



Review Article

## Complementary and alternative medicine approaches for children with autism

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### ABSTRACT

Autism spectrum disorder (ASD) patients increasingly turn to complementary and alternative medicine (CAM) as a treatment method. This therapy includes hyperbaric oxygen therapy (HBOT), casein-free/gluten-free diet (CF/GF), vitamin D, and music therapy. Hyperbaric oxygen therapy (HBOT) may be used for autistic children to overcome cerebral hypoperfusion, and it has an anti-inflammatory effect. Casein-free/ gluten-free diet has a good effect on autistic children by decreasing peptides resulting from the breaking down of these proteins. These peptides have a bad effect on the brain and cognitive functions. Vitamin D can relieve autism symptoms by repairing DNA mutations. Also, Vitamin D has anti-inflammatory and stimulates the immune system. More parents of autistic children use CAM therapies due to their safety and fewer side effects. CAM therapies need to be evaluated for their effectiveness in autistic children. This review compares several studies to determine the validity of these therapies and helps specialists decide in this regard. Most of the studies support CAM therapies for relieving symptoms of autism, while few oppose these therapies. Complementary and alternative medicine are promising therapies and need more attention to prove their effectiveness.

## Introduction

Autism Spectrum Disorder (ASD) is a disorder in the nervous system characterized by a group of disabilities that includes impaired verbal and non-verbal communication, restricted interests, and repetitive behaviors [1]. However, so far, no major causative factors lead to ASD, but there are many insights about these factors. Many studies referred to genetic factors. The genetic theory proposes several genes that influence social cognition, language, and fundamental behaviors and are linked to ASD [2]. Other studies showed impaired metabolic pathways [3], environmental factors such as food allergy [4], vitamin D deficiency [5], and lead or mercury poisoning [6]. Because there are no yet sufficient clinical biomarkers associated with ASD, be realized [7]. The evaluation of autistic children after treatment is based on behavioral therapists suggest [10]:

- Fish oil supplements (omega 3 fatty acids) for hyperactivity
- Vitamin B12 (for behavioral matters)
- Probiotics for gastrointestinal problems

These therapies may or may not be very beneficial for any particular person; only a few studies have been conducted to investigate their effectiveness, and all of them are extremely small. The findings are inconclusive. They are thought to be safe and are not prohibitively costly [11]. This review will focus on other types of complementary and alternative medicine to study their efficacy in treating children with autism. So, the aim of this review is to give a comprehensive background of the efficacy of complementary and alternative medicine in treatment of ASD.

## COMPLEMENTARY AND ALTERNATIVE MEDICINE:

scales such as Childhood Autism Rating Scale (CARS), Autism Behavior Checklist (ABC) or Autism Treatment Evaluation Checklist (ATEC) [8]. In general, the most-recommended complementary and alternative medicine options for autism are for specific symptoms such as sleeplessness or anxiety [9]. Specially, they include [9]:

- Melatonin, a hormone produced by the pineal gland, has been shown to aid in the treatment of insomnia.
- Multivitamins/minerals with a suggested help providing healthy nutrition for children with autism.
- Massage treatment is a well-known and hazardless method of decreasing anxiety and tension.

In adding to these conservative advices, some doctors and

## Hyperbaric oxygen therapy (HBOT):

"Hyperbaric oxygen therapy (HBOT) provides a higher concentration of oxygen delivered in a chamber or tube containing higher than sea level atmospheric pressure (1 atmosphere absolute [ATA])" [12]. New reports indicate that hyperbaric oxygen therapy (HBOT) may be used for autistic children. Several randomized controlled trials examined the efficacy of hyperbaric oxygen therapy in the management of children with ASD, as shown in **Table 1**. Hyperbaric oxygen therapy (HBOT) has some positive effects on both behavioral and neurochemical profiles by overcoming hypoperfusion, potent anti-inflammatory effects, and reducing oxidative stress, as shown in **Figure 1** [12, 13]. Many studies about using HBOT for the treatment of autism are shown in **Table 1**.

**Table 1: Studies about using HBOT for the treatment of autism**

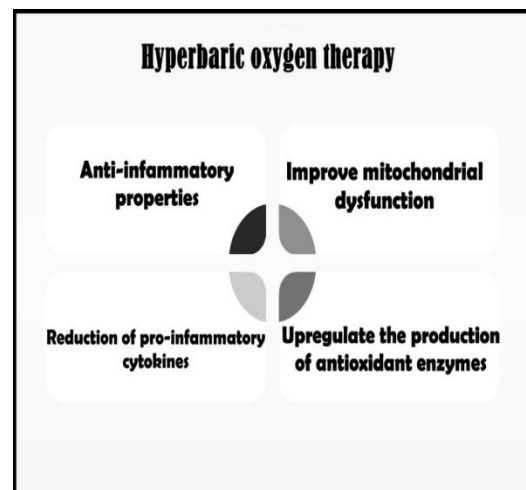
Author	Cases	Methods of evaluation	of	Conclusion
S Bent [14]	10 children, aged 3.3 to 7.5 years	Clinical Impression scores	Global (CGI)	Clinical improvements noted in the study
A. S. Mohamed [15]	80 autistic Children aged (5-7),	Childhood Rating Scale Standard (CARS)	Autism	Hyperbaric oxygen therapy has a positive effect than the control group
A. Mukherjee [16]	150 children with autism	CARS		HBOT may have a beneficial effect in improving cognition in autism
F. ElBaz [17]	50 autistic children	Autism treatment evaluation checklist (ATEC) and CARS		HBOT is an effective modality for treatment in autistic patients

The previous studies demonstrate the role of HBOT for autism therapy by using different scales to assess the severity of autism. Firm operational procedures like pre-HBOT assessments and in-chamber observing are vital and increase patient safety [18]. If done, HBOT may be regarded as one of the safest medical procedures currently accessible. Most of the side effects can be prohibited and, if they do occur, treated by minimal efforts [18].

**Gluten and/or casein-free (GFCF) diet**

The process of eliminating gluten entails avoiding all foods manufactured with wheat, rye, barley, oats, or any combination of these. Eliminating items such milk, yoghurt, cheese, butter, cream, and ice cream is necessary to exclude casein. Following this diet necessitates adjustments to children's routines, which have an impact on their eating patterns [19]. In addition, due to a leaky gut, children with ASD have difficulty digesting these proteins and absorbing associated peptides, which causes abdominal pain and behavioral problems [20].

Gluten and casein-based peptides were thought to enter the body through the leaky gut and go to the central nervous system where they were thought to attach to opioid receptors [21].



**Figure 1: HBOT's potential therapeutic pathways for the treatment of autism**

These peptides lead to changes in brain harmony that interfere with neural growth, cognitive action concentration, and education in children with ASD [22]. This diets depends on the age and duration of the dietary

intervention [23]. The possible mechanisms of action of GFCF in the treatment of autism are shown in **Figure 2**. Many studies reported the importance of a gluten-free / casein-free (GFCF) diet in relieving core symptoms of autism, as shown in **Table 2**. Some studies support the use of GFCF in the treatment of

autism, while others show the ineffectiveness of its use as a method of treatment.

Despite the widespread misconception that the GFCF diet is perfectly safe [24], There is no conclusive evidence that it has no any hazard, The potential vitamin deficits are of critical significance. But neither this nor anything else has been made clear as of yet [25].

**Table 2: Studies about using gluten and/or casein-free (GFCF) diet for the treatment of autism**

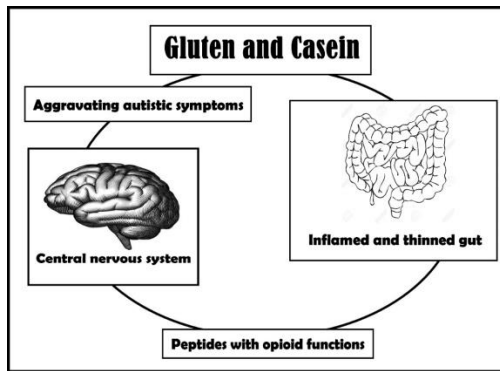
Author	Cases	Methods of evaluation	Conclusion
Whiteley et al . [26]	N=55 ( 26 diet and 29 controls) 4-10 years old	Autism Diagnostic Observation Schedule (ADOS) and the Gilliam Autism Rating Scale (GARS)	The diet group improved on social interaction, inattention and hyperactivity
Susan L. Hyman [27]	N=14 age 3–5 years	Applied Behavioral Analysis (ABA) programs	The impact of diet was not attributed to other interventions a child might be receiving.
Klaus W. Lange [28]	4 studies [29-32]	Multiple diagnostic tests and scales	The efficacy of the gluten-free and casein-free diet in the treatment of autism is very sparse
Omnia El-Rashidy [33]	N=45 age 3–8 years	Childhood Autism Rating Scale (CARS) and Autism Treatment Evaluation Test (ATEC) scales	Gluten free Casein free diet safely improve autistic symptoms

### Vitamin D

Several risk factors for autism exist, including maternal metabolic syndrome, vitamin D and folic acid insufficiency during pregnancy or infancy, and genetic predisposition to the disorder [34]. One of the important risk factors for ASD may be vitamin D insufficiency [35, 36]. Alexithymia, which has a high comorbidity with autism, has been linked to decreased blood vitamin D levels

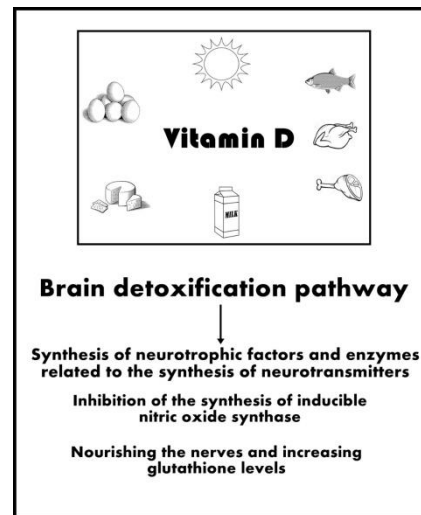
[37]. Vitamin D shortage may prevent the repair of de novo DNA mutations that arise early in fetal development. Vitamin D activation can control the DNA repair gene. According to genetic research, copy number variation and uncommon mutations are more common in autism [38]. Vitamin D decreases the degree of autism by several mechanisms like its anti-inflammatory actions, increasing T-regulatory cells, anti-autoimmune effects and

upregulating glutathione as a result of oxidative byproducts [38].



**Figure 2: Possible mechanisms of action of GFCF in the treatment of autism**

Other possible mechanisms were shown in Figure 3. Several studies approved vitamin D benefits are shown in Table 3. The results of the use of vitamin D in the treatment of autism spectrum varied, so some studies indicated the effectiveness of its use in treatment, and some other studies reported the limited success of its use in the treatment of autism spectrum. The negative effects of vitamin D have often been linked in clinical situations to acute signs of



**Figure 3: Possible mechanisms of action of Vitamin D in the treatment of autism**

severe hypercalcemia related to vitamin D poisoning [39]. The main complaints are weakness, constipation, backache, amnesia, gastro-intestinal upset, and weight loss. Increased absorption of vitamin D in diet or in milk products has been observed infrequently, nearly often in those with diminished renal function [39].

**Table 3: Studies about using Vitamin D for the treatment of autism**

Author	Cases	Methods of evaluation	Conclusion
F. Jia et al 2015 [40]	Case report	1-Autism Behavior Checklist 2-Childhood Autism Rating Scale 3-Severity of Illness of Clinical Global Impression	Reevaluation scores at the end of the follow-up period were 39, 28, and 4, respectively
K. Saad et al 2015 [41]	122 autistic children	1-levels of 25-hydroxyvitamin D 2-Autism Behavior Checklist 3-Childhood Autism Rating Scale	1-Vitamin D deficiency is a frequent finding among children with ASD 2-Vitamin D has beneficial effects in ASD subjects, especially when the final serum level is more than 40 ng/ml
K. Saad et al	120 autistic children	1-Aberrant Behavior Checklist	Oral vitamin D safely improve signs and

2018 [42]		2-Childhood autism rating scale 3-Autism Treatment Evaluation Checklist 4-Social Responsiveness Scale	symptoms of ASD
H. Mazahery et al 2018 [43]	111 autistic children between 2.5 and 8 years	1-Aberrant Behavior Checklist 2-Biomarkers (serum 25-hydroxyvitamin D [25 (OH) D] and omega-3 index)	Vitamin D has a significant beneficial impact on hyperactivity in these children
Conor P Kerley et al [44]	42 autistic children	Aberrant Behavior Checklist (ABC). Children’s Global Assessment Scale (DD-CGAS), biochemical parameters of total vitamin D and systemic inflammation	Vitamin D had limited effects in children with ASD

**Music therapy**

Music may activate both hemispheres of the brain, which is why it has become a strategy utilized in autism therapy. A song or music can enhance cognitive function, increase self-awareness, and strengthen interpersonal interactions. Music improves communicative performance and can increase interaction with others [45].

**Music improves social interactions**

A study by Kim, Wigram, & Gold found that in comparison to play sessions without music, autistic children have shown more social interaction and emotional expressiveness during music therapy sessions than in play sessions without music. Additionally, compared to play sessions without music, these kids responded to the therapist's demands more frequently during music therapy [46].

**Music enhances behavior**

A study of 41 autistic children over 10 months revealed that music therapy sessions every

week enhance behavior in general, mainly inattentive behaviors. Children in this study participated in music therapy sessions lasting an hour once a week and were observed for behaviors such as aggressiveness, and restlessness. As a result, improvement for more than fifty percent of the group by 1 or 2 points on the scale after the music therapy [47].

**Music enhances communication.**

Music can improve the sound mapping to actions, by making the connection between the auditory and motor parts of the brain, that facilitate comprehension of spoken orders. Through repeated practice and pairing music with movements, the brain's circuits were strengthened [48].

**Music decreases anxiety**

Children with autism are more susceptible to anxiety than normal children because they are unable to block upsetting stimuli. A study found that there was a reduction in anxiety effects in children with autism by music therapy after 16-20 minute sessions patients

listened to rhythmic music. The individuals' anxiety-related behaviors seemed to have diminished [49]. Classical or rhythmic music are the best to alleviate anxiety in autistic children [47]. According to some researches, music therapy has little impact on the severity of a child's ASD symptoms. [50]. A study conducted in 9 countries and enrolled children aged 4 to 7 years with ASD. Its objective is to assess the effects of music therapy on social skills of communication in autistic children. It concluded that autistic children on improvisational music therapy resulted in no discernible difference in the intensity of the symptoms [50]. Music therapy was shown to be a safe treatment, with proof for its use in

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## Conclusion

Because of the spread of autism worldwide, all studies are trying to reach optimal treatment for autism. Of these studies, what is proven and the other has not been proven yet. Complementary and alternative medicine has a promising future in this area. We need more investigations to prove its effectiveness in autistic children. We hope to reach a definitive treatment for this disorder soon.

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