YOGA AS A COMPLEMENTARY THERAPY FOR CHILDREN AND ADOLESCENTS: A Guide for Clinicians

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ABSTRACT

Yoga is being used by a growing number of youth and adults as a means of improving overall health and fitness. There is also a progressive trend toward use of yoga as a mind-body complementary and alternative medicine intervention to improve specific physical and mental health conditions. To provide clinicians with therapeutically useful information about yoga, the evidence evaluating yoga as an effective intervention for children and adolescents with health problems is reviewed and summarized. A brief overview of yoga and yoga therapy is presented along with yoga resources and practical strategies for clinical practitioners to use with their patients. The majority of available studies with children and adolescents suggest benefits to using yoga as a therapeutic intervention and show very few adverse effects. These results must be interpreted as preliminary findings because many of the studies have methodological limitations that prevent strong conclusions from being drawn. Yoga appears promising as a complementary therapy for children and adolescents. Further information about how to apply it most

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effectively and more coordinated research efforts are needed.

CASE STUDY

Jeremy was a 12-year-old boy with a history of being diagnosed with mild asthma, attention deficit hyperactivity disorder (ADHD), and recent onset obesity. Jeremy was accompanied to a psychiatric evaluation by his mother and his 14-year-old sister, Janice. The mother reported that Janice was "always stressed out" and "worried about gaining weight." The mother explained that she was interested in getting help for her children but she wished to avoid medication. She and her children heard that yoga could be helpful but they did not know much about it and wanted to learn more.

INTRODUCTION

The practice of yoga for fitness and wellness in gyms, community centers, and yoga studios is broadening into yoga therapy being provided in schools, hospitals, and community treatment centers. In fact, the leading yoga magazine, *Yoga Journal*, recently claimed that "yoga as medicine represents the next great wave."[1] According to a 2008 survey, an estimated 6.9 percent (15.8 million) people in the United States practice yoga.[1] Additionally, another 4.1 percent (9.4 million) of those who are not currently practicing yoga said they would definitely try yoga during the next year.[1] While many clinicians remain unfamiliar with the practice of yoga, the same 2008 survey indicated that 6.1 percent (14 million) of Americans said a doctor or therapist had recommended yoga to them.

Other surveys assessing the familiarity and acceptance of complementary and alternative medicine (CAM) practices by the general public and medical practitioners report similar use and acceptance patterns for yoga. In a 2000 survey of 39 CAM practices, 95 percent of 589 respondents had heard of or tried yoga, and 93 percent had heard of or tried meditation.[2] Yoga was ranked fifth out of 39 therapies surveyed in terms of its perceived effectiveness. In a study looking specifically at the acceptability of CAM practices in a pediatric hospital outpatient pain clinic setting, both the children's and parents' ratings placed yoga as the third most likely helpful CAM approach.[3] When conventional treatments were included in the ratings, yoga was rated fourth for both groups, with medications rated "more likely" to help, and surgery "less likely" to help than yoga.

Likewise, the 2002 and 2007 United States National Health Interview Surveys (NHIS), which included specific questions on CAM use by adults and children, document a growing trend of yoga practice by adults and children, in particular by children whose parents use CAM.[4] Four of the 10 most frequently used CAM interventions by children are yoga practices. In addition, 3 of the 4 CAM practices showing the most growth in use by adults between the 2002 and 2007 NHIS surveys were yoga practices.[4]

TABLE 1. Timeline for the development of yoga

3000–1500 BCE[1]	Vedic texts ("to know") collection of hymns and rituals celebrating harmony with the forces of nature provide earliest written evidence of yoga including breath, philosophy, and spirituality
1500 BCE[1]	Upanishads ("sitting down near" [a teacher]) answers the existential questions of birth, death, meaning and purpose of life, "yoga" encountered by name
700 BCE[2]	Bhagavad Gita text on brahmavidya (supreme science) of yoga defines 3 paths of yoga: jnana (path of wisdom), bhakti, (path of devotion), and karma (path of service/action)
400 BCE[3]	Patanjali writes the Yoga Sutras; Ashtanga (eight-limb) and Raja (royal) yoga defined
600 CE–1500 CE[4]	*Hatha Yoga Pradipika* written
1900–present	Hatha yoga introduced in the West and becomes mainstream as exercise and a popular lifestyle choice
1989	International Association of Yoga Therapists (IAYT) established
1991	Office of Alternative Medicine (OAM) established in the National Institutes of Health (NIH)
1998	OAM upgraded to NIH National Center for Complementary and Alternative Medicine (NCCAM)
1999	Yoga Alliance (YA) formed from merger between Unity in Yoga (formed 1982) and Ad Hoc Yoga Alliance (formed 1997). Sets national training standards for yoga teachers.

[1]Easwaran E. *The Upanisads.* Tomales, CA: Nilgiri Press; 1987.
[2]Easwaran E. *The Bhagavad Gita.* Tomales, CA: Nilgiri Press; 1985.
[3]Saraswati S. *Four Chapters on Freedom.* Bihar, India: Yoga Publications Trust; 1976.
[4]Muktibodhananda S. *Hatha Yoga Pradipika: Light on Hatha Yoga.* Bihar, India: Yoga Publications Trust; 1985.

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TABLE 2. Factors to consider in choosing a yoga class

DIFFERENTIAL CLASS FACTORS	VARIATIONS
Temperature of the room	• Heat of the room between 90 and 104 degrees F • Heat of the room between 75 to 80 degrees F
Fixed vs. variable sequences	• Repetition of same poses in same order each class • Sequence of poses varies
Pace of movement in and out of poses and between poses	• Poses may change with each inhale and exhale • Poses may be held for between 5 breaths to one minute • Combination of repetition in and out of the pose, then holding the pose for several breaths
Use of props to make poses more accessible and supported	• Block, strap • Blanket, bolster • Chair, wall
Use of augmenting yoga practices	• Bandha (energy locks) • Kriya (purification) • Mudra (gesture, seal, or attitude)
Use of more regulated or vigorous breathing practices	• Nadhi shodhana (alternate nostril) • Kapalabhati (skull shining/bellow) • Krama (inhale and/or exhale in segments) • Bramuri (bumble bee) • Ratio - regulate individual components of inhale, retain after inhale, exhale, suspend after exhale
Meditation	• Guided visualization • Focus on breath • Witnessing thoughts • Mantra japa (silent repetition of a meaningful sound or phrase)
Spirituality	• Kirtan (devotional chanting) • Mantra japa • Connection with the divine or a higher power

The popularity of yoga has created a need for empirical studies to evaluate the efficacy and limitations of yoga as a method of wellness, disease prevention, and treatment intervention. There is also a need to provide clinicians with practical information about yoga and the current state of evidence supporting its use with children and adolescents. The majority of available yoga studies have been conducted with adults, with recent epidemiological research indicating that many adults perceive yoga to be beneficial for musculoskeletal problems, mental health conditions, and overall health.[5] However, studies to evaluate the potential benefits of yoga with children and adolescents are limited. Two recent systematic reviews of yoga for the pediatric population concluded that the majority of studies report benefits from yoga, but the evidence is low in methodological quality and quantity.[5,6] While this conclusion continues to appear valid, it seems insufficient for clinicians who are questioned by patients and families about the practice and potential benefits of yoga.

The objectives of the present article are as follows: 1) provide clinical practitioners with a brief and practical overview of yoga and how it might be used as a complementary mind-body therapeutic tool in the pediatric population; 2) review the current evidence suggestive of benefits to using yoga for the improvement and maintenance of overall health and fitness as well as the evidence for potentially improving or augmenting the treatment of specific health problems; and 3) provide information about the availability and evaluation of yoga resources for children and adolescents.

SOME BACKGROUND INFORMATION ON YOGA

Yoga originated 4,000 or 5,000 years ago in what is now India.[7] Over time, yoga developed as a science, philosophy, and psychology.[8–10] Table 1 provides a timeline for the development of yoga in ancient times and the present. The yoga practices that arose out of these systems of thought were designed to facilitate development and integration of the human body, mind, and breath to produce structural, physiological, and psychological effects.[7] The aims of yoga are the development of the following: 1) a strong and flexible body free of pain; 2) a balanced autonomic nervous system with all physiological systems, e.g., digestion, respiration, endocrine, functioning optimally; and 3) a calm, clear, and tranquil mind. Beyond these specific outcomes, yoga practices are intended to facilitate self transformation at every level of functioning, with the goal of improving the overall quality of life.

In the century since yoga was introduced into the West, there has been a substantial proliferation in the number of schools of yoga and yoga teachers. As of April 2010, Yoga Alliance (YA), the professional credentialing body for yoga, lists 1,007 schools approved by YA in the United States to train yoga teachers, and 25,026 registered yoga teachers

(RYTs). The schools of yoga differ on a number of dimensions that influence the instructions given by the teacher, the structure and content of the class, and the environmental conditions of the class. Table 2 lists factors to take into consideration when choosing a yoga teacher and class. Table 3 defines terms and practices commonly used in yoga classes.

Traditionally, yoga was taught by oral transmission from teacher to student so that the practices could be individually tailored to the evolving needs of the student. Currently in the West, the principle mode of instruction is a group class. The advantages of group yoga classes are similar to those for group therapy: one teacher can provide instruction to more individuals at one time, the cost for a class is less than for private instruction, and the group members can provide support in addition to that offered by the teacher. The disadvantages are also similar to those of group therapy in that less personalized attention and instruction may be less beneficially targeted or even harmful to the needs of the individual at any given time. However, skilled yoga teachers, like skilled clinicians, can provide individualized guidance even in a group setting by offering alternatives, modifications, and personalized adjustments to individual class members.

One of the hallmarks of yoga is that the practice has been continuously adapted to the culture and the individual needs of the practitioner. The growing number of yoga schools in the West is evidence that this tailoring to different needs, interests, and conditions persists. The processes of matching and individualizing yoga to each participant are quintessential to yoga, and are recommended for yoga classes, but they are an even more signal aspect of yoga therapy.

YOGA THERAPY

Yoga is recognized by the National Institutes of Health (NIH) National Center for Complementary and

TABLE 3. Commonly used Sanskrit terminology in yoga

SANSKRIT TERM	APPLIED DEFINITION
Yoga	To yoke together to unite
Jnana yoga	Path of wisdom
Bhakti yoga	Path of devotion
Kriya yoga	Path of action
Raja yoga	Royal path
Hatha yoga	Ha signifies prana (vital force, life energy) and Tha indicates mind or mental energy. Hatha encompasses the dialectical elements of heating and cooling, active and passive, energizing and calming, which are individually developed and then brought into balance.
Yoga Cikitsa	Yoga therapy
Asana	"Seat," physical poses
Prana	Life force energy
Pranayama	Breathing practices: heating, cooling, cleansing, and balancing
Pratyahara	Drawing the senses inward
Dharana	Concentration
Dhyana	Uninterrupted concentration
Samadhi	Becoming united as one with the object of concentration
Kriya	Cleansing and purification of physical organs or subtle energy channels
Mudra	Gesture with a part of the body, e.g., the hand with thumb and forefingers touching, or the whole body, e.g., bowing, to stimulate an awareness or attitude
Bandha	Directing attention to an area of the body (throat, abdomen, or perineum) then through muscular action and subtle awareness deepening the awareness of energy in the area
Mantra japa	Silent repetition of a meaningful sound or word(s)
Kirtan	Chanting or singing mantras out loud
Yoga Nidra	Yogic sleep; guided, progressive relaxation of body, mind, and emotions to help achieve intentions

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TABLE 4. Developmental considerations in a yoga class with children and adolescents

AGE OF PARTICIPANTS	DURATION
Preschool age (3–6 years)	• Total duration: 15–20 minutes • Focus awareness 2–3 minutes • Poses: 10 minutes • Breathing or singing 2–3 minutes • Guided visualization 2–3 minutes
School age (7–12 years)	• Total duration: 30–45 minutes • Focus awareness: 3–5 minutes • Poses: 15–25 minutes (can be incorporated into a story or game) • Breathing or singing: 3–5 minutes • Guided visualization relaxation: 5 minutes
Adolescents (13–18 years)	• Total duration: 45–90 minutes • Focus awareness: 5–10 minutes • Poses: 30–50 minutes • Breathing: 5–10 minutes • Guided relaxation: 5–10 minutes
AGE OF PARTICIPANTS	**SPECIAL CONSIDERATIONS**
Preschool and school age	• Use English nature names for poses • Use short and simple instructions • Demonstrate poses • Hold poses for a maximum of 3 breaths • Maintain an attitude of playful calm • Create a safe environment
Adolescents	• Be sensitive to body image • Use touching adjustments with care; give opportunity to opt out of being touched • Be aware of clothing issues (tight jeans, bare feet, revealing shirts or shorts) • Encourage nonjudgmentalness and noncompetitiveness

Alternative Medicine (NCCAM) as a form of CAM in the category of "mind-body" medicine. NCCAM asserts that mind-body medicine "focuses on the interactions among the brain, mind, body, and behavior, and on the powerful ways in which emotional, mental, social, spiritual, and behavioral factors can directly affect health."[11] Furthermore, "Mind-body medicine typically focuses on intervention strategies that are thought to promote health…It regards as fundamental an approach that respects and enhances each person's capacity for self knowledge and self care, and it emphasizes techniques that are grounded in this approach."[11] Consistent with the NCCAM definition, *yoga therapy* is defined by the International Association of Yoga Therapists (IAYT) as "the process of empowering individuals to progress toward improved health and well-being through the application of the philosophy and practice of yoga."[12]

Yoga practices can be designed to foster developmental, preventative, therapeutic, and/or transformational aims.[7,13] In yoga therapy, the emphasis is on adapting the techniques of yoga to address the specific concerns of the individual or group.[7] Table 4 lists developmental factors to consider when teaching yoga to children and adolescents. Table 5 provides guidance in matching types of yoga to particular diagnostic presentations.

METHOD

We conducted a comprehensive review of the literature, extracting citations from the following sources: Ovid MEDLINE, PsycINFO, Cochrane Reviews, EMBASE, and ERIC databases. Using controlled language for each of these databases, we searched expanded terms for yoga and children, as well as the truncated synonyms of these concepts as text words utilizing appropriate proximity operators. We excluded book chapters, dissertation abstracts, studies involving participants younger than school age, studies of physiological responses, and developmental disabilities. We included studies specifically evaluating college students, but did not include other adult studies or studies that examined a mixed population of children and adults. Studies included in the current review cite the use of yoga 1) in a developmental or preventative way to foster or bolster healthier functioning in youth at risk for psychiatric or medical disorders and 2) in a therapeutic way with youth who are diagnosed with psychiatric or medical disorders. For areas in which the pediatric literature was scarce, the use of yoga in the adult literature was referenced. In addition to a literature review, recommendations and resources were gathered and presented for clinical practitioners in their work with children and adolescents.

DEVELOPMENTAL AND PREVENTATIVE USES OF YOGA

Developmental uses of yoga are geared toward nurturing inherent capacities and facilitating mastery, e.g., strengthening the physical body, increasing energy and stamina, building coping capacity, and enhancing attention, concentration, and memory.[13] Preventative yoga approaches aim to protect and preserve capacity that an individual has already achieved. This may include protecting structural stability or maintaining self esteem in the face of challenges. Three studies examined the effects of yoga on self

worth and self perception with the goal of improving positive self concept. The findings must be considered preliminary as the studies all have small sample sizes and the interventions lack appropriate controls. Table 6 presents links to the yoga programs evaluated in the studies.[14–16,18,21,25,40]

An uncontrolled pilot study examined the effects of an after-school "Bent on Learning" program that included yoga postures, breathing, relaxation, and meditation with fourth and fifth grade inner-city children.[14] The yoga intervention was one hour per week for 12 weeks in groups of approximately 20 students. The participants demonstrated improved negative behavior scores post-intervention compared to the non-yoga group, although no significant differences were indicated for the other well being outcomes.

A nonrandomized, control treatment design evaluated a "Self Discovery Program," which integrated elements of yoga, massage, and relaxation for children ages 8 to 11 years with emotional, behavioral, or learning difficulties in the United Kingdom.[15] The intervention was 45 minutes, once a week, for 12 weeks. The yoga group demonstrated small, though significant, improvements in levels of self confidence, social confidence with teachers, communication with peers, contributions in the classroom, and level of total difficulties on the Strengths and Difficulties scale.

In another study, college students in a lecture-only health course were compared to peers in health fitness courses where yoga was one of the fitness courses.[16] The health fitness course groups collectively evidenced significant differences on five indicators of emotional well being (e.g., Global Self Worth, Appearance), but the specific effects of the yoga class were not separately evaluated.

CASE STUDY, CONTINUED

Jeremy was interested in doing yoga. He asked, "Could yoga help my

TABLE 5. Diagnostic considerations in a yoga class with children and adolescents

DIAGNOSES	CONSIDERATIONS
Anxiety and attention deficit hyperactivity disorder	• Use movement in poses to discharge and direct energy; begin with energizing and end with calming poses. • Use instructions to focus attention on present moment sensations. • Teach belly breathing as anxiety/agitation may increase with upper chest breathing. • Teach guided relaxation as anxiety/hyperactivity may increase during relaxation. • Progressively increase length of exhale.
Depression and obesity	• Begin with slow and easy movements; progressively increase activity level. • Use instructions to focus attention on present moment sensations. • Gently encourage deeper twists, new poses, and longer holds in poses to increase capacity to go beyond self-perceived limits.
Eating disorders: anorexia nervosa and bulimia	• Be sensitive to competitiveness, especially in groups. • Find balance between overly vigorous and too gentle poses to discharge agitation and not weight loss. • Cultivate awareness of positive bodily attributes, e.g., strength and flexibility, and change in pre-post states. • Use guided relaxation and progressive muscle relaxation to cue how to relax. • Consider use of positive mantras as affirmations.
Pain and injury	• Differentiate pain from unfamiliar sensation; do not increase pain. • Move gently in and out of poses with awareness of effects. • Direct attention to area of pain and visualize breathing into it to release pain; observe changing sensations. • Use props to make poses more safely accessible (blocks, straps, bolsters, blankets).
Asthma	• Focus on breath in belly and lengthening exhale; use windmills and feathers to see effect of exhale. • Use frequent reminders to breathe smoothly and evenly and to increase awareness of changes in breath, e.g., if it becomes erratic or constricted.
Irritable bowel syndrome	• Use prone backbends, gentle twisting poses, and forward bends to increase peristalsis and relaxation.

TABLE 6. Yoga resources

NAME OF RESOURCE	DESCRIPTION AND URL
CAM on PubMed	A subset of the PubMed system developed by NCCAM and NLM focused on CAM http://nccam.nih.gov/research/camonpubmed/
NCCAM Time to Talk Toolkit	An educational campaign to encourage patients and their healthcare providers to openly discuss the use of CAM http://nccam.nih.gov/timetotalk/forphysicians.htm
Yoga Alliance	Yoga Alliance (YA) has established minimum curriculum standards and number of contact training hours for yoga teachers at the 200, 500, and 1,000-hour levels. The YA website is a good resource for locating a yoga teacher and knowing the questions to ask when choosing a yoga teacher. http://www.yogaalliance.org/teacher_search.cfm
International Association of Yoga Therapists (IAYT)	Supports research and education in yoga and serves as a professional organization for yoga teachers and yoga therapists worldwide. Establishes yoga as a recognized and respected therapy http://www.iayt.org/
American Viniyoga Institute, Gary Kraftsow	An approach to yoga that adapts the various means and methods of practice to the unique condition, needs, and interests of the individual; practitioners given tools to individualize and actualize the process of self discovery and personal transformation. http://www.viniyoga.com/
Bent on Learning	Seeks to improve the physical fitness and cognitive, social, and emotional skills of New York city public school students by providing regular instruction in yoga and meditation http://www.bentonlearning.org/who_we_are/index.htm
Sahaja Yoga Meditation	Focuses on awakening dormant energies to facilitate self-realization http://www.sahajayoga.org/
Yoga Ed	"Yoga Fitness for Kids ages 3–6" and "Yoga Fitness for Kids ages 7–12" 30-minute VHS tapes, instructed by Kalish, published by Gaiam, 2001 and 2002. Develops health/wellness programs, training, and products for teachers, parents, children, and health professionals that improve academic achievement, physical fitness, emotional intelligence, and stress management http://www.yogaed.com/
Sivananda Yoga Vedanta Centers	A nonprofit organization founded by Swami Vishnu-devananda to spread the teachings of Vedanta worldwide http://www.sivananda.org/
Ashtanga Yoga	A physically vigorous form of yoga that aims to build internal heat through synchronizing movement with breathing while doing a set sequence of postures http://yoga.about.com/od/ashtangayoga/a/ashtangs.htm http://www.kpjayi.org/
Yoga for the Special Child® LLC	A comprehensive program of yoga techniques designed to enhance the natural development of children with special needs; emphasizes gentle and therapeutic yoga safe for babies and children with Down syndrome, cerebral palsy, microcephaly, autism, and other developmental disabilities; also used with children diagnosed with attention deficit hyperactivity disorder and other learning disabilities http://www.specialyoga.com/
YogaKids	A comprehensive program using yoga, Howard Gardner's Multiple Intelligences Theory, curriculum integration techniques, and character education techniques http://yogakids.com/
Storytime Yoga	Integrates yoga and storytelling, poetry, Spanish, healthy eating, and peace and character education to produce healthy, peaceful, and literate children, families, and communities http://www.storytimeyoga.com/

CAM: complementary and alternative medicine

ADHD?" Janice also wanted to find out whether yoga might help her feel less "stressed out." The clinician explained that both children needed to be thoroughly evaluated before any specific treatment recommendations were made, then discussed some of the evidence supporting the use of yoga for pediatric mental health problems.

THERAPEUTIC USES OF YOGA FOR MENTAL HEALTH DISORDERS

Therapeutic yoga is intended to alleviate suffering, support rehabilitation, and improve quality of life.[13] With children, therapeutic interventions are often facilitative rather than rehabilitative in that their capacities are still in the process of being developed. The current review shows yoga being used in its facilitative capacity with children at risk for developing disorders, and in academic and treatment settings with children with diagnosed disorders of attention, anxiety, depression, and eating disorders.

Attention. Four published studies[17–21] have evaluated methods of teaching yoga to children (ages 8–13) diagnosed with ADHD, and a fifth study assessed yoga taught to first through third graders with "attention concerns." A randomized, controlled crossover treatment design examined the effect of yoga as a complementary treatment for 19 boys (ages 8–13) diagnosed with ADHD.[17] Most of the boys were taking medication during the 20-week study. The weekly one-hour yoga classes included postures, breathing practices, relaxation training, and a yoga gazing concentration exercise (tradaka). Significant improvements pre- to post-test were found for five of the Conners Parent Rating subscales for the yoga group only: Oppositional, Global Index Restless/Impulsive, Global Index Emotional Lability, Global Index Total, and ADHD Index. The control group (and not the yoga group) that participated in cooperative activities showed

improvements on the Conners Hyperactivity, Anxious/Shy, and Social Problems subscales. Both groups showed improvements in some of the parent-rated scales (e.g., Perfectionism, *DSM-IV* Total), but no changes on the teacher report. There was a positive dose response effect on a measure of attention for subjects who participated in more home-based practice and attended more sessions.

In a nonrandomized, quasicontrolled treatment study, a six-week Sahaja Yoga Meditation intervention was evaluated with children (ages 8–12 years) diagnosed with ADHD (most of whom were taking medication) and their parents.[18] The three-week intervention was a 90-minute guided meditation two times a week. In between sessions, parents were asked to lead their child in meditation at home and to keep a record of their practice. Pre- and postintervention results indicated a decrease in ADHD symptoms on the Conners Rating Scale, reduced dosage in stimulant medication reported at six weeks, and an increase in parent-child relationship quality in the treatment group.

A nonrandomized, controlled treatment design evaluated the effects of an eight-week yoga program in a group of Iranian children (ages 9–12 years) diagnosed with ADHD.[19] The 45-minute yoga class included 10 minutes of breathing practices, 25 minutes of beginner yoga poses, and 10 minutes of relaxation, twice a week for eight weeks. Results indicate a reduction in ADHD symptoms on both attentional and hyperactivity subscales.

One study assessed the additive benefits of yoga and massage as adjunctive treatments to standard outpatient care for children diagnosed with ADHD.[20] All participants received standard care. One group also received yoga as exercise, and a second group also received massage. The yoga and massage interventions were 20 minutes, once a week, for six weeks. Parents were present during the training sessions and they were asked to provide massage or guide the yoga practice at home with their child between sessions. No statistical analysis was reported for any of the measures. Results were reported in terms of patient satisfaction scores and interview comments, which were positive for all groups. Negative comments from yoga participants were 1) children did not like doing the poses at home with their parents but did enjoy class, and 2) parents would have liked more instruction before being asked to teach the poses at home.

A yoga video was assessed as a means of increasing time on-task in a study of elementary school children (first through third graders, n=3) with attentional concerns.[21] The children practiced to a 30-minute "Yoga Fitness for Kids" VHS tape twice a week for three weeks.[22,23] Using a multiple baseline, nonrandomized, controlled treatment design and a follow-up phase, effect sizes of the intervention ranged from 1.5 to 2.7 for the outcome of on-task behavior, a large effect size according to Cohen's 1992 guidelines; follow-up treatment gains decreased somewhat (0.77 to 1.95), but fell within a moderate-to-large effect size. The comparison group's on-task behaviors did not improve.

Anxiety. Three child and adolescent studies[24–26] were identified that evaluated yoga as a treatment intervention for anxiety. An intervention that combined yoga postures, rolling pin massage, and progressive muscle relaxation intervention was used with 40 psychiatrically hospitalized adolescents diagnosed with adjustment disorder and depression.[24] Using a within-subjects pretest/post-test design, the combination intervention was administered once to assess its immediate effects. The yoga participants (and not the controls) reported decreased anxiety and increased positive affect, and they were observed to show less anxious behavior and fidgeting. The subjects diagnosed with adjustment disorder and one-third of those diagnosed with depression had reduced cortisol levels post intervention.

Using a nonrandomized, controlled treatment design, the effectiveness of the "Training of Relaxation with Elements of Yoga for Children" program based on Sivananda yoga was evaluated with participants aged 11 and 12 who evidenced high levels of school examination anxiety.[25] The participants showed significant reductions in aggression, helplessness in school, physical complaints, and an increase in stress-coping abilities and general well being, but no significant reduction in school exam anxiety or increase in self efficacy.

The effects of Hatha yoga on perceived stress, affect, and salivary cortisol were examined using a nonrandomized, controlled trial design in a sample of college students.[26] The Hatha yoga and African dance course groups (but not the biology lecture group) self reported significant reductions in negative affect and perceived stress. The yoga participants showed a decrease in salivary cortisol in contrast to the African dance group who had an increase in cortisol levels. No significant effects were found for positive affect in the yoga group, but were found for the African dance group. The authors speculate that the cortisol differences may have been due to differences in the intensity of the two activities.

There have been nine Cochrane reviews involving the use of yoga, but only one of these reviews specifically focuses on children or young people. In this review, yoga was one of many exercise interventions used as a potential prevention and treatment for anxiety and depression in youth 11 to 19 years old.[27] The authors reported methodological quality and quantity limitations similar to the studies evaluating yoga. Mindful of this caveat, the authors concluded,

"there is a small effect in favor of exercise in reducing depression and anxiety scores in the general population of children and adolescents," and it made little difference on the outcome whether the exercise was of high intensity, e.g., aerobics class, or low intensity, e.g., relaxation classes or yoga.

Eating disorders. Three studies[28–30] were identified that evaluated the impact of yoga as a complementary intervention for children and adolescents with eating disorders or weight and body satisfaction concerns. A pilot study assessed the potential benefits of an eight-week, individualized yoga treatment added to standard outpatient treatment for adolescents diagnosed with an eating disorder.[28] The participants were 11 to 21 years old, primarily female (n=50 girls, 4 boys), and diagnosed with anorexia nervosa, bulimia nervosa, or eating disorder not otherwise specified. All participants received outpatient care, which included physician and/or dietician appointments every other week. The group that also received yoga demonstrated greater decreases in eating disorder symptoms as assessed by the Eating Disorder Examination (EDE) compared to the controls at four weeks post-intervention, and reported significantly reduced food preoccupation immediately after yoga sessions. Both groups maintained current body mass index (BMI) levels and evidenced decreased anxiety and depression over time.

A prevention study using an integrated yoga, relaxation, and teaching intervention was undertaken with normal fifth grade girls to assess impact on self-perception related to body image.[29] The participants showed significant decreases in body dissatisfaction on bulimia subscales and an increase on a social self-concept scale. However, no support was found for the outcomes of drive for thinness, eating disordered attitudes/intentions, or perceived stress.

In a study with college women who reported dissatisfaction with their bodies, no significant post-intervention differences were found between the yoga and control groups, but the third study arm, a cognitive dissonance intervention, reported lower scores on outcomes of disordered eating, body dissatisfaction, alexithymia, and anxiety.[30]

CASE STUDY CONTINUED

After Jeremy underwent a thorough psychiatric evaluation and physical exam and information and behavior ratings were obtained from school and home, the clinician agreed with the diagnosis of ADHD. Treatment recommendations were reviewed and Jeremy and his mother considered all the options, including yoga. Janice was recently diagnosed with irritable bowel syndrome (IBS) and wondered if she would benefit from doing yoga. Jeremy's mother also wondered if yoga was helpful for other pediatric medical problems, such as Jeremy's asthma and overweight condition. The clinician explained some of the evidence supporting the use of yoga for pediatric medical problems.

APPLICATION OF YOGA TO MEDICAL DISORDERS

The literature evaluating the effectiveness of yoga as an intervention for specific medical disorders with adults is more robust that the literature is with youth. Beneficial effects from yoga in adult populations have been reported for cardiovascular disease,[31] diabetes mellitus,[32–34] epilepsy,[35] back pain,[36] and asthma.[29–32]

In contrast, only 7 out of 63 studies evaluating yoga and asthma included child participants. Perhaps in response to recruitment challenges, a surprising number of yoga studies include both children and adults in their subject pool. Eighty of the articles excluded from the pediatric yoga review by Birdee et al[5] were eliminated because they included both child and adult participants. Three of the studies showing yoga to be helpful for children and adolescents with asthma include studies combining adults and youth as participants, so consistent with our review exclusion criteria these are not included here.[33,34]

Asthma. Given the emphasis of yoga on regulating the breath, the potential effect of yoga practices on asthma has been a primary target of investigation. In addition to the child-adult combined articles, two studies[37,38] have evaluated the impact of yoga as a treatment intervention for asthma with children. An integrated yoga intervention that included yoga postures, breathing techniques, and cleansing rituals was evaluated with hospitalized youth, mean age 15.8, with a history of childhood asthma, recurrent episodes of asthma during the previous year, and exercise-induced bronchoconstriction.[37] The intervention was delivered twice daily (90 minutes in the morning and 60 minutes at night) for 40 days. Pulmonary functions, exercise capacity, and exercise-induced bronchoconstriction were all reported to improve post-intervention. Follow-up data for up to two years on some of the subjects documented continued to show improvements in asthma symptoms and decreased medication use. A yoga exercise practice with 31 school-aged Chinese children diagnosed with asthma found that yoga exercise was a benefit to flexibility, muscular endurance, and cardiopulmonary fitness.[38]

Irritable bowel syndrome. Gastrointestinal disorders are classed along with asthma as disorders that may be exacerbated or precipitated by stress and other mind-body interaction factors. As such, they may be particularly amenable to a mind-body intervention. A 14-minute yoga video was specifically designed to target symptoms of IBS.[39] Twenty-five adolescents (aged 11–18 years) diagnosed with IBS took a one-hour instructional class then were asked to practice daily with the video at

home. The teens in the yoga intervention group reported lower levels of functional disability, less use of emotion-focused avoidance, and lower anxiety following the program than teens in the control group. The yoga-group teens said they found practicing yoga to be helpful and indicated they would continue to use it to manage their IBS.

Diabetes. An uncontrolled pilot study examined both physical and psychological outcomes of yoga intervention in a small sample of predominantly Hispanic children (ages 8–15 years) at risk for the development of type 2 diabetes.[40] The yoga intervention was an Ashtanga yoga class modified to decrease the physical intensity of the sequence so the children did not fatigue or harm themselves. The class was 75 minutes, three times a week for 12 weeks. The participants showed positive outcomes of weight loss, improved self concept, and improved anxiety symptoms.

CASE STUDY CONCLUDED

Janice and Jeremy practiced yoga on a regular basis. Their mother was pleased with the health-promoting aspects of yoga and decided to practice it herself. Janice especially liked the breathing practices and the way she felt more relaxed after class. Jeremy lost some weight and was proud of the many yoga poses he could do.

DISCUSSION

Yoga is intended to have an optimizing effect, which is consistent with the current research. One area of focus in the child literature is the use of yoga programs as a primary prevention strategy and the school environment as a primary context to enhance children's mental health. When using yoga to facilitate positive self attitudes, two of the three studies with school-age children reported significant improvement in positive outcomes and reduction in negative behaviors,[15,40] but one study reported only reduction in problematic behaviors.[14] All three studies were of 12 weeks duration and had similar core yoga practice elements; however, they each used different, specific yoga interventions, and one of the two with positive outcomes included massage.[15] A second potentially distinguishing factor is the degree of physical vigor in the yoga interventions. The study using Asthanga yoga[40] found reductions in anxiety but the one using Sivananda techniques[15] did not. The differential benefits cannot be clearly ascribed to the schools of yoga because of other differing variables in the studies, but it is noteworthy that Ashtanga is a more physically vigorous form of yoga than Sivananda. It may be that children with anxiety benefit from more physically active forms of yoga, at least initially, in order to discharge physical restlessness and shift their attention from mental preoccupations.

The studies exploring the potential for yoga to facilitate development of concentration and attention in a school setting with children with attention problems differed in that two of them actively included parents in delivery of the intervention.[18,20] Three of the 4 studies reported reductions in ADHD symptoms;[17–19] the fourth was a parent-facilitated study where the parent led this aspect of the yoga practice.[40] In contrast, the second parent-facilitated treatment led to improvement in the parent-child relationship.[18] One distinguishing factor between the two parent-led interventions seemed to be the amount of coaching parents received before being asked to lead the child in the intervention, with more preparation leading to greater satisfaction.

The components in the yoga interventions used in three of the attention studies were otherwise relatively similar, so we may begin to form some conclusions about the type and dose of yoga needed to be effective in this population. The available evidence suggests a school-aged child diagnosed with ADHD would most likely benefit from a yoga class 1) with same-aged peers, 2) multiple components that include use of poses and focus on the breath, 3) intentional cues to concentrate attention, and 4) an ending period of quiet or guided relaxation in a still position. The class time may span 45 to 90 minutes. At least 6 to 8 weeks of weekly sessions, or approximately 20 hours of class time may be required to see beneficial effects, but they may also manifest sooner. There is likely to be greater benefit if use of the skills is practiced at home and supported by the classroom environment.

In addition to optimizing normative development, yoga is also being used as a remediation strategy for children who demonstrate clinically significant mental health concerns. Three studies evaluating yoga as a tool for reduction of anxiety and stress and improvement in coping abilities and mood states yielded mixed results.[24–26] One demonstrated a decrease in anxiety and increase in positive affect,[24] one found no decrease in anxiety but an increase in self efficacy,[25] and the third reported a decrease in negative affect and stress, but no increase in positive affect.[26] Two of the studies used one-time cortisol sampling as a biomarker for stress and in both cases cortisol levels decreased following yoga practice.[24,26]

Across the various studies, a trend emerged showing consistent reduction in problem behaviors and mixed results in terms of promoting positive affect states. There was also one study showing a decrease in positive self concept.[40] One hypothesis why yoga practice may have this differential effect is that increasing self awareness, especially of limitations, may have the effect of lowering self esteem and increasing existing anxiety or depression, at least in the short run. Trying something new at which a person is not skilled may also increase feelings of inadequacy. It is noteworthy that individuals progressing through the stages of change from

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precontemplative to contemplative and active often experience more distress in the transitive contemplative stage where there is awareness of the need to change, but the person has not yet developed the means or the mastery to do so. The authors suggest that this finding would reverse with a longer dose of the intervention. In order to address this question, it is recommended that studies use multiple data points rather than two data point pre-post measures to track the trajectory of change more closely. Also, implementation of studies with longer intervention periods would help to clarify dose response patterns. Other factors to consider are the sensitivity of the measures being used to detect shifts in internalizing behaviors compared with externalizing behaviors, and the fact that a reduction in negative behaviors may be more readily observed and valued by parent and teacher raters.

The studies targeting youth with disordered eating habits demonstrated reductions in body dissatisfaction, food pre-occupation, anxiety, and depression.[28,29] The two studies that measured these reductions also found improved self concept. There was no weight loss in the study populations with a low-weight eating disorder, but in a population at risk for type 2 diabetes there was some weight loss, which was construed as a positive outcome. Weight regulation in children and adolescents is a topic of urgent concern. Yoga may present a healthy mode of exercise for youth who are obese or underweight, although studies will need to continue to explore this potential.

For children with medical conditions, the studies reviewed demonstrated initial benefits from the mind-body interaction effects of yoga. The studies with asthma showed improvements in pulmonary functions, exercise capacity, and exercise-induced bronchoconstriction, which were sustained over two years follow up and led to decreased medication use.[37] The youth with IBS evidenced psychological benefits in terms of lower levels of functional disability, less use of emotion-focused avoidance, and reduced anxiety levels.[39]

The state of the yoga research literature clearly demonstrates that the utilization of yoga is outpacing the Western scientific study of yoga. The current review of the pediatric literature is consistent with previous reviews in finding promising results from studies with variable methodological quality. The limitations of the studies include the following: 1) few randomized, controlled trials (RCTs); 2) there are few adequate descriptions of the randomization method in the existing RCTs; 3) few studies adequately characterize the type of yoga intervention, the specific postures used, and the intensity of the intervention; 4) small sample sizes and few studies adequately justify the sample size; 5) few studies describe the qualifications of the yoga instructor; 6) the lack of an adequate description of the outcome assessor's blind status; and 7) adverse effects of yoga interventions are not systematically described.[5]

The high utilization rates for yoga suggest it is an intervention that children and adolescents are willing to try and to sustain with some degree of adherence. The authors who reviewed the yoga literature as a treatment for anxiety suggested that yoga might be appealing because it is nonpharmacological, has few adverse risks if practiced as recommended, and may be an acceptable option to individuals who reject psychological diagnoses and treatments.[41] Additional factors may include that, compared with most other healthcare options, yoga is relatively accessible and inexpensive. Yoga is a self-care practice, so it is a good match for individuals who want to take a more active role in their healthcare. In general, yoga teachers advocate a self-accepting, noncompetitive, and nonjudgmental attitude that may be especially appealing to youth with physical limitations, body dissatisfaction, or emotional insecurities. The less threatening approach of yoga may be more enticing than competitive sports as a means to increase children's levels of physical activity and mental well-being. That yoga may help with children's self-regulation abilities could be a key component; children learn the skills to regulate and calm their bodies and emotions and to increase their repertoire of healthy coping skills. Furthermore, yoga may increase a youth's sense of mastery, particularly for those children who may not have found mastery in the academic or social domains.

Along with the benefits, there are potential risks involved in yoga practice. In the popular yoga literature there are suggestions for avoiding "common yoga injuries" that include minor back and spinal problems, neck injuries, shoulder and hamstring injuries, as well as ankle, wrist, and knee injuries, but there are no available data on the frequency of these injuries.[42] Although there are a few case reports of adverse events related to the use of yoga in adults,[5] there is a need to conduct controlled studies in which systematic data could be gathered regarding any adverse effects of yoga with adults, children, and adolescents. Only one of the studies we reviewed reported an adverse event, in that case some of their yoga group participants scored lower on the self-esteem measure at the end of the study than at baseline. Other potential risks are present in individuals with specific medical conditions. Yoga poses that are beneficial for some conditions are contraindicated for others. Therefore, it is important that children and adolescents taking general yoga classes let the teacher know if they have any illnesses, injuries, or chronic conditions. Poses with the most risk tend to be inverted poses, which are contraindicated for certain disorders most often seen in adults (e.g., disc disease of the spine, extremely high

or low blood pressure, glaucoma, retinal detachment, fragile or atherosclerotic arteries, a risk of blood clots, ear problems, severe osteoporosis, or cervical spondylitis).[11] There are also cautions for pregnant women, which would include pregnant teens, against practicing inversions or deep twists, as well as the need for trimester-specific guidance in the use of supine, prone, and pelvic opening poses. Pregnant women are advised to take prenatal yoga classes rather than general yoga classes if they are new to yoga, if they do not know how to appropriately modify the class content, and in order to gain positive social support. There is a need to conduct controlled studies that gather systematic data regarding any adverse effects of yoga with adults, children, and adolescents.

Given that the initial research on the use of yoga for children and adolescents is promising, more systematic study is needed that includes the following:

1. More long-term and follow-up studies
2. Larger sample sizes to enhance statistical power
3. Randomization
4. Use of appropriate control groups are recommended.

The yoga literature would benefit from standardization of the measures used to allow for accurate comparison across studies. More direct study of the underlying processes by which yoga is beneficial to children's mental and physical health concerns will also be an important area for future research. Other potentially informative questions for exploration include the following:

1. Whether a specific style of yoga might be most helpful for a specific condition
2. If a specific dose-response relationship exists for various conditions and age groups
3. If certain yoga styles and approaches might be optimal for specific age groups
4. Whether there are specific risks in using yoga in the pediatric population
5. Which conditions might place a youth at greater risk for adverse events from yoga participation
6. How the potential benefits of yoga might be modified by cultural and societal influences, since most existing studies of yoga have been conducted in India where the practice of yoga has a tradition of greater cultural acceptance
7. How the benefits of yoga might be mediated by specific factors, such as exercise, meditation, philosophy, spirituality, and lifestyle.

There are limitations to this review as well. This review narrowed the scope of the already limited pediatric yoga literature to focus on the effectiveness of yoga as a complementary physical and mental health intervention with school-age children and adolescents. The review was not exhaustive and did not include quantitative analysis of the data (e.g., a meta-analysis). Studies evaluating physiological functioning, mental retardation, developmental disabilities, studies of children younger than school age, and studies with mixed child and adult populations were excluded. Studies published only in India and in languages other than English were also excluded. The small number of studies on any one diagnostic category made it difficult to formulate practice recommendations that are evidence based.

Many CAM interventions, including yoga, emerge from Eastern systems of medicine. As sciences, they have their own methods of observation and assessment, but those strategies have not historically included randomized, controlled trials and the other features for which Western reviewers look in rating the effectiveness of an intervention. Likewise, yoga practitioners train in small, independent training programs not affiliated with universities. If yoga is indeed to develop as a yoga therapy profession in the Western healthcare system, partnerships and cross training are needed between researchers and practitioners who are knowledgeable in the elements essential to both systems.

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