

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 have shown that the incidence of autism is increasing and its treatment is vitally important. Therefore, the purpose of this study was to investigate the effectiveness of vitamins, minerals, essential fatty acid, and a gluten-free and casein-free (GFCCF) diet as a treatment for children with ASD. The existing nutrition and dietary therapies were investigated and their effects on ASD symptoms were discussed briefly. Reviewing the studies showed that nutritional and dietary therapies can improve the core symptoms of ASD. This review investigated the importance of vitamins, minerals, essential fatty acids and GFCCF diet. Recent studies have 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 about 1% of children worldwide (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 behavioral challenges, including self-injury, aggression, and non-compliance (3). Currently, there is no available medication to treat ASD, however some medications are effective to address some of the symptoms associated with ASD, especially certain behaviors (3).

Some ASD interventions have focused on behaviors, whereas others have considered food therapies that families believe they may lead to enhance behavioral outcomes, such as vitamins, minerals, essential fatty acids and Gluten-Free and Casein-Free (GFCF) diet (4-10). The common complains of ASD individuals are chronic constipation, diarrhea and abdominal pain (11, 12). Some foods in addition to behavioral symptoms cause allergies and gastrointestinal 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 the 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 treated for three months with vitamins and minerals supplements and evaluated the symptoms of pre- and post-autism (19). Based on the findings of this study, the supplement group showed significantly more improvements than the placebo group regarding 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). Another randomized, placebo-controlled trial was conducted by Hendren et al. in 2016. They examined the efficiency of methyl B12 in a sample of 57 children with autism (aged 3–7 years), and found that the subjects displayed a significant improvement in clinician-rated measures (20). Recently, Guo et al. (2018) conducted a study aimed at comparing the vitamin and mineral levels of Chinese children with ASD with those of typically developing (TD) children with the same age as well as examining 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 of vitamin D, folate, Ca, Mg, Fe, and Zn among children with ASD were significantly lower than the TD children (21). Folate, Ca, Fe and Zn were positively correlated with the Gesell Developmental Scale (GDS) of autistic children (21). Furthermore, a recent study found that vitamin D treatment for 12 months among 19 children (aged 2.5-8 years) resulted in 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 considered omega-3 acids for

supplementation are Eicosa-Pentaenoic Acid (EPA), and Docosa-Hhexaenoic Acid (DHA), since they cannot be synthesized by human body, and the intake of EPA and DHA is generally depended on dietary intake (23). The EPA and DHA are essential for the structure and function of the brain, because they are orthomolecular and their functional sites are exclusively cell membranes (24). Studies have found 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 to the 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) with 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 studies with larger sample sizes are required to confirm the efficacy of omega-3 in improving the ASD symptoms.

GLUTEN AND CASEIN FREE DIET

Several studies have recommended that special diets, such as GFCF diet can be beneficial for individuals with ASD. The GFCF suggests the elimination of all food items comprising cereals, for example flours and bread or having dairy products, like 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 on 54 children with ASD, and they compared the GFCF diet group to the control group (7). The study findings showed that there were significant benefits in communication subscores among children using the Autism Diagnostic Observation Schedule (ADOS) (7). It also reported the 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) as well as social interaction, daily living skills, inattention, and hyperactivity. The beneficial effect of GFCF diet on ASD symptoms has also confirmed by Adams et al. in 2011 (19).

DISCUSSION

The ASD has a negative effect on child's cognitive development status and impaired communication, social interaction, and imagination skills, however there is no approved medication for treating the core symptoms of ASD (3). Children with ASD have vitamins, minerals and OMG-3 deficiency, and also the common gastrointestinal disorders are prevalent in ASD children. Exploring for a safe alternative has recently been 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 remain in our knowledge of the autism-related digestive functions,

specifically about mechanisms of action leading 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 that various nutritional and dietary therapies are beneficial for managing the symptoms of ASD in children and adolescents. Many studies have recommended special diets to help individuals with ASD (29). Among the different tested supplements, ASD individuals had minerals, vitamins and omega-3 fatty acids deficiency (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 are some evidences that following a GFCF diet is beneficial for ASD symptoms management in children (7). Based on the reviewed studies, dietary supplements, such as minerals and vitamins as well as omega-3 fatty acid supplementation have improved the core symptoms of ASD (19, 21, 22, and 26). Dietary supplementation and such food restrictions can potentially improve some ASD symptoms; however, further studies should be considered with larger sample size and longer period to confirm their efficacies (26).

Individuals with ASDs need annual medical, nonmedical, and indirect economic costs and lifetime supporting (30). Nevertheless, the provided dietary supplement for children with ASD should be safe, cost-effective, easily accessible and available (31). Dietary supplements, such as minerals, vitamins as well as omega-3 fatty acid supplementations have shown generally safe with no severe adverse events, but the available GFCF diet has a reasonable high price (31).

CONCLUSION

Some ASD interventions have considered behaviors, whereas others have focused on food therapies, which are believed by families to enhance behavioral outcomes, such as vitamins, minerals, essential fatty acids and GFCF diet. Recent studies have 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 investigations are required with a larger sample size and longer period, as dietary supplements are commonly administrated for a long time. The combination of dietary supplement and a healthy diet causes further effectiveness in reducing the ASD symptom and may increase the 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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