
Integrative Approaches to Caring for Children with Autism



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Parents commonly integrate complementary and alternative medical (CAM) treatments for autism spectrum disorder (ASD) with conventional care. The aims of this article are to (1) describe the most commonly used treatments, (2) assess their efficacy and safety, and (3) organize the information in practical format for practitioners. We organized treatment modalities into four categories: recommended, monitored, tolerated, and therapies that should be avoided. These four categories are based on a two by two table weighing a therapy's effectiveness and safety. To meet the threshold for "recommended," its effectiveness needed to be supported by two or more randomized, controlled trials. In addition to promoting an overall healthy lifestyle via nutrition, exercise, sleep, stress management, social support,

and avoiding neurotoxins (healthy habits in a healthy habitat), the most promising therapies recommend are applied behavior analysis, parent-implemented training, melatonin supplements to improve sleep, supplements to correct deficiencies, and music therapy. Medications and restrictive diets may be helpful for some children, but use should be monitored given the risk of side effects. Most complementary therapies are safe, so they can be tolerated, but additional research is needed before they should be recommended. Given their risks, costs, and limited evidence of efficacy, chelation, secretin, and hyperbaric oxygen should be avoided.

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Background

Autism spectrum disorder (ASD) is a dynamic set of metabolic, mitochondrial, immune, inflammatory, and behavioral abnormalities involving many parts of the body.¹ The DSM V characterizes people with ASD as individuals with (1) persistent deficits in social communication and interaction; (2) restricted, repetitive patterns of behavior, interests, or activities with inflexible adherence to routines; (3) hyper- or hypo-reactivity to sensory input (4) that significantly impair functioning; and (5) symptoms that are not better explained by another diagnosis.²

The prevalence of ASD has increased to one in 68 children, with males being four and half times as likely as females to be diagnosed. This growth in prevalence has likely occurred as a result of a complex combination of increased awareness, greater access to services, broader diagnostic criteria, an increase of environmental toxins, poor nutrition, pregnancy stress, maternal obesity, and increased gamete mutations from pregnancies to older parents. Risk factors include both

genetic and environmental factors. For example, gestational diabetes, low maternal folate and essential fatty acid intake, and use of illicit drugs and teratogenic medications are linked with increase in ASD.³ Maternal exposure to toxic environmental compounds such as chlorinated solvents, heavy metals, diesel particles, organophosphate pesticides, and phthalates are also connected with neurodevelopmental disorders and can be contributing factors.⁴ Co-morbid phenotypic characteristics, such as skin and food allergies and variations in the digestive microbiome may be either causative or part of the syndrome.⁵

Because there is no medical cure for ASD, up to 95% of families dealing with ASD turn to complementary therapies to help improve one or more symptoms.⁶⁻⁸ Often, these therapies include dietary changes and dietary supplements, but may include sensory stimulation therapies, music and manual therapies, and unconventional uses of conventional therapies such as hyperbaric oxygen, chelation, and secretin administration.^{7,9}

Conceptual Model for Recommending Therapeutic Interventions

Different treatments address different aspects of social behavior (aggressiveness and mood instability), communication difficulty, sensitivities (touch, auditory, and

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visual), physical disabilities, specific symptoms (constipation or abdominal pain), comorbidities (allergies), or for overall health (general nutrition, exercise, sleep, stress management, and social support).

Different therapies also have varying amounts of evidence regarding safety and effectiveness. To organize the discussion about different modalities, clinicians can use a framework balancing the evidence regarding both effectiveness and safety.¹⁰ This review begins with therapies that are *recommended* for at least some children with ASD based on evidence suggesting both safety and effectiveness from a systematic review or at least two randomized controlled trials (RCTs) for at least one aspect of ASD. This is followed by a discussion of therapies that are effective but have side effects, costs, and/or toxicity, and therefore should be closely *monitored*. Numerous treatments can be medically *tolerated* because they are safe but do not yet have strong supporting evidence of effectiveness from two or more RCTs. Because this category is so large, it is divided further into biochemical, lifestyle, biomechanical, and bioenergetic therapies. Finally, there are therapies that should be *avoided* because evidence from clinical trials suggests that they are neither effective nor safe.

Recommended Therapies

Regardless of diagnosis, clinicians can recommend healthy lifestyle practices: nutrition, activity, sleep, stress management, social support, and avoidance of toxins. Of the many therapies that are used specifically for ASD, few have compelling evidence that demonstrate both effectiveness and safety. Since ASD is expressed in many different ways, even these treatments may not be suitable for everyone, and should be tailored for each patient.

Applied Behavior Analysis (ABA) and Parent-Implemented Training (PIT)

Among the most promising therapies is applied behavior analysis (ABA). To address difficulties in communication and social interaction as well as irregular reaction to sensory input, the goal of ABA is positive reinforcement of desired behavior and breaking down tasks into simple steps with frequent rewards and corrections. Therapy sessions are generally conducted one-on-one and help create a personalized behavior support plan. Earlier, more intense ABA

therapy improves the outcomes of children diagnosed with ASD early in childhood.¹¹

An extension of ABA is parent-implemented training (PIT), in which parents are taught how to embed strategies to support social communication throughout everyday activities; PIT is also associated with improved outcomes.¹²

Healthy Lifestyle and Dietary Supplements

A healthy lifestyle—healthy habits in a healthy habitat, including avoidance of essential nutrient deficiencies can improve mood and behavior in any person. For example, it is important for mothers to have adequate intake of essential vitamins and minerals such as folate, iron, and iodine during pregnancy. Specific strategies have undergone some evaluation for some ASD symptoms.

Exercise

Several studies have demonstrated that exercise positively affects academic engagement and reduces stereotypy during instruction in children with ASD.¹³ Exercise is part of a healthy lifestyle; the American Heart Association recommends at least 60 minutes of moderate to vigorous exercise daily for children. There are insufficient studies to recommend one type of exercise over another for children with ASD.

Melatonin

Sleep difficulties affect 50–80% of children with ASD. Supplemental melatonin has improved sleep and behavior and lowered parent-reported parental stress.¹⁴ Melatonin is well-tolerated and safe.

Music Therapy

In all, 10 studies with a total of 165 participants have shown that music therapy is associated with improvements in social interaction, verbal communication, initiating behavior, and social–emotional reciprocity, and may also increase social adaptation skills and parent–child relationships.¹⁵

Neurofeedback

A review of four small RCTs concluded that neurofeedback promoted sustained attention, communication, sociability, and flexibility for children with ASD.¹⁶ Neurofeedback is safe, but may be expensive for families if not covered by insurance.

Monitored Therapies

Therapies that should be monitored are ones where scientific scrutiny has shown effectiveness in at least one aspect of treating ASD, but there are concerns about safety, toxicity, or cost. Pharmacotherapy and restrictive diets fall in this category.

Pharmacotherapy

Risperidone and *aripiprazole* are the only two medications that have been approved by the FDA for ASD. They have been shown to be effective for treating *problematic* irritability (aggression, self-injury, and severe tantrums) in children with ASD. Treatment is reserved for severe problem behavior because of adverse events of weight gain, dyslipidemia, hyperglycemia, sedation, and tremor.¹⁷

Restrictive Diets: Gluten-Free-Casein-Free Diets

ASD is often co-morbid with gastrointestinal (GI) difficulties and food sensitivities, and improvement with these symptoms has been reported with certain dietary restrictions. A popular dietary treatment for ASD is a gluten-free-casein-free (GFCF) diet. However, there is limited evidence of effectiveness for non-GI symptoms.¹⁸ Dietary restrictions run the risk of deficits in socialization, poor adherence, and inability to meet needs for essential nutrients if improperly implemented. A GFCF diet should be implemented only with the help of a registered dietitian, and only for individuals who have sensitivities or allergies to the foods that are being eliminated.¹⁹

Tolerated Therapies

Most therapies used for ASD have not been studied using large, well-designed RCTs and cannot be actively recommended. On the other hand, most appear to be generally safe so they can be medically tolerated. Due to the large number of these therapies, they are divided into biochemical, lifestyle, mind-body, biomechanical, and bio-energetics therapies.

Biochemical: Dietary Supplements

ASD either causes or is partially caused by metabolic differences, oxidative stress, or inflammation. Use of

dietary supplements to address these abnormalities is common.

Omega-3 Supplement

Preliminary evidence has shown that a micronutrient formula with omega-3 fatty acids is more effective than pharmacotherapy with risperidone, showing less social withdrawal, less anger, less irritability, more flexibility with spontaneity and none of the side effects. Additional studies with adequate blinding are necessary before moving omega-3 from tolerated to recommended category.²⁰

Vitamins B6, Folate, and B12

Above average levels of homocysteine have been reported in individuals with ASD, suggesting potential benefits of vitamins involved in homocysteine metabolism: Vitamins B6, folate, and B12.²¹ Furthermore, some children with ASD have higher average blood levels of vitamin B6 but lower forms of metabolically active pyridoxal kinase, suggesting that they do not metabolize B6 properly to its active form of pyridoxal-5-phosphate. Some studies have shown improvement in social interaction, stereotyped restricted behavior, and delayed functioning with B6 and B6-magnesium supplements compared to controls.²² Maternal use of folate supplements during pregnancy is associated with a reduced risk of ASD in offspring, but there are no large RCTs suggesting supplemental folate for children reduces ASD symptoms.²³ Methyl B12 is thought to help reduce oxidative stress by increasing the ratio of reduced to oxidized glutathione; limited studies have not shown benefit compared with controls, but side effects are uncommon.²⁴ These supplements remain in the *tolerated* category of treatments for ASD.²⁵

Vitamins C and D

ASD is often associated with elevated levels of oxidative stress, and a small preliminary study using supplemental Vitamin C has demonstrated improvement of sensorimotor, sleep, and GI symptoms.²⁶ There are no significant side effects of supplemental vitamin C at moderate doses (up to 1–2 g/day). Higher doses may cause diarrhea.

Vitamin D insufficiency and deficiency are common in children with ASD, and lower levels are associated with worse symptoms; one open-label study suggested that supplementation to restore optimal levels was associated with improved symptoms.²⁷

Other Supplements

Large RCTs have not demonstrated benefits of supplementation with vitamin A, dimethylglycine (DMG), amino acids, herbal remedies, antibiotics, antifungals, or probiotics for children with ASD. Most supplements, other than excessive vitamin A, have an excellent safety profile.

Lifestyle and Mind–Body Therapies

Occupational Therapy, Including Sensory Integration

Many families use occupational therapy (OT) to help develop skills needed for daily living. Occupational therapists have used sensory integration (massage, pressure, and brushing) and auditory integration therapies. Sometimes, these therapies are combined with play activities to improve social participation.²⁸ Therapists have also focused on cognitive social skills and social–emotional skills, using behavior training and parent education. Small studies have shown improvement in social behavior, communication, developmental outcomes, and decreased aggressiveness, but other studies have had mixed results.²⁹ Implementation depends on resources available, stage-of-life, practitioner’s expertise, and family preferences.

Animal-Assisted Therapy

Through animal-assisted interventions (AAI), many children are able to develop a relationship with animals. One form of AAI is equine-assisted activities and therapies (EAAT). In addition to developing a bond, working with horses gives children the opportunity to communicate in a complex nonverbal manner. The feeling of riding a horse can be calming in a similar manner to massage. The effects of therapeutic horse riding are promising, and preliminary evidence indicates there are reductions in problem behaviors (irritability, hyperactivity, stereotypy, inattention, self-injury, and ASD symptom severity).³⁰ Additional RCTs are needed. While EAAT can be expensive, some equestrians provide EAAT for free as a public service.

Hydrotherapy

A few studies have evaluated hydrotherapy for high-functioning children with ASD to provide a multi-sensory stimulus to promote activity, engagement, movement, relaxation, self-awareness, self-effectiveness, and strength. Hydrotherapy has the most positive

impact on social behaviors with smaller gains with educational performance, stereotypical movements, and response to stimuli.³¹

Yoga

Small pilot studies suggest that yoga can improve maladaptive behavior and concentration in learning environments.^{32,33}

Biomechanical Therapies

Massage

Small studies have shown that massage therapy improves anxiety, social relatedness and communication, and sleep, and repetitive behaviors; additional research with adequate controls and follow-up are needed to determine optimal dose, frequency, and type of massage.³⁴

Chiropractic manipulation

Chiropractic manipulation is covered by most insurance carriers and is generally safe, but research is needed to establish effectiveness for ASD-related symptoms.³⁵

Bioenergetic Therapies

Acupuncture

Over 30 studies of acupuncture have reported improvements in comprehension, cognition, motor skills, independence, and parental reported social communication. Poor study design and variable courses of treatment prevent conclusions about effectiveness, but acupuncture is generally considered safe.^{36,37}

Transcranial Magnetic Stimulation (TMS)

The use of TMS is a safe and efficacious therapy used to treat depression, Parkinson's disease, and epilepsy, by stimulating targeted areas of the brain with strong, rapidly alternating magnetic currents. For patients with ASD, there have been preliminary data from eight small trials with a total of 108 individuals in the attempt for TMS to induce a long-lasting modulation of cortical excitability, with improvements reported for social relatedness, social-related anxiety, and repetitive movements. The risk of adverse events for individuals with ASD appears to be comparable to the general population.³⁸ Currently, TMS is not widely available and is limited to research.

Other Therapies

There are no controlled trials evaluating the effectiveness of hypnotherapy, prayer, Reiki, therapeutic touch, or homeopathy for ASD, but the practices are safe and may be supportive of families' cultural, spiritual, or religious beliefs.

Given the lack of evidence of effectiveness from large RCTs, but the general safety and low cost, clinicians can *tolerate* families' use of supplemental omega-3 fatty acids, vitamins B6, folate, B12, C, and D; occupational therapy; animal-assisted therapy; hydrotherapy; yoga; massage; chiropractic; acupuncture; and transcranial magnetic stimulation therapies while additional research is conducted.

Therapies to Avoid or Discourage

Hyperbaric Oxygen

Trials of hyperbaric oxygen therapy have not consistently shown significant improvements for individuals with ASD.³⁹ Treatment in a hyperbaric chamber is expensive, and given the lack of evidence of effectiveness, this treatment should be avoided.

Chelation

Chelation is used to remove heavy metals from the body. One study did not show improvement of ASD symptoms from chelation; side effects include hypocalcemia, renal and hepatic toxicity, diarrhea, and fatigue.⁴⁰

Secretin

Secretin is a hormone released by the duodenum and plays a role in pH regulation of the intestinal tract. Multiple RCTs have failed to demonstrate effectiveness of secretin in improving ASD-related symptoms.⁴¹

Due to the lack of evidence of effectiveness and the substantial costs and/or risks, clinicians should avoid or discourage use of hyperbaric oxygen, chelation, or secretin therapy for ASD-related symptoms.

Conclusion

ASD encompasses a broad spectrum of disorders with genetic and environmental etiologies. No single care plan is one-size-fits-all. Pharmacology has had limited success in addressing the core symptoms of

ASD, and myriad non-pharmacologic treatments have been proposed to help different aspects of the disorder. Given the evidence of safety and effectiveness, clinicians can

- (1) *Recommend*: healthy lifestyle advice for nutrition, exercise, sleep, stress management, social support, and avoiding neurotoxins. Prenatal vitamins to avoid deficiencies of essential nutrients such as folate, iron, and iodine. In addition, specific therapies to recommend for ASD include ABA and PIT, music, neurofeedback, and melatonin,
- (2) *Monitor*: medications; gluten-free, casein-free diet, and other restrictive diets limiting suspected allergens or symptom-provoking foods,
- (3) *Tolerate*: omega-3 fatty acids, vitamin B6, vitamin C, methyl B12 supplements; occupational therapy, animal-assisted therapy, hydrotherapy, yoga, massage, chiropractic manipulation, acupuncture, and transcranial magnetic stimulation therapies; art therapy, prayer, hypnotherapy, healing touch, qigong, and craniosacral therapy, and
- (4) *Avoid*: hyperbaric oxygen, chelation, and secretin

Unfortunately, for most therapies large, definitive RCTs to show evidence of effectiveness have yet to be completed (Fig). Despite the lack of conclusive evidence, it is important for professionals who treat individuals with ASD to be familiar with the different treatments that parents commonly use for children with ASD. Even if they do not receive information from their clinicians, parents have access to information from the

		Safe	
		Yes	No
Effective	Yes, in 2 or more RCTs	<i>Recommend:</i> Healthy Lifestyle ABA, PIT Melatonin for sleep Music Therapy Neurofeedback	<i>Monitor:</i> Medications (risperidone, aripiprazole) for problematic irritability GFCF diet Other restrictive diets
	No or not established in 2 or more RCTs	<i>Tolerate:</i> Multiple essential nutrients Vitamins B6, B12, C, D and folate; omega-3 fatty acids; probiotics Sensory and auditory integration Animal-Assisted Therapy Hydrotherapy Yoga Massage Chiropractic Acupuncture TMS	<i>Avoid:</i> Hyperbaric oxygen Secretin Chelation

FIG. When to recommend, tolerate, monitor, or discourage a therapy for ASD.

internet and support groups and will integrate a variety of therapies in any attempt to help their children and loved ones. Communicating with people and providing accurate information about the therapies that are being implemented will result in better care and better outcomes. Most of all, compassionate care is crucial. Reassurance and re-evaluating each individual child is needed to determine the best possible care over time.

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