

## Nutritional and Dietary Interventions of Autistic Spectrum Disorders: A Short Review

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### Abstract

Autism spectrum disorder (ASD) is a neurodevelopmental condition of heterogeneous etiology, categorized by social communication deficits, repetitive or restrictive behaviors and interests. Epidemiological studies display that the incidence of autism is increasing, and the treatment of autism is vitally important. Therefore, the purpose of this article is to reorganize evidence on the effectiveness of vitamins, minerals, essential Fatty Acid, and a Gluten-Free and Casein-Free (GFCF) diet as a treatment for children with ASD. The existing nutrition and dietary therapies have been lectured and their effects on ASD symptoms have been discussed briefly considering specific research. Reviewing the studies showed that nutritional and dietary therapies improved the core symptoms of ASD. This review article investigates the importance of vitamins, minerals, essential fatty acids and GFCF diet and the recent studies suggested that nutrition and dietary supplements may play an active role in improving symptoms of ASD.

**Key Words:** Autistic Spectrum Disorders, Autism, Child, Diet, Dietary supplements.

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## INTRODUCTION

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition, affecting around 1% of children (1, 2). The ASD is categorized by social communication deficits and the presence of repetitive or restricted behavior or interests (3). There are common problems in communication and social interactions among children with ASD such as issues related to behavioral challenges, including self-injury, aggression, and non-compliance (3). Currently, no drug can treat ASD; but some medications can help address some of the symptoms associated with ASD, especially certain behaviors (3). Some ASD interventions are based on behaviors, while others are considered food therapies that families believe may lead to enhanced behavioral outcomes, such as vitamins, minerals, essential fatty acids and Gluten-Free and Casein-Free (GFCF) diet (4-10). The common complaints of ASD individuals are chronic constipation, diarrhea and abdominal pain (11, 12). Some foods cause allergies and gastrointestinal symptoms, in addition to behavioral symptoms (12, 13). Given the early-onset and chronic nature of ASD, dietary supplements can determine the need for families, because they can be administered early or for a long time for younger children (14, 15).

## VITAMINS AND MINERALS

Children with ASD suffer from impaired methylation, decreased glutathione, and increased oxidative stress (16, 17). A study conducted by James et al. (2009) on 48 children who were qualified metabolically for the research showed that dietary supplements with methyl-B12, folic acid, and trimethyl glycerin were beneficial in improving the homocysteine level and glutathione (18). Another double-blind, placebo-controlled randomized study followed 141 children with autism administered three-month

treatment with vitamins and minerals supplements and evaluated the symptoms of pre- and post-autism (19). The finding of this study showed that the supplement group had significantly larger improvements than the placebo group on autism-related symptoms on the Parental Global Impressions-Revised Average Change ( $p = 0.008$ ), and on the sub scores for Hyperactivity ( $p = 0.003$ ), Tantrum Ming ( $p = 0.009$ ), and Receptive Language ( $p = 0.03$ ) (19). In another randomized, Placebo-Controlled Trial conducted by Hendren et al. in 2016 the efficiency of Methyl B12 in a sample of 57 children (aged 3–7 years) with autism displayed significant improvement in clinician-rated measures (20). Recently, in 2018 Guo et al. conducted a study aimed to compare the vitamin and mineral levels of Chinese children with (ASD) with those of age-matched Typically Developing (TD) children and to examine their effects on the symptoms of autistic children. The study included 274 children with ASD and 97 age-matched TD children (21). The findings of the study showed that the levels for vitamin D, folate, Ca, Mg, Fe, and Zn among children with ASD were significantly lower than those of TD children (21). Folate, Ca, Fe and Zn were positively correlated with the Gesell Developmental Scale GDS of autistic children (21). Furthermore, a very recent study found that vitamin D treatment for 12 months among 19 children (aged 2.5-8 years) had a more significant reduction in hyperactivity compared to placebo (22).

## ESSENTIAL FATTY ACID

Poly-Unsaturated Fatty Acids (PUFAs) are either necessary essential or necessary provided and contain many fatty acids such as omega-3 and omega-6. The two omega-3 acids that are of concern for supplementation are Eicosa-Pentaenoic Acid (EPA), and Docosa-Hhexaenoic Acid (DHA) as the human body cannot synthesize them, and the intake of EPA

and DHA are generally dependent on dietary intake (23). The EPA and DHA are essential for the structure and function of the brain because they are orthomolecular and functional sites are exclusive cell membranes (24). Studies concluded the positive impact of omega-3 fatty acid supplementation on improving ASD symptoms (25).

A meta-analysis of fifteen case-control studies found that the ASD group compared with TD individuals, had lower DHA, EPA and arachidonic acid (AA), and a lower ratio of total omega-3 to total omega-6 fatty acids (26). Furthermore, a meta-analysis of sixteen randomized controlled trials confirmed the benefits of supplementation with omega-3 Polyunsaturated Fatty Acids (PUFAs) for some psychiatric disorders such as schizophrenia, depression, Attention Deficit Hyper Activity Disorder (ADHD) that involves similar symptoms like ASD (27, 28). A meta-analysis of four randomized controlled trials among a total sample of 107 patients has shown that omega-3 fatty acid supplements significantly improved social interaction ( $p < 0.02$ ) and restricted interests and behaviors ( $p = 0.05$ ) (26). Further research with larger sample size is required to confirm the efficacy of omega-3 in improving the ASD symptoms.

## GLUTEN AND CASEIN FREE DIET

Many studies recommended that special diets such as Gluten-Free and Casein-Free (GFCF) diet can be beneficial for individuals with ASD. The GFCF suggested the elimination of all food items comprising cereals, for example flours and bread or having dairy products such as milk, yoghurt, and butter (26, 29). In 2010 Whiteley et al., conducted a randomized, single-blind, placebo-controlled study to examine the effectiveness of GFCF diet for a period of 12 months, involving 54 children with ASD, and they compared the

GFCF diet group to the control group (7). The study finding showed that there were significant benefits in communication subscores among children using the Autism Diagnostic Observation Schedule (ADOS) (7). It also reported benefits in social interaction, daily living skills, inattention, and hyperactivity (7). In the GFCF group there were significant improvements in the scores for the communication (ADOS), also benefits described in social interaction, daily living skills, inattention, and hyperactivity. The beneficial effect of GFCF diet on ASD symptoms was also confirmed by Adams et al. in 2011 (19).

## DISCUSSION

The ASD had a negative effect on child's cognitive development status and impaired communications social interaction, and imagination skills; in addition, there is no medication approved for treating the core symptoms of ASD (3). Children with ASD were deficient in vitamins, minerals and OMG-3, as well as the common gastrointestinal disorders which are prevalent in ASD children and the search for a safe alternative has recently increased. Vitamins, minerals, omega-3 fatty acids and dietary (GFCF) were effective in improving the underlying symptoms of ASD as a treatment under certain conditions (8).

The nutritional supplements intervention as a complementary and alternative therapy is broadly used (4, 5, 8). The gastrointestinal tract is an essential biological system associated with ASD (4, 8). Disproportionate representation of functional and pathological bowel conditions and behaviors showed bi-directional associations and a possible relationship between diet and gastrointestinal function and autism (4, 8). Gaps in knowledge remain of autism-related digestive functions, specifically about mechanisms of action leading up to

the behavioral presentation. However, in the context of diversity in the performance of autism, science seems to be moving towards identifying relevant genotypes associated with autism with the potential for promising nutrition and other relevant options to emerge to improve the quality of life (4, 8). This mini review literature suggested various nutritional and dietary therapies are beneficial for managing the symptoms of ASD in children and adolescents. Many studies recommend special diets to help individuals with ASD (29). Among the different supplements tested (minerals, vitamins and omega-3 fatty acids) were deficit in ASD individuals (8, 21). Methyl B12 treatment improved the clinician-rated symptoms of ASD outcomes which was measured by the Clinical Global Impressions-Improvement (CGI-I) score (7). There is some evidence that following a GFCE diet is beneficial for ASD symptoms management in children, based on the findings from one trial (7).

Throughout the studies reviewed, dietary supplements such as minerals and vitamins, as well as omega-3 fatty acid supplementation improve the core symptoms of ASD (19, 21, 22, and 26). Dietary supplementation and such food restrictions can potentially improve some ASD symptoms; however, further research should be considered with large sample size and adequate study duration to confirm the efficacy (26). Individuals with ASDs need annual medical, nonmedical, and indirect economic costs and lifetime support (30). Nevertheless, the importance of dietary supplement for children with ASD is congruent on them being safe, low cost, easily accessible and available (31). Dietary supplements such as minerals and vitamins, as well as omega-3 fatty acid supplementations were generally safe with no reports of severe adverse events but the readily available GFCE diet has a reasonably high price (31).

## CONCLUSION

Some ASD interventions are based on behaviors, while others are considered food therapies that families believe may lead to enhanced behavioral outcomes, such as vitamins, minerals, essential fatty acids and Gluten-Free and Casein-Free (GFCE) diet. The recent studies suggested that nutrition and dietary supplements may play an active role in improving symptoms of ASD.

## RECOMMENDATIONS

Further molecular studies should be carried out to understand the mechanisms of dietary supplements and the specific health benefits on improving ASD symptoms. Future research requires a larger population size and should be followed for an extended period, as dietary supplements are commonly administered long-term. The combination of dietary supplement and a healthy diet aid in further effectiveness in reducing the ASD symptom and may increase overall functioning level, which should be considered. In general, dietary supplements should be combined with additional clinical studies as a safe and effective alternative treatment of ASD.

**CONFLICT OF INTEREST:** None.

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