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The Ketogenic Diet: An Answer for Autism?

Anne Perez

Abstract: Lacking substantial evidence regarding its genetic identity, autism spectrum disorder (ASD) is a remarkably misunderstood condition with limited options for effective treatment. As the prevalence of patients with ASD increases, medical professionals continue to search for a solution. Could the ketogenic diet, a high fat, low carbohydrate nutrition plan, provide the relief that ASD patients are searching for?

Lacking reliable pharmaceuticals to effectively treat this condition, Autism Spectrum Disorder (ASD) is a source of perplexity for medical professionals. According to a study conducted by the United States Center for Disease Control and Prevention, 50% of Americans take at least one prescription drug per day.¹ In contrast, most individuals diagnosed with ASD commit to a strict schedule of prescription medications including stimulants and antipsychotics. These medications are associated with high risks and regularly prescribed for off-label indications.² Worse though, due to insufficient data regarding the genetic identity of ASD, many marketed medications fail to provide relief from debilitating symptoms including repetitive thoughts, communication deficits, and social anxiety.³ As existing therapies prove to be inadequate for most patients, medical professionals continue to examine the success of nutritional therapy in the treatment of autism. Suppose the answer isn't in a prescription bottle, but rather, right inside the refrigerator door. As the prevalence of ASD among patients increases, researchers explore the possibility of utilizing the ketogenic diet (KD) as an effective treatment for autism. Could a trendy diet compete with society's most powerful prescriptions?

According to the National Institute of Mental Health, Autism Spectrum Disorder (ASD) is a neurological disorder that primarily affects communication and behavior.⁴ Patients with ASD exhibit mood swings, repetitive habits, and learning deficits that contribute to a diminished quality of life. There is no known cause for ASD, making it particularly difficult for physicians to manage and treat. Still, research suggests that autism most likely develops as a result of both genetic and environmental factors. Today, ASD is primarily treated with medication and cognitive therapy. However, there is no single treatment method that has proven to be safe and effective for all ASD patients.^{5,3} Striving to establish a cohesive and successful solution for autism, some researchers have turned to a nutritional practice making headlines - the ketogenic diet.

The ketogenic diet is a high fat, low carbohydrate nutritional practice intended to initiate metabolic ketosis within the body. Ketosis occurs when ketones, molecules produced from fatty acids, replace carbohydrates as the body's primary source of fuel during metabolic reactions.⁶ The benefits associated with keto-adapted metabolism, especially weight loss and reduced hunger, have largely increased KD's popularity within the last decade. Notably, multiple variations of the ketogenic diet placed

among Google's trending topics in 2016.⁷ However, despite the growing popularity of this diet, many patients and medical practitioners alike fail to acknowledge the potential cognitive benefits of ketosis including elevated levels of energy, focus, attention, and neurological development. These ketogenic brain boosters would be especially beneficial for patients diagnosed with autism. To understand how KD could positively reduce symptoms of ASD, one must explore the way in which KD affects metabolic functions.

Firstly, it is important to note that patients with ASD demonstrate varying levels of mitochondrial dysfunction, which inhibit the creation of metabolic energy.⁶ This loss of energy can result in damaged brain cells and the manifestation of physical symptoms like epileptic seizures which affect 1 in 4 ASD patients.⁷ To combat this, ketosis produces elevated levels of NADH and FADH₂ molecules that contribute to the creation of new energy.⁶ In this way, KD increases mitochondrial function and can decrease the prevalence of seizures in ASD patients. Additionally, higher rates of reactive oxygen species in the mitochondria of ASD patients cause compromised cellular activity resulting in neurological abnormalities.⁶ KD inhibits mitochondrial reactive oxygen species and serves as a regulatory mechanism for the cell. Finally, studies have recently revealed that ketosis targets certain governors of energy within the body, such as the mTOR neurological pathway, which is inhibited in many ASD patients and contributes to communication deficits.⁶ Today, medical professionals continue to study these unique metabolic activities as they search for credible data to support the therapeutic potential of KD.

Results of significant studies continue to validate KD's positive effect on patient's with autism. The first experiments utilizing this treatment method were conducted on mice that possess traits comparable to ASD patients. These mice are characterized by low sociability, reduced communication, and high levels of self-directed behavior. After 3 to 5 weeks on the ketogenic diet, mice exhibited enhanced sociability and communication as well as a decrease in self-directed behavior.⁸ These results mark the first indication that an established dietary intervention demonstrates behavioral benefits in a mouse model of autism. Consequently, KD has been identified as a potential therapeutic strategy for individuals with ASD and a topic of further research for medical professionals.

Following promising pre-clinical results, a primary clinical study conducted in 2003 prescribed KD to 30 patients with ASD for approximately 6 months.¹¹ Among the patients who successfully followed the diet, those with mild ASD symptoms displayed significant improvement in neurological habits, such as concentration, information retention, and social behavior. The rest of the participants showed mild to moderate alleviation of ASD symptoms. It is also noteworthy that no patient suffered from metabolic side effects during this trial.

Perhaps the most convincing evidence for the ketogenic diet as ASD therapy comes in the form of personal accounts. Open publications are flooded with reports from parents and physicians claiming to have alleviated ASD symptoms with low-carb dietary intervention.⁹ Most notably, a case published in 2018 describes a 6-year-old with severe ASD symptoms placed on the ketogenic diet.¹² The patient reported to have responded poorly to traditional behavioral and pharmacological treatments. However, after just one month of KD, the patient showed improvements in communication skills, attention span, intelligence, awareness, and emotional stability. These advancements were measured through several IQ tests as well as the Childhood Autism Rating Scale (CARS), a method used by licensed physicians to measure the severity of ASD. The patient began with a CARS score of 43, indicating severe autism. After 16 subsequent months of KD, the patient scored 27 on the CARS scale, classifying this ASD case as mild to moderate. Throughout the study, PET scans were used to track metabolic changes in the brain. Analysis of these images prove that glucose metabolism in the patient's brain decreased by 20%.⁹ Still, research has yet to identify a definitive link between reduction of glucose metabolism and elevated neurological function.

"The Magic Pill", an Australian documentary now streaming on Netflix, explores the effects of the ketogenic diet on several ailments, including ASD. The film follows Abigail, a young girl with autism, as she commits to the ketogenic diet for a total of five weeks. Although initially difficult to introduce, the diet ultimately displays benefits, including communication and digestive improvements observed by Abigail's clinicians. However, the film faces criticism from many healthcare professionals including Michael Gannon, president of the Australian Medical Association, who says, "The idea that a high-fat diet can change a child's behavior in a month is just so patently ridiculous...and yet the reality is the parents of autistic children are so desperate they will reach for anything".¹⁰ Andrew Baumann, president and CEO of New York Families for Autistic Children, adds "Parents are willing to try just about anything. You can't cure something [when] you don't know what the cause is."¹¹ Ultimately, many providers demand more evidence before they utilize KD as a principal therapy for their patients. When asked her opinions on the ketogenic diet as therapy for neurological disorders, Tara Rochford, registered dietician and nutrition specialist at Butler University, explains, "the ketogenic diet is a very restricted eating plan that limits our intake of foods that we know provide a high range of health benefits. For special populations, this may be a successful therapy, however, more research is needed." Without further evidence regarding the origin of autism and the efficiency of KD, clinicians are likely to

recommend traditional medication for the management of ASD symptoms despite possible risk factors.

For patients who are unsatisfied by medicinal intervention, the ketogenic diet continues to be a promising solution to a growing problem. Today, 1 in 59 children is diagnosed with ASD, according to estimates from CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network.¹² Although clinical evidence remains scarce, the ketogenic diet has proven to be successful under certain conditions in alleviating symptoms associated with ASD. Still, without an approved alternative treatment method, many patients shut the refrigerator door and head to the pharmacy.

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