



Case report: The use of medical yoga for adolescent mental health

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ABSTRACT

Mental health issues are epidemic among youth in the United States today. Recent studies suggest that up to 50% of all teenagers have complaints related to stress, anxiety, and/or depression. This problem is accompanied by an unprecedented rise in the rates of child and teen suicide in the United States. In response to this epidemic, the American Academy of Pediatrics is recommending universal depression screening for all teens. Medications are available to ameliorate mental health disorders, and many can be safely used in the primary care setting. However, many of these medications have unwanted side effects or may not be familiar to the primary care physician. For these reasons and others, primary care physicians require additional approaches to respond to the challenges imposed by a growing number of patients requiring mental health support. Medical Yoga Therapy, prescribed by a physician with special yoga therapy training, offers a safe and effective way to serve the patient with physical or mental challenges disabilities. Medical Yoga therapy is an individualized and personal approach to the patient, and it may be integrated with any current therapy or medical regimen. Here, evidence for medical yoga is reviewed in the context of an adolescent patient with a common disorder. Yoga practices, with particular focus on mindfulness, offer a safe and effective intervention for a growing number of pediatric patients.

1. Introduction

Mental health issues are epidemic among youth in the United States today. Recent studies suggest that up to 50% of all U.S. teenagers have complaints related to stress, anxiety, and/or depression; this is accompanied by an unprecedented rise in the rates of child and teen suicide. According to the CDC, suicide is the third leading cause of the death for individuals between the ages of 10 and 24, with approximately 4600 lives lost each year. A survey performed on high school students in the United States, found that 16% of students stated that they had seriously considered suicide, while 13% reported creating a plan.¹

In response to this epidemic, the American Academy of Pediatrics is recommending universal depression screening for all teens.² This recommendation promises to recognize patients at risk of severe mental health disorders; at the same time, however, the recommendation increases the demand for already insufficient mental health services for patients and their families. In addition to the problem of mental health disorders among the general pediatric population, many patients with acute or chronic illness have difficulty adapting to their diagnoses or disabilities, leading to secondary mental illness.

Medications are available to ameliorate mental health disorders, and many can be safely used in the primary care setting. However, many of these medications have unwanted side effects, may be

ineffective, or may require nuanced application not familiar to the primary care physician. For these reasons and others, primary care physicians require additional approaches to respond to the challenges imposed by a growing number of patients requiring mental health support.

Mindfulness practices have ancient origins in many cultures. These practices all share the essential intention of directing awareness to the present moment. Mindfulness practices allow one to observe, or witness, their thoughts and emotions, rather than immediately reacting or getting caught up in them. With consistent practice, mindfulness techniques may help one understand that he or she is not simply the sum of his or her thoughts or emotions, thus empowering the patient to control them. Ultimately, negative ideations or perceptions can be accepted by the patient with grace and detachment, instead of with judgement.

When undertaken on a steady basis, mindfulness practices have been shown to offer an extraordinary number of health benefits. Mindfulness-based interventions have been shown to reduce generalized anxiety and depressive symptoms; improve cardiovascular health and sleep; enhance ability to concentrate, relax, and deal with distractions; and augment the ability to adapt to social and personal challenges.^{3–5} An increasing number of studies have shown that yogic practices, including mindfulness and Mindfulness-based Cognitive Therapy (MBCT), can help ease stress, depression and anxiety, and in fact, may be at least as effective in treating symptoms as antidepressant

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medication.^{6–8}

The most common and approachable mindfulness practices include meditation and contemplation, mindful breathing, mindful walking, mindful eating, deep breathing techniques (known as pranayama) and yoga asanas (i.e. postures and mindful movement). In fact, almost any action can be performed mindfully. Meditation itself is often found to be difficult for western pediatric patients, who live in a world of constant stimulation. However, *active* mindfulness techniques can be taught effectively and embraced by nearly any child of school-age and beyond.

Yoga is a particularly powerful active mindfulness practice.⁹ This ancient practice is notably effective in improving one's well-being and emotional regulation, as well as providing stress relief and enhancing self-care. Mastering self-care and self-regulation are essential tools against mental illness, substance abuse, and advocates for a healthy body and mind.¹⁰ The practice of yoga and mindfulness can help to increase alertness and positive emotions, while decreasing negative feelings of aggression, depression and anxiety.^{11–16}

On the physiologic level, mindfulness practices like yoga and meditation work by balancing and modulating the body's stress response systems.⁸ They help to ease the nervous system by enhancing parasympathetic tone and diminishing sympathetic tone, thus balancing the autonomic nervous system. These practices decrease physiological arousal by reducing heart rate, lowering blood pressure, easing respiration and increasing heart rate variability.^{17,18} Yogic practices have been shown to increase the body's levels of natural "positive" neurotransmitters such as gamma-aminobutyric acid, serotonin, melatonin, oxytocin, and B-endorphins, while decreasing the stress hormone cortisol.^{19–21} With consistent yoga practice, the limbic system is calmed and the work of the prefrontal cortex is enhanced, leading to regulation of impulse control, heightened executive function and decision making, and improved control over stress and emotions. The amygdala, often referred to as the brain's "threat center", responsible for fear, anxiety, stress and post-traumatic stress disorder, can be calmed with consistent yogic practices, even showing decrease in size by fMRI.^{22–27} In particular, yogic breathing techniques can help to calm the nervous system very quickly; studies have shown that teens can use these techniques to relax before exams, help with sleep, and calm themselves down during emotional upheaval.^{28, 29}

Medical yoga therapy is an individualized, personalized approach to the patient, and may be integrated with any current therapy or medical regimen. Yoga practices, with particular focus on mindfulness, offer a safe and effective intervention for a growing number of pediatric patients, particularly those with mental health concerns. The use of medical yoga can be illustrated with a case discussion.

2. Case presentation

BG was a 14 yo female, referred to the Pediatric Medical Yoga and Integrative Health Clinic from the Pediatric Neurology service for further evaluation and management of chronic migraine headaches with episodic transient ischemic events, and generalized anxiety disorder. BG had a history of migraine headaches, approximately 1 to 2 times per month, for approximately 2 years. She was pre-menses, however, she felt that her migraine headaches started with hormonal changes accompanying her growth spurt, development of vaginal discharge, axillary hair, and acne. Her migraines were fairly well controlled on ibuprofen, acetaminophen, diphenhydramine, and/or prochlorperazine, until approximately one month prior to presentation, when she developed a complex migraine headache that included loss of sensation and movement of her right arm and leg. At this point, she was seen by a pediatric neurologist, who suggested the use of a triptan and oral contraceptives to control her headaches. Of significance, the patient's mother had a significant history of complex migraine headaches, which she had since her teenage years. The mother felt that her own headaches were hormonally related, and had been managed with a low dose

of oral contraception. The mother also avoided certain triggers such as alcohol and chocolate. Both of these interventions helped to control her own migraines, however, neither the mother nor the patient wanted to start oral contraceptive therapy for the patient. The patient was referred to our medical yoga clinic for further management.

3. Clinical findings

The patient's family history was significant for an aortic aneurysm with dissection in her father the prior year, requiring emergency surgery. The patient was screened and found to have neither an aneurysm nor a predisposing disorder. Other significant family history include a benign brain tumor in her older brother, which was surgically removed approximately two years ago. Her brother also underwent an emergency appendectomy two weeks prior to our clinic visit.

BG endorsed that she experienced a great deal of anxiety around her own medical condition, as well as her family's medical complexities. She feared that "she is next" in terms of having emergency surgery, or that something "bad will happen" to her. She stated that when she got these thoughts in her mind, she would become very anxious, and unable to concentrate on anything else. She stated that over the prior two months, these thoughts occurred multiple times during the day. During one of these episodes two weeks prior to our appointment, she had a "full-blown panic attack" during school. She began to hyperventilate, developed palpitations along with severe nausea, necessitating leaving school due to her anxiety.

BG stated that she "gets angry a lot" especially at her parents and her brother. She also tended to get "annoyed a lot" at little things. She felt that her body started to get very tense when this occurred, and she didn't know what to do when this happens. She had no complaints of chronic dizziness, syncope, chest pain, wheezing, shortness of breath, vomiting, diarrhea, constipation, joint pain, or muscle pain.

BG stated that she "usually ate well" but tended to skip breakfast most mornings. She often snacked on chips, bread or fruit in the afternoon between meals. After dinner, she was often hungry and snacked on ice cream, cookies, cheeses, crackers and bread.

BG had no recent travel outside of the United States, recent tick or mosquito exposure, or any high-risk exposures for TB. The family lived in Northern Virginia in a single-family home with a pet dog.

On physical exam, BG was oriented to person, place, and time. She appeared well-developed, well-nourished and in no distress. She had a normal mood and her affect was pleasant, although somewhat nervous. Her behavior was normal. Judgment and thought content were normal. She was notably tall and slender. She was hypermobile but with a normal Beighton score for hypermobility, with negative hand or finger hypermobility. She was able to touch the floor with both hands. Her elbow hyperextension was measured at approximately 190°. The rest of her physical exam was within normal limits.

4. Diagnostic assessment

The management approach to this patient was primarily to control her anxiety, anticipating a favorable impact on her migraine headaches and general wellness. Initial recommendations included a medical yoga prescription and dietary supplements for anxiety and active (*rajasic*) depression. The yoga prescription was demonstrated to the patient during the appointment as well as discussed in detail with both the patient and parent. The medical yoga prescription, described below, included four essential components of yogic practices: Asanas (mindful movement), Pranayama (deep breathing), Contemplation (mindfulness exercises including meditation) and Svadhyaya (Self-reflection/Self-study).

Intervention: The initial medical yoga prescription for Anxiety and *Rajasic* Depression:

The medical yoga prescription for this patient, discussed and demonstrated, included: six postures (Asanas), one deep breathing

technique (Pranayama) and multiple mindfulness exercises, recommended to be performed twice daily at a minimum. The patient was to choose one mindfulness activity during each practice session. It was also recommended to do one or more of the practices when she was feeling anxious or noted an increase in anxiety-like behaviors (the practices are described in detail in Supplemental material).

4.1. *Asanas – mindful movement practices*

- 1 Child's pose (Balasana) – This asana is a resting posture that works to stretch the hips, thighs and chest, while reducing stress and fatigue.
- 2 Cat/Cow (Marjaryasana/Bitilasana) – This asana is a gentle flow between two postures (Cat and Cow). It stretches the back, torso and neck as well as opens the chest, encouraging the breath to become slow and deep.
- 3 Rag Doll (Uttanasana) – This asana is a basic standing forward bend that stretches the lower back, hamstrings and neck. It is beneficial in releasing stress, anxiety, depression and fatigue.
- 4 Seated cobblers pose (Baddha Konasana) – This asana is an effective hip opener, strengthening and improving flexibility in the inner thighs, groins and knees, and preparing the body for seated meditation. It is beneficial in soothing menstrual discomfort and digestive complaints including nausea and constipation.
- 5 Seated forward fold (Paschimottanasana) – This posture helps to relieve stress and tension as well as reduce headache, anxiety and fatigue.
- 6 Legs up the wall pose (Viparita Karani) – This posture stimulates the body's relaxation response by combining controlled breathing with a mild inversion. The pose alleviates menstrual discomfort, improves digestion, provides migraine and headache relief, restores fatigued feet and legs as well as stretches the back, neck and torso.

4.2. *Pranayama – deep breathing for anxiety/rajasic depression*

Benefits from this type of pranayama, deep breathing that emphasizes and prolongs the exhalation, include the activation of the parasympathetic nervous system and diverting attention from negative thoughts, thereby helping to relieve anxiety, stress and tension in the body. *Viloma* pranayama is a simple breathing technique that can be practiced by almost anyone. It may be practiced sitting up or lying down. This pranayama introduces the concept of breath expansion and lung capacity with a controlled breathing technique and includes three-part (interrupted) inhalations and exhalations, with a 1:2 ratio. For example, the inhalation can comprise two consecutive controlled breaths, followed by four consecutive controlled exhalations.

4.3. *Mindfulness practices and exercises*

Mindfulness is the practice of purposeful, focused awareness on the present moment. It is to be practiced without judgement (e.g. without the constant interrupting thought of “I am not doing this correctly”). All of these practices below are exercises to help to bring about this type of focused awareness. Practicing mindfulness can help to create resilience and hope, particularly important for today's adolescent. Mindfulness practices may involve breathing methods, guided imagery, and other practices to help relax the body and mind, and reduce stress. Examples of mindfulness practices include walking meditations, eating meditations, taking mindful mini-breaks, listening mindfully, gratitude journaling, experiencing nature and body scan meditations. In the age of technology, electronic devices may even be used here for benefit. There are numerous phone and computer applications that can help teach or promote mindfulness practice. Many of these applications have guided meditations that are simple to follow, and are often easier for a beginner practitioner to help with focus.

4.4. *Nutritional support and supplements for anxiety*

Recommended dietary support for BG included adding more whole grains, fruits and vegetables, and more foods with increased omega-3 fatty acids. A formal breakfast was recommended with suggestions that included foods such as whole steel-cut oatmeal with berries and nuts (almonds, cashews, walnuts), eggs with sliced avocado on whole-grained breads, yogurt with nuts and berries, etc. Protein sources such as omega-3 rich fishes were recommended including salmon and sardines. Complex carbohydrates were recommended in lieu of simple white carbohydrates: sweet potato instead of white potatoes, brown or wild rice instead of white rice, or trying quinoa or amaranth as the base carbohydrate. Spices with anti-inflammatory properties such as turmeric, black pepper and ginger were recommended to be added to foods. Eating a larger lunch meal, with removal of carbonated sodas was also recommended. Recommended snacks included fruits, nuts and/or whole grain crackers with nut butters.

Additional supplements that were recommended included a multi-strained probiotics with greater than 10 billion CFU per dose. Prebiotics, such as Transgalactooligosaccharide and Fructo-oligosaccharides were recommended along with the probiotics. Omega-3 fatty acids, including docosahexaenoic acid and eicosapentaenoic acid, were recommended if BG was unable to find these from food sources such as fish, avocados and oils. Vitamin D levels were checked and found to be low. Supplemental Vitamin D – 2000 IU daily was also recommended. Additional Magnesium – 400 mg daily, and Riboflavin – 400 mg daily, were also recommended for migraine headaches.

Lastly, essential oils were recommended including lavender, frankincense, lemon balm and ylang-ylang. These were recommended to be delivered in a diffuser and aerosolized in the patient's bedroom.

4.5. *Self-reflection and study*

When self-reflection is done effectively, one's actions become a mirror in which one can learn to see oneself more clearly and deeply. In BG's case, recognizing her emotions when they actually occurred was very important and powerful. If one can understand and learn to recognize an emotion as it is occurring, one can work to alter it. Teaching BG to recognize her emotions, whether “good or bad”, can help to put her in control of her emotions, instead of having her emotions control her. Self-reflection is an ongoing process where one can assess where one is at any given moment. It is ideally a life-long practice and starting at a young age is very beneficial.

4.6. *Follow up and outcomes*

Eight weeks after the initial visit, both BG and her father stated that she seemed to be doing quite a bit better since her last visit. BG stated that she hadn't had a migraine headache since her last visit: her only headache was mild, short-lived and non-migraine in nature. She felt that this headache was tension and stress-related as it occurred right after she realized that she failed to do a science homework assignment on the day that it was due. She stated that this headache resolved without the use of medication and seemed to lessen while she did her deep breathing exercise at school. BG stated that both of her parents often did her mindfulness exercises with her, which she found helpful. BG did her asana practice approximately 4 times a week since school had just resumed, but that over the last month of summer vacation, she was doing them almost daily. Most of the days that she did her practice, she would do it twice per day. She does admit that doing the practices usually made her feel better and more relaxed.

BG did state that since school had started, she recognized that she had been more easily stressed. In particular, she had noticed tension around playing Field Hockey, especially when she had games. She had been working on her deep breathing while she riding the buses to the games, and stated that it quieted down that “tense feeling in her

stomach” that she got prior to the games. At the follow-up visit, the Medical yoga prescription was further developed to include:

4.7. Follow up intervention – continued medical yoga prescription

Five additional asanas (postures) were recommended to be done 3–4 times per week, particularly for muscle relaxation and balance. Each posture was recommended to be held for five deep diaphragmatic breaths. Additional pranayama (breathing) methods were recommended, particularly ones to help calm the nervous system, encourage tranquility, and withdraw the senses from outer distraction. Mindfulness exercises were reviewed, and recommended to be continued daily. It was discussed in detail how to "be mindful about being mindful" while doing mindfulness exercises.

4.8. Follow up and outcomes

At her sixteen week follow-up appointment, BG had continued to do well with both good control of her migraine headaches and her anxiety. Over the interim period between the two visits, she stated that she felt the “beginning of migraine with a visual scotoma” but that it never developed into a full migraine headache. Her anxiety level is felt to be much improved. She states that she now “knows when she is getting anxious” and is able to “calm herself down with deep breathing”, so that the anxiety does not bother her or “ruin her day”. She continues to work on her medical yoga prescription almost daily and is thinking of signing up for a gentle, restorative yoga class in town (Table 1).

5. Discussion

Yogic practices, in particular, one-pointed concentration and the meditation aspects of yoga, help to turn the mind away from the constant stream of distractibility and churning thought-forms. These practices can help the patient to manage and cope with potential triggers for anxiety and stress, while helping to develop resilience. They can encourage the patient’s own self-reflection, and thus, uncover the origin and cause of his/her own anxiety. Medical yoga therapy is most effective when it helps one to understand one’s own health outlook, by helping to change the stress from a reactive management to proactive health emphasis. When done regularly, consistent yoga practice can help move one towards healing, resilience, connectedness and wholeness.³⁰

Many typical habits of today’s youth include excessive technology consumption, particularly remote screen time and social media, with less time spent socializing with friends, family or just being with themselves. Time spent out of doors and in nature is less frequent. This outward focusing can lead to a feeling of disconnection from themselves and others, and can be very isolating for anyone, especially a susceptible teen. Yogic practices are about learning to pay attention: paying attention to one’s self, one’s body and to others. Yogic and mindfulness practices can help to bring back that feeling of connection with others, as it brings back an inward attention, helping one to “truly be with him or herself”. This focused attention can lead to a deeper appreciation of one’s internal state, and thereby help heal, and be more aware, of this disconnect.

It is predictable that yoga has rapidly grown across America over the past number of years. Yoga studios are now found in most towns and cities, and yoga teachers can be found in gyms, on the internet and on television. Under the guidance of a qualified teacher, yoga can also serve as a safe and effective exercise for nearly anyone, in particular to manage the many disorders caused by tightness of joints and muscles. The ease and availability of multiple varieties of yoga and yogic practices to Americans could lead to the long-term integration of these practices into the lives of many individuals, with lasting benefit. For migraine headache, this report and other studies have shown that migraine headache frequency and intensity were reduced with yoga

Table 1
Timeline.

Symptoms	Anxiety	Migraines	Complex Migraines	Panic Symptoms
2016	Onset of anxiety after brother's brain tumor diagnosis	Onset of migraines – 1-2 x month		
2017	Worsening anxiety symptoms after Father's illness	Continued migraines with minimal relief		
April 2018	Worsening anxiety after brother's acute appendectomy		Onset of complex migraine with transient ischemic event	Panic attack with hyperventilation at school
Early May 2018 Intervention with Medical Yoga Therapy – Late May 2018	Improved symptoms of daily anxiety	No migraines in past 2 months	No further events	No further events
Late July 2018 – 8 weeks after starting intervention	Continued improvement of symptoms of daily anxiety	Simple migraine x 1 with quick resolution	No further events	No further events
September 2018 – 16 weeks after starting intervention				

therapy. Yoga therapy practice enhances vagal tone and decreases sympathetic drive, thereby improving cardiac autonomic balance. Yoga therapy may be effectively incorporated as an adjunctive therapy in migraine patients.³¹

Although yoga is available to nearly anyone, there are individuals for whom yoga may offer special challenges. Patients with physical and mental disabilities may not be well-served in the average commercial yoga studio. Conventional yoga teacher training does not prepare the yoga teacher for patients with specific challenges or medical complexities. Medical yoga therapy is quite different than taking a group yoga class, as it is individualized and prescribed for the patient's particular needs. Even a very qualified yoga instructor may not be knowledgeable, or aware of, an individual student's health issues. Although yoga teacher training certifications include training in anatomy and physiology, this training is not equivalent to the training required by most certified yoga therapists or healthcare practitioners, and can be quite varied. Medical Yoga Therapy, prescribed by a physician with special yoga therapy training, offers the most effective, and safest, way to serve the patient with physical or mental disabilities. The medical yoga prescription can include practices that can improve a wide range of disorders, in ways that are safe and non-invasive. Once taught, patients can perform the practices on their own, with follow-up as required.

There are limitations to the use of medical yoga, even when prescribed by a skilled professional. Regular practice of yoga requires energy and commitment; many patients lose this commitment and some (particularly depressed patients) may not have the energy for regular practice. In addition, there may be risks to engaging in yoga as well if not prescribed, and practiced, appropriately for the individual. Prescribing a medical yoga intervention also is limited as medical yoga certification is not widely available to healthcare practitioners, and training can be varied.

Another limitation to this manuscript is inherent to a single case report: In a recent systematic review examining yoga interventions for anxiety in children and adolescents, nearly all studies indicated reduced anxiety after a yoga intervention. However, because of the wide variety of study populations, limitations in some study designs, and variable outcome measures, it was concluded that further research is necessary to generalize and apply yoga to reduce anxiety.³²

Medical Yoga therapy is an individualized and personal approach to the patient. The beauty of this therapy is that it does not expose one to the potentially negative side effects of medications, and can leave the patient with long-lasting benefits. Among the more tractable disorders for medical yoga therapy include anxiety, mild depression, chronic pain, musculoskeletal complaints, asthma, attention deficient and hyperactivity disorder (ADHD) and high-functioning autism.

It is imperative to recognize that medical yoga therapy is an adjunctive and complementary therapy, and is not a substitute for appropriate psychotherapy or medication. If necessary, medications such as anti-anxiolytics, anti-depressants, and/or pain medication, as well as psychotherapy may be required in tandem. The hope of medical yoga therapy would be to give the patient additional tools. When medications are weaned off or discontinued, the patient will still have the ability to manage their underlying symptoms themselves.

Medical yoga intervention may be integrated with any current therapy or medical regimen. Yoga practices, with particular focus on mindfulness, offer a safe and effective intervention for a growing number of pediatric patients.

Informed consent

The mother and patient provided their informed consent for the publication of this case report. Both the mother and patient read the article and confirmed its content.

CARE guidelines

The CARE guidelines were followed for this case report.³³

IRB approval

The IRB considered this case report exempt from formal review.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.ctim.2019.01.006>.

References

- <https://www.cdc.gov/healthcommunication/toolstemplates/entertainment/tips/SuicideYouth.html> - Accessed 10 October 2018.
- Zuckerbrot R, Cheung A, Jensen P, Stein R, Laraque D, GLAD-PC STEERING GROUP. From the American Academy of Pediatrics Statement of Endorsement. Guidelines for Adolescent Depression in Primary Care (GLAD-PC): part I. practice preparation, identification, assessment, and initial management. *Pediatrics*. 2018;141(March (3)).
- Huang J, Nigatu Y, Smail-Crevier R, Zhang X, Wang J. Interventions for common mental health problems among university and college students: a systematic review and meta-analysis of randomized controlled trials. *J Psychiatr Res*. 2018;29(September (107)):1–10.
- Lundgren O, Garvin P, Kristenson M, Jonasson L, Thülen I. A journey through chaos and calmness: experiences of mindfulness training in patients with depressive symptoms after a recent coronary event – a qualitative diary content analysis. *BMC Psychol*. 2018;6(September (1)):46.
- Ong J, Smith C. Using mindfulness for the treatment of insomnia. *Curr Sleep Med Rep*. 2017;3(June (2)):57–65.
- Zhang Z, Zhang L, Zhang G, Jin J, Zheng Z. The effect of CBT and its modifications for relapse prevention in major depressive disorder: a systematic review and meta-analysis. *BMC Psychiatry*. 2018;18(February (1)):50.
- Zou L, Yeung A, Li C, et al. Effects of meditative movements on major depressive disorder: a systematic review and meta-analysis of randomized controlled trials. *J Clin Med*. 2018;7(August (8)).
- Goyal M, Singh S, Sibinga E, et al. Meditation programs for psychological stress and well-being: a systematic review and meta-analysis. *JAMA Intern Med*. 2014;174(3):357–368.
- Noggle JJ, Steiner N, Minami T, et al. Benefits of yoga for psychosocial well-being in a US high school curriculum: a preliminary randomized controlled trial. *J Dev Behav Pediatr*. 2012;33(April (3)):193–201.
- Gard T, Noggle JJ, Park CL, et al. Potential self-regulatory mechanisms of yoga for psychological health. *Front Hum Neurosci*. 2014;30(September (8)):770.
- Miller JJ, Fletcher K, Kabat-Zinn J. Three-year follow-up and clinical implications of a mindfulness meditation-based stress reduction intervention in the treatment of anxiety disorders. *Gen Hosp Psychiatry*. 1995;17:192–200.
- Yadav RK, Sarvottam K, Magan D, Yadav R. A two-year follow-up case of chronic fatigue syndrome: substantial improvement in personality following a yoga-based lifestyle intervention. *J Altern Complement Med*. 2015;21:246–249.
- Klainin-Yobas P, Oo WN, Suzanne Yew PY, Lau Y. Effects of relaxation interventions on depression and anxiety among older adults: a systematic review. *Aging Ment Health*. 2015;19:1043–1055.
- Amaranath B, Nagendra HR, Deshpande S. Effect of integrated Yoga module on positive and negative emotions in Home Guards in Bengaluru: a wait list randomized control trial. *Int J Yoga*. 2016;9:35–43.
- DeBruin E, Formosa AR, Frijstein G, Bogels SM. Mindful2Work: effects of combined physical exercise, yoga and mindfulness meditations for stress relieve in employees. A proof of concept study. *Mindfulness*. 2017;8:204–217.
- Danhauer SC, Addington EL, Sohl SJ, Chaoul A, Cohen L. Review of yoga therapy during cancer treatment. *Support Care Cancer*. 2017. <https://doi.org/10.1007/s00520-016-3556-9>.
- Oka T, Tanahashi T, Sudo N, Lkhagvasuren B, Yamada Y. Changes in fatigue, autonomic functions, and blood biomarkers due to sitting isometric yoga in patients with chronic fatigue syndrome. *Biopsychosoc Med*. 2018;10(April (12)):3.
- Telles S, Verma S, Sharma SK, Gupta RK, Balkrishna A. Alternate-nostril yoga breathing reduced blood pressure while increasing performance in a vigilance test. *Med Sci Monit Basic Res*. 2017;29(December (23)):392–398.
- Streeter CC, Gerbarg PL, Saper RB, et al. Effects of yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. *Med Hypotheses*. 2012;78(May (5)):571–579.
- Lim SA, Cheong KJ. Regular yoga practice improves antioxidant status, immune function, and stress hormone releases in young healthy people: a randomized, double-blind, controlled pilot study. *J Altern Complement Med*. 2015;21(September (9)):530–538.
- Yadav RK, Magan D, Mehta N, Sharma R, Mahapatra SC. Efficacy of a short-term yoga-based lifestyle intervention in reducing stress and inflammation: preliminary results. *J Altern Complement Med*. 2012;18(July (7)):662–667.
- Engström M, Pihlsgård J, Lundberg P, Söderfeldt B. Functional magnetic resonance imaging of hippocampal activation during silent mantra meditation. *J Altern*

- Complement Med.* 2010;16(December (12)):1253–1258.
23. Carrion VG, Wong SS. Can traumatic stress alter the brain? Understanding the implications of early trauma on brain development and learning. *J Adolesc Health.* 2012;51:S23–S28.
 24. Carrion VG, Weems CF, Richert K, Hoffman BC, Reiss AL. Decreased prefrontal cortical volume associated with increased bedtime cortisol in traumatized youth. *Biol Psychiatry.* 2010;68:491–493.
 25. Travis SG, Coupland NJ, Hegadoren K, et al. Effects of cortisol on hippocampal subfields volumes and memory performance in healthy control subjects and patients with major depressive disorder. *J Affect Disord.* 2016;201:34–41.
 26. Holzel BK, Carmody J, Evans KC, et al. Stress reduction correlates with structural changes in the amygdala. *SCAN.* 2010;5:11–17.
 27. Gotink RA, Vernooij MW, Ikram MA, et al. Meditation and yoga practice are associated with smaller right amygdala volume: the Rotterdam study. *Brain Imaging Behav.* 2018;7(February) <https://doi.org/10.1007/s11682-018-9826-z>.
 28. Perciavalle V, Blandini M, Fecarotta P, et al. The role of deep breathing on stress. *Neurol Sci.* 2017;38(March (3)):451–458.
 29. Dhruva A, Miaskowski C, Abrams D, et al. Yoga breathing for cancer chemotherapy-associated symptoms and quality of life: results of a pilot randomized controlled trial. *J Altern Complement Med.* 2012;18(May (5)):473–479.
 30. Stephens I. Medical yoga therapy. *Children.* 2017;4(12) doi:10.3390/children4020012.
 31. Kisan R, Sujan M, Adoor M, et al. Effect of yoga on migraine: a comprehensive study using clinical profile and cardiac autonomic functions. *Int J Yoga.* 2014;7(July-December (2)):126–132.
 32. Weaver LL, Darragh AR. Systematic review of yoga interventions for anxiety reduction among children and adolescents. *Am J Occup Ther.* 2015;69(November-December (6)) 6906180070p1-9.
 33. Gagnier J, Kienle G, Altman DG, Moher D, Sox H, Riley DS, the CARE group. The CARE guidelines: consensus-based clinical case report guideline development. *J Clin Epidemiol.* 2013;67(1):46–51.