

Yoga as an Intervention for Patients with Autism Spectrum Disorder: A Review of the Evidence and Future Directions

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Abstract

Background: The increase in prevalence of Autism Spectrum Disorder (ASD) has led to a corresponding surge in demand for novel, effective, and safe clinical interventions. Evidence-based treatment options for ASD are limited, resulting in a high utilization rate of complementary and alternative medicine (CAM) treatments in the ASD population. Yoga is a CAM practiced by over 20 million people in the United States, and multiple studies have investigated yoga as a possible effective treatment intervention for patients with ASD. Patients with ASD could potentially benefit from yoga either directly, through the targeting of core ASD symptoms, or indirectly through the improvement of commonly occurring co-morbid psychiatric conditions.

Objective: To review the evidence for yoga as an effective treatment option for patients with ASD.

Method: Using a variety of online databases, including PubMed, PsychINFO, Scopus, CINAHL, and Google Scholar, published studies meeting the authors' selection criteria were reviewed for evidence of improvement in core ASD and related symptoms in patients with ASD.

Results: There is a paucity of studies published in peer-reviewed journals that met the search criteria. While each of the studies investigated the use of yoga with ASD subjects, they targeted a broad range of symptom clusters, and varied greatly in overall quality, methods, outcome measures, and results.

Conclusion: Based on published studies, there is little current evidence that yoga improves core autism symptoms and co-morbid psychiatric symptoms in patients with ASD. However, there is a clear need for additional, larger randomized trials targeting both core ASD symptoms and co-morbid psychiatric conditions. Future clinical trials should utilize more uniform intervention methods, a standardized set of outcome measures, and blinded raters in order to determine whether yoga is indeed an evidence-based treatment option for patients with ASD.

Keywords: Autism; Yoga; Treatment

Background

Autism Spectrum Disorder (ASD) is estimated to affect 1 out of every 68 children in the United States (equal to 1.47%), including 1 in 42 boys (equal to 2.38%) [1]. The worldwide ASD prevalence rate is approximately 1%, with males affected 4 to 5 times more frequently than females [2,3]. As a direct result of this high prevalence, ASD has a tremendous societal, public health and economic impact around the globe. The estimated lifetime cost of care for a person with ASD, for example, is \$1.4 Million [4].

ASD is defined by the DSM-5 as involving deficits in two major areas: 1) social communication and social interaction and 2) restricted/repetitive behaviors, interests or activities [5]. While ASD prevalence has been steadily increasing over the last two decades, the number of evidence-based clinical interventions that address both core ASD symptoms and co-morbid symptoms are limited in number and availability. Both diagnostic services and evidence-based behavioral

treatments, including applied behavioral analysis (ABA) and early intensive intervention (EI), can be difficult to access, due to the complexity of triaging available resources [6-10]. Other treatments such as the UCLA PEERS program effectively teach targeted social skills to a high-functioning subset of patients with ASD, but do not include other patients on the Autism Spectrum [11-16]. From a biological treatment standpoint, options are quite limited. While risperidone and aripiprazole have received an FDA indication for the treatment of irritability associated with ASD, remarkably no biological treatments have received an FDA indication for the treatment of core ASD symptoms. Adding to this healthcare crisis, there is an overall paucity of medical training aimed at caring for this patient population [17].

Evidence-based interventions for patients with ASD—along with providers specializing in ASD—are limited in number and overwhelmed by demand. This disconnect possibly accounts for the range of 28% to 95% of patients with ASD who receive treatment using complementary and alternative medicines (CAM), a rate twice that of the non-ASD population [18-22]. Furthermore, treating physicians

who are more likely to integrate CAM into their practice have more interactions with ASD patients than their peers, indicating that the limited availability and access to evidence-based treatment options in conventional, Western medicine may lead providers and families to explore CAM options [23].

Yoga is a mind-body form of CAM that has become increasingly popular in recent years. Comprising poses, asanas (controlled breathing) and chanting, yoga is practiced by an estimated 20.4 million people in the United States [24]. As its popularity has surged, yoga has been successfully applied to patients with a wide variety of medical conditions, including Parkinson's disease, coronary artery disease,

chronic pain, cancer, and many others [25-28]. In recent years, non-medical programs and lay publications focused on delivering yoga to individuals with ASD have emerged in an effort to serve this growing patient population [29, 30].

There are a large number of claims in the lay media, and anecdotal reports by parents and therapists suggesting that yoga makes a significant impact on the trajectory of patients with ASD, and there is some plausibility to this idea. Yoga could potentially benefit patients with ASD in one of two distinct pathways; directly, by impacting core ASD symptoms or indirectly, by impacting conditions that are co-morbid with ASD (Figure 1).

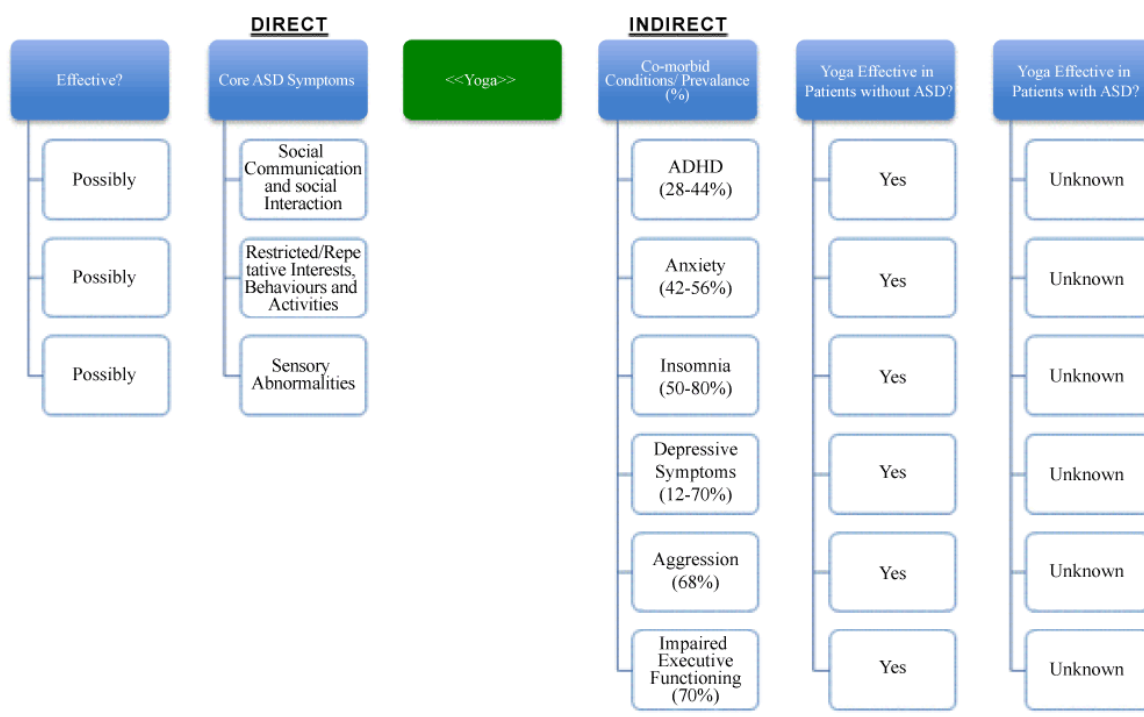


Figure 1: Potential response pathways for patients with Autism Spectrum Disorder (ASD) receiving yoga. Left: The “Direct” pathway outlines potential core ASD target symptoms and the evidence base for response to yoga. Right: The “Indirect” pathway lists co-morbid conditions frequently diagnosed in patients with ASD (with respective prevalence in parentheses), followed by the evidence for yoga’s efficacy in both non-ASD and ASD patient populations with these respective co-morbid conditions.

Yoga as a direct intervention for core ASD symptoms

One reason for its theoretical effectiveness for patients with ASD is that yoga is amenable to being practiced both in groups and individually. The former scenario could serve as a potential training ground for social situations, which are frequently both challenging and anxiety-provoking for patients with ASD [31]. Yoga could also potentially help practitioners modulate ASD patients’ known hypo-reactivity and/or hyper-reactivity to stimuli in the environment [32]. Yoga has been demonstrated to impact the autonomic nervous system including pulse, blood pressure and respiration rate, along with multiple aspects of the neuromuscular system [33,34]. Yoga’s physiological impact may therefore have relevance for patients with ASD, who exhibit atypical sensory processing and differ from neurotypical peers with regard to their autonomic and physiological responses to stimuli [35-47]. Patients with ASD participating in yoga may also benefit socially. For example, teaching yoga position to peers

involves the practice of imitation skills and mentalizing how others see themselves (thereby addressing the “Theory of Mind” deficit) [48,49].

Yoga as an indirect intervention for co-morbid conditions in patients with ASD

Evidence suggests that yoga, when applied to non-ASD individuals, can improve psychiatric symptoms or conditions that are commonly co-morbid in patients diagnosed with ASD (see Figure 1) [50-53]. The conditions treated successfully with yoga include ADHD (present in 28-44% of patients with ASD), anxiety (present in 42-56% of patients), insomnia (present in 50-80% of individuals), depressive symptoms (present in 12-70%), aggressive behaviours (present in 68%), and impaired executive functioning (present in 70%) [2,50,51,53-69]. Yoga has therefore effectively targeted multiple psychiatric conditions in patients without ASD. However, the evidence base for yoga as an

effective intervention for these aforementioned conditions in patients with ASD is currently undefined.

Methods

Search strategy

The authors conducted a search in January, 2015 of PubMed, PsycINFO, Scopus, CINAHL, and Google Scholar (for the latter database, the authors reviewed the first one hundred returned items). All databases were searched using the medical subject headings “child development disorders” and “yoga,” along with the keywords “autism” “autistic” “asperger*” and “yoga.”

Selection Criteria

The authors set out to review studies that included child or adult subjects with Autism Spectrum Disorder or Asperger syndrome, implemented a standardized protocol, assessed clinical outcomes, and

utilized either a control group or the subjects as their own control. Studies were required to be published in peer-reviewed journals and to appear in English or with an English translation available.

Data Extraction, Yield, and Determination of Evidence.

Two authors (MFG and NJW) analysed the list of returned published studies and agreed on those that met the selection criteria. The studies meeting review criteria were then analysed as a whole using the Oxford Centre for Evidence Base Medicine 2011 Levels of Evidence to determine the level of evidence for yoga’s effectiveness as a clinical intervention for patients with ASD [70].

Results

There is a paucity of published studies on yoga as an intervention for patients with ASD, with only two studies meeting our selection criteria, and two other studies nearly meeting the selection criteria. The findings are summarized in Table 1 and are discussed below.

Study	Author	N	Subjects age	Exclusions	Subject type	Design	Intervention	Outcomes	Outcome measures	Rater	Blinded Raters?	Parent Involvement?
Get Ready to Learn Yoga	Koenig et al	46	5-12 yo	None	ASD elementary school	Randomized control study	Manualized (Anne Buckley-Reen): 16 weeks of daily 15-20 minutes	Improvements in lethargy/ social withdrawal subscale of the ABC-Community	ABC, vineland, video	Parents, teachers, research assistants	No	No
Interactive Yoga therapy (IAYT)	Radhakrishna et al	12	Avg age=12.7 yo	Neurological disorders of known etiology; significant sensory or motor impairment; major physical abnormalities; history of head injury or neurological disease	ASD	Case study approach	IAYT 5 hours/week + 15 hours/week of ABA x 10 months a year for two consecutive years.	Improvements were observed in eye-to-eye gaze, sitting tolerance, body postures, body awareness, depth perception and balance, imitation skills, self-stimulatory behavior, receptive skills regarding spatial relation, and self-injurious behaviors.	The Autism Research Institutes' form E-2 check list, Imitation test battery, Repetitive stereotyped behavior test battery	Parents, special education teachers.	No	Yes
Relaxation Response-Based yoga improves functioning in Yoga in Children with Autism: a Pilot study	Rosenblatt et al	24	3-16 yo	None	ASD	Within subject analysis	8 weeks of weekly relaxation response yoga, music and dance	Statistically significant improvements in a typicality subscale of the BASC-2.	ABC, BASC-2(parent)	Parent	No	Yes
Radhakrishna Imitation skills	Radhakrishna	6	8-14 yo.	None	ASD	Case study approach	5x/week, 45 minutes daily for 10 months.	Qualitative improvement in	3-point scale for Imitation Behavior Assessment	Special educators and parents	No	Yes

								1) Imitating gross motor actions, 2) Imitating vocalizations, 3) Complex imitation, 4) Imitating oral facial movements, 5) Imitating breathing exercises	(not validated)				
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Table 1: A summary of published clinical trials examining yoga as an intervention for patients with Autism Spectrum Disorder (ASD).

Direct Efficacy of Yoga for Treating Core ASD Symptoms

Based on this review, minimal evidence suggests that yoga interventions may improve core symptoms of ASD, with an Oxford Centre for Evidence-Based Medicine (CEBM) Score of Level 5. While one study reported statistically significant improvements for all subjects in the atypicality subscale of the Behavior Assessment System for Children, Second Edition (BASC-2), the investigators utilized a blend of yoga therapy and music therapy, leading to uncertainty with regard to the effectiveness of yoga as a pure intervention in this population [71-72].

Another study reported improvements in the lethargy/social withdrawal subscale of the Aberrant Behavior Checklist (ABC)-Community, but did not demonstrate improvement in other core ASD symptoms [73-74].

The vast majority of raters in all of the studies were not blinded to condition and at least two of the studies were likely significantly underpowered.

Based on analysis of the studies above, and likely attributable to the low number of quality studies, there is little evidence to suggest that yoga interventions may improve core symptoms of autism, and more research in this area is warranted to clarify the benefits for this population.

Indirect efficacy of yoga, when applied to an ASD population, in diminishing commonly co-morbid symptoms or conditions

The majority of data collected in the studies published on yoga and ASD did not examine changes in co-morbid psychiatric symptoms. Koenig et al. reported a moderate effect on total behavior scores and a small effect on the Irritability/Agitation/Crying subscale of the ABC-Community form completed by teacher raters who were not blinded to condition [74]. Rosenblatt et al. reported that a combined yoga therapy and music therapy intervention resulted in a statistically significant improvement in depressive symptoms on the BASC-2 Depression subscale for a latency-aged subset of subjects [72]. In the latter study, analysis of the other BASC-2 subscales, which comprised irritability, aggression, anxiety, attention problems, conduct problems, hyperactivity, somatization, and withdrawal found no statistically significant changes.

While evidence indicates that yoga interventions in non-ASD patients improve psychiatric conditions commonly co-morbid in ASD

subjects, no studies have been published that specifically target changes in these co-morbid conditions in subjects with ASD.

Delivering yoga interventions to patients with ASD and measuring potential treatment response

Based on the published studies reviewed here, there are no standardized intervention protocols, study structures, or outcome measures to assess the efficacy of yoga as a treatment for patients with ASD. It has also yet to be determined whether the location of a yoga intervention, such as in school versus a clinical setting, has an impact on potential efficacy. While there is some evidence that less intensive yoga interventions, for example one to two times per week, may be sub-optimal in patients without ASD, the current evidence base does not provide guidance as to the ideal intensity, duration, frequency, setting, group size, or age range for participants with ASD [58]. In addition, the value of parent and/or teacher involvement is also not clear at this time, based upon review of the evidence.

Conclusion and Future Directions

There are a limited number of interventions that affect the core symptoms of ASD. As a result, complementary and alternative medicines are increasingly being considered in the clinical care of this patient population. While there are a number of reasons why yoga could potentially benefit patients with ASD including the direct and indirect treatment pathways, there are few published reports in this area. Each of the studies reviewed here had substantial methodological limitations, and two were significantly underpowered.

Before yoga can be vetted as an evidence-based treatment, more rigorous trials are needed. For example, a higher number of subjects, randomization, control groups, blinded raters, manualized interventions, and outcome measures gauging core ASD symptoms and co-morbid psychiatric symptoms would strengthen the evidence base.

As noted previously, there is evidence in the scientific literature that yoga may be an effective treatment in a non-ASD population for conditions that are commonly co-morbid with ASD. Future studies should consider developing yoga curricula and utilizing outcome measures aimed at both core ASD symptoms and commonly co-morbid psychiatric conditions, reflecting the clinical needs of patients.

Key questions for future investigators to consider would appear to include the following:

Is yoga effective in improving the quality of life for patients with ASD, either through improved core ASD symptoms or the mitigation of co-morbid symptomatology?

How might certain characteristics of the patients, such as severity of autism symptoms, cognitive ability, or pre-existing levels of anxiety, affect potential treatment response?

Is a more naturalistic setting, such as in school, preferred to a clinical setting?

Are any potential gains from yoga interventions maintained over time?

What is the minimum and optimal number of hours of yoga per week required in order to observe clinical improvement?

What level of training should providers have in order to implement yoga interventions for patients with ASD?

Given its favourable risk profile and acceptability, yoga has the potential to help meet the demand for treatments addressing core ASD symptoms and psychiatric co-morbidities. The use of yoga either as a direct intervention for core symptoms— or an adjunctive intervention for patients with ASD—warrants further investigation.

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