almost tenfold in the last 40 years.⁵ Currently, one in every 88 children is diagnosed with ASD.⁵ When broken down by gender, five times more males (one in 54) than females (one in 252) are affected.⁵ These statistics indicate that ASD affects more than 2 million people in the United States and more than 10 million worldwide.⁴ According to the organization Autism Speaks, ASD affects more children than diabetes, AIDS, or cancer combined.⁵

The increase in diagnoses may be due in part to better diagnostic tools, but many believe environmental toxins and genetics hold better clues to the increase in prevalence, although this hasn't been proven.

Link Between ASD and Environmental Toxins

No specific environmental toxin has been identified as the cause of autism, but research to determine which chemicals may be culpable is under way. It's been proven that a fetus is vulnerable to environmental chemicals during development. Examples of chemicals that, in the past, have been shown to harm fetal development include organophosphate insecticides⁶ (eg, chlorpyrifos), mercury exposure,⁷ and heavy metals (eg, lead).⁸

It's a widely held belief that people with ASD have difficulty eliminating toxic chemicals from their body. If this is the case, exposure to environmental contaminants could play a significant role in poor neural development or brain function processing. Unfortunately, because of the short amount of time research has been conducted on the link between autism and environmental toxins, causality still remains speculative. However, it continues to appear that genetics, environment, and the interaction of a child's physical and psychosocial environment

play an interrelated role in the possible causes and triggers of ASD. Such associations can be seen in the high incidence of autism in twins and genetic siblings who have the disorder.⁹

Other suspected causes of autism include advanced parental age,¹⁰ low birth weight,¹¹ and multiple births.¹² A viral infection, such as the flu, in the first trimester has been shown to triple the odds of a child developing ASD, and a bacterial infection, such as a urinary tract infection, in the second trimester has been found to increase the risk of ASD by 40%.¹³ Recently, researchers examined inflammatory disease as a possible cause of autism and found that it could possibly contribute to the etiology of the disorder.¹⁴

Problem-Eating Behaviors

While the medical community may not have identified the exact causes of ASD, much has been learned about the challenges ASD patients face that often lead to poor diet quality. These include problems with sensory processing, eating behaviors, and feeding disorders. It's estimated that 46% to 89% of patients with ASD experience some kind of problem-eating behavior.¹⁵ Some feeding difficulties revolve around changes in routine. For example, patients with ASD may refuse to eat unless they sit in the same place at the table, eat on the same dishes, use the same tablecloth, and eat the same foods daily.¹⁵ The slightest change in routine can cause a tantrum or result in the refusal to eat.

Other issues may occur in the area of sensory processing. For example, if children with ASD are hypersensitive to sounds, they may not want to eat in a noisy area or with others engaged in conversation. If they have visual sensitivities, they may accept foods only of certain colors. They also may not be able to eat foods that are touching each other on their plate.

Some children are sensitive to the way foods feel in their mouth. They may avoid crunchy foods or foods that have a slick mouthfeel. The way food smells can cause similar reactions, and there are instances in which children may not recognize certain tastes but can distinguish between others.

A study by Benetto and colleagues showed that children with ASD were less able to accurately identify sour or bitter tastes but could recognize salty and sweet tastes.¹⁶ This study may shed light on why patients with ASD avoid several types of foods, such as proteins, but will usually accept foods in the carbohydrate group.

The best approach to solving problem-eating behaviors, according to Elizabeth Strickland, MS, RD, LD, author of the book ***Eating for Autism: The 10-Step Nutrition Plan to Help Treat Your Child's Autism, Asperger's, or ADHD***, is to assemble a "feeding team," a group of healthcare professionals consisting of a physician, speech language pathologist, occupational therapist, behavioral therapist, and RD.¹⁷ A dietitian can evaluate the foods the child agrees to eat for potential dietary deficiencies. He or she can watch the child and family during meal times to assess habits that may be hindering food intake. An RD also can screen the medications the child takes that may have side effects that contribute to feeding problems.

ASD and Food Additives

Just as problem-eating behaviors can prevent ASD patients from getting the nutrients they need, so can consistently consuming highly refined foods. Since highly refined foods may contain artificial dyes and preservatives that could be associated with aggravating behavioral symptoms in those with ASD,^{18,19} suggesting the family eat natural, whole foods may be an important treatment intervention.

Dietitians working with ASD patients can recommend eliminating the following substances from an ASD patient's diet if they believe a sensitivity exists:

Food dyes and artificial colors: These additives have been linked to hyperactivity, breathing disorders, skin eruptions, and gastrointestinal symptoms in non-ASD patients.^{18,19} Since many ASD patients already have these symptoms, eliminating foods that contain these substances may be helpful to assess a patient's reaction.

High-fructose corn syrup: One of the main concerns with high-fructose corn syrup involves the manufacturing process. Research has found that mercury, one of the environmental toxins that may be responsible for the increased prevalence of ASD, is part of the refining process when making high-fructose corn syrup.⁷ However, an independent study commissioned by the manufacturers of high fructose corn syrup in the United States and Canada and reviewed by mercury researcher, Woodhall Stopford, MD, MSPH, of Duke University Medical Center, found there are no quantifiable levels of mercury in the production of high-fructose corn syrup. Nevertheless, removing it from the diet whenever possible may be a helpful suggestion.

Artificial flavorings: Monosodium glutamate (MSG), for example, has been shown to cause headaches, muscle tightness, numbness or tingling, weakness, and flushing in people who are sensitive to it.²⁰ Because of these known potential side effects, it may be appropriate for ASD patients to avoid MSG as a precautionary measure.

Artificial preservatives: Studies have indicated that artificial preservatives may cause sensitive individuals to experience headaches, behavioral/mood changes,²¹ or hyperactivity.²² So removing foods that contain these substances may be beneficial.

Artificial sweeteners: Aspartame, acesulfame-K, neotame, and saccharin have been known to cause headaches, mood changes, nausea, vomiting, and diarrhea in the general population.²³

When discussing dietary recommendations with ASD patients or their parents or caregivers, also suggest that patients be screened for nutritional deficiencies that can result from the medications they take. Some medications can affect appetite and cause nausea, vomiting, constipation, hard stools, diarrhea, esophageal reflux, weight gain or loss, sedation, drooling, and sometimes dysphagia, all of which can compromise nutritional status. For example, if a child is constipated, he or she may experience a decrease in appetite. If dysphagia is an issue, he or she may decrease food intake for fear of choking while swallowing. If medication causes sedation, the child may not feel the need to eat even though he or she is hungry.

Supplementation

Another aspect of ASD treatment involves supplementation with multivitamins, omega-3 fatty acids, vitamins D and B₆, magnesium, and other nutrients. Beginning multiple supplements at one time may impede the ability to determine what's working or not working in ASD patients. Therefore, the best strategy may be to start one supplement at a time for several weeks to determine whether there's an improvement in symptoms.

If the patient takes one supplement for several weeks and experiences no improvements in symptoms, it means the supplement may not be helpful for that particular patient. If improvements are seen, stopping the supplement for a week or so to determine whether symptoms return can be a good strategy to gauge effectiveness. This process allows ASD patients to follow the least restrictive regimen possible while identifying improvements in symptoms.

Multivitamins

Most practitioners who work with ASD patients agree that a good-quality multivitamin without artificial colors or flavors can help offset limited dietary preferences and poor nutritional intake. Finding the right multivitamin will depend on a patient's tolerance. Some will swallow a pill, while others will prefer a liquid, gummy, or chewable form. RDs are in a perfect position to determine what's acceptable and meets each patient's needs.

Omega-3 Fatty Acids

Research has shown that adding omega-3 fatty acid supplements to ASD patients' diets may provide many benefits. Omega-3s are critical for brain development and proper neural function. Multiple studies have shown imbalances in the ratio of omega-3 to omega-6 fatty acids in the bloodstreams of ASD patients.²⁴⁻²⁷ Obtaining adequate amounts from food alone may be difficult because of the limited number of foods they may eat. For example, some children with ASD won't eat cold-water fish (eg, salmon, tuna), and some parents won't add fish to their children's diet because they believe it contains mercury that may exacerbate ASD symptoms. Still, many parents do give their children omega-3 supplements.²⁸

Some practitioners recommend 1.5 g/day of omega-3 fatty acids for most pediatric patient populations.²⁵ According to research, children with ASD who take omega-3 supplements have less anxiety and aggression, decreased hyperactivity and impulsivity, longer attention spans, and improvement in language development, reading, and spelling skills.^{27,29-31} Most omega-3 supplements are made from fish oil, so it's important to ensure they're free of mercury. (The label will indicate mercury-free processing.) Because oils can become rancid, it's best to use supplements before their expiration date. Some supplements contain added vitamin E as a preservative to improve shelf life, while others are bound with dietary calcium to preserve the oil at room temperature.

If patients complain of stomach upset or fishy burps but don't experience this when they eat fish, question the freshness of the supplements. Patients may need to keep the supplements in the refrigerator so they stay fresher longer.

Vitamin D

Several studies suggest a direct link between low vitamin D (25-hydroxyvitamin D) levels and the risk of ASD since vitamin D regulates the immune system. Research shows that children are at risk of ASD because of their body's inability to identify foreign invaders and eliminate toxic substances and have an even higher risk of developing the disorder if they're vitamin D deficient.

Vitamin D protects against DNA damage and can help repair damage once it's occurred. (Its role in reducing damage in the case of environmental toxins is being investigated.) In addition, vitamin D may reduce oxidative stress, a hallmark of ASD, and lower the number of inflammatory cytokines present in the brain, which have been associated with the disorder.³²

According to John J. Cannell, MD, founder and executive director of the Vitamin D Council, the prevalence of ASD increases in "regions of greater cloud cover and rainfall."³³ Studies have shown there are more ASD cases in children born between October and March.³⁴ Research suggests this may be due to the lack of sunlight exposure.

The body produces vitamin D when the skin is exposed to the sun's ultraviolet B rays, but during the cooler months of the year, the sun isn't out long enough for pregnant mothers to get ample exposure. Ensuring women get adequate amounts of vitamin D during pregnancy is imperative. In supplement form, the Recommended Dietary Allowance (RDA) is 600 IU. However, if blood work shows a pregnant woman is deficient, a plan for increasing her vitamin D level must be directed by her physician, who may prescribe doses much greater than the RDA. This applies to nursing mothers and children with ASD as well.

Vitamin B₆ and Magnesium

Vitamin B₆ and magnesium supplementation also are used in treating ASD patients. One way to boost intake is in the form of a multivitamin that contains both at US Reference Daily Intake standards. Some studies have shown improvements in behaviors, such as increased speech, decreased aggression/temper issues, better eye contact, increases in IQ, and the ability to interact socially, with vitamin B₆ and magnesium supplementation.³⁵ Other studies, however, have shown that high-dose pyridoxine supplements can cause peripheral or sensory neuropathies,³⁶⁻³⁷ and larger doses of magnesium can cause gastrointestinal upset and diarrhea.

Other Supplements

Glutathione, which can be used in ASD treatment, enables the body to detoxify and protect itself against oxidative damage.³⁸ Moreover, dimethylglycine is touted to improve language skills and the ability to make eye contact. However, there's little evidence showing that either alleviates symptoms.³⁹⁻⁴⁰ More research is needed to show efficacy of some of the current supplements being used.

Probiotics, Antifungals, and Digestive Enzymes

Probiotics and antifungals are common treatments for the abdominal pain, bloating, gas, constipation, gastroesophageal reflux disease, nausea, vomiting, and diarrhea that many ASD patients experience. No conclusive evidence is available to explain why these digestive

symptoms are common in ASD patients, but the use of probiotics has provided relief of these symptoms for many of them.

The National Center for Complementary and Alternative Medicine defines probiotics as live microorganisms—usually bacteria, but they also can include microbes such as yeast—that people can ingest to increase the population of desirable bacteria in the gut. Antifungals inhibit the growth of a fungus or destroy it. They're used in the treatment of *Candida albicans*, a fungus frequently reported as the culprit when a yeast infection is present. It can cause itching and burning of the mucous membranes, skin eruptions, and imbalances in the overall health of the gastrointestinal tract.

Digestive enzymes are substances that help break down large macromolecules in foods to smaller substances to facilitate their absorption. Examples of digestive enzymes include proteases that break down proteins or lipases that help break down fat. If a dietitian suspects a patient is experiencing inadequate digestion, digestive enzymes may help. In some cases, digestive enzymes may aid in the removal of toxic compounds from the gut.¹⁷

Elimination Diet Therapy

The elimination diet is another option that has shown promise in treating ASD and involves removing certain foods from the diet for a period of time to determine whether they're causing symptoms of food allergies and intolerances. Research has shown that eliminating gluten and casein from the diet of ASD patients can alleviate symptoms such as behavior problems and poor cognitive and social functioning.⁴¹

There are several theories as to why the elimination diet may be beneficial. One hypothesis is that ASD patients can't digest gluten and casein, causing the formation of the peptides gluteomorphin and caseomorphin and their absorption into the bloodstream because of increased gut permeability, or leaky gut syndrome. These two peptides, which appear to have a chemical structure similar to opiates, can cross the blood-brain barrier and cause symptoms such as delayed social and language skills, and withdrawn behavior.⁴²

There are concerns about the use of a gluten-free/casein-free diet because its planning requires a skilled professional who understands the complexities of elimination diets and the restrictions of appropriate foods. The exclusion of wheat and milk puts an ASD patient at risk of nutrient deficiencies in calcium, protein, vitamin D, folic acid, and B vitamins. And studies have found that diets lacking gluten and casein raise the risk of decreased bone density and stunted growth.⁴³ However, RDs can introduce other foods into the diet as well as provide advice on nutritional supplements to compensate for low nutrient intakes.

A more complex elimination diet that some specially trained dietitians use is called the LEAP (Lifestyle, Eating, and Performance) protocol. This involves eliminating any known foods or chemicals suspected of triggering symptoms. These foods and chemicals are identified by a blood test called the Mediator Release Test, which shows reactions to multiple foods and chemicals. These reactions involve the immune systems of patients who ingest foods and chemicals to which they're sensitive. Their immune system identifies these foods and

chemicals as foreign invaders, causing the immune system to release mediators to fight off the “invaders.”

Some of the mediators released include histamine, prostaglandins, leukotrienes, cytokines, and peroxides. These mediators have been shown to cause reactions such as inflammation, diarrhea, pain, intestinal cramping, constipation, headache, and pain receptor changes. Studies have shown enhanced proinflammatory cytokine production is present in patients with ASD.⁴⁴⁻⁴⁷

Reactions to certain foods and chemicals also can cause the release of the brain neurotransmitters dopamine and serotonin. Dopamine appeals to the sense of reward and enjoyment, and plays a role in addictive behavior. Serotonin contributes to feelings of well-being and happiness.

When dopamine and serotonin are released as a result of ASD patients ingesting foods and chemicals to which they're sensitive, they may experience less pain, brain fog, or inability to focus and concentrate. According to certified LEAP therapists, ASD patients also may feel euphoric after ingesting a reactive substance or stop throwing a tantrum after eating a reactive food. It's in these instances where the Mediator Release Test may help with identifying reactive substances that can be eliminated to improve behavior, communication skills, and other immune-related health issues and allow for more variety in the diet for better nutrition.

What Lies Ahead

So what does the future hold for individuals with ASD? While there's no concrete answer to this question, we know RDs can play a huge role in the management and treatment of ASD symptoms.

RDs' ability to analyze diets for nutritional deficiencies can help concerned parents. Contacts with other healthcare disciplines that monitor patient behaviors make RDs invaluable as they provide holistic approaches to treatment for optimal cognitive and social functioning. RDs are the best source for providing accurate and up-to-date information on supplementation, elimination diet therapy, and current research on new nutritional approaches.

More and more patients will depend on dietitians as the source of information that will enable patients to live productive lives. Dietitians with the passion to work with this challenging segment of the population will be a much-needed resource in the dietetics community in the years to come.

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Examination

1. A patient presents with significant delays in language and social skills, and can't clearly communicate. The patient may have which type of autism spectrum disorder (ASD)?

- A. Autistic disorder
- B. Asperger's syndrome
- C. Pervasive developmental disorder, not otherwise specified
- D. None of the above

2. Which of the following is not usually a challenge ASD patients may face that often leads to poor diet quality?

- A. Sensory processing
- B. Feeding disorders
- C. Binge eating
- D. Problem-eating behaviors

3. Patients with ASD who avoid several types of food, such as protein, usually will accept foods in the carbohydrate group.

- A. True
- B. False

4. Which of the following is one of the best approaches to addressing problem-eating behaviors?

- A. Introduce one new food every three weeks until the child gets accustomed to eating it.
- B. Eliminate a food the child doesn't want to eat for three weeks then reintroduce it.
- C. Evaluate the foods the child agrees to eat for potential deficiencies.
- D. A and B

5. Which of the following supplements have been shown to reduce anxiety and aggression, decrease hyperactivity and impulsivity, and increase attention span in ASD patients?

- A. Multivitamins
- B. Omega-3 fatty acids
- C. Vitamin D
- D. Glutathione

6. Which of the following treatments may aid in removing toxic compounds from the gut of ASD patients?

- A. Probiotics
- B. Antifungals
- C. Digestive enzymes
- D. Dimethylglycine

7. Research has shown that eliminating gluten and casein from the ASD patient's diet can alleviate which of the following symptoms?

- A. Behavior problems
- B. Poor cognitive functioning
- C. Poor social functioning
- D. All of the above

8. Patients with Asperger's syndrome are more likely to have which of the following characteristics than those diagnosed with a different type of ASD?

- A. Significant delays in language skills
- B. Abnormal responses in balance
- C. Delayed reactions to pain
- D. A near genius IQ

9. A viral infection such as the flu in the third trimester has been shown to triple the odds of a child developing ASD.

- A. True
- B. False

10. Which of the following is not an early sign of ASD in infants?

- A. Not wanting to cuddle
- B. Lack of eye contact
- C. Abnormal responses to touch and affection
- D. Colic