

REVIEWS

Assessing the Effectiveness of Yoga as a Complementary and Alternative Treatment for Post-Traumatic Stress Disorder: A Review and Synthesis

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Abstract

Objectives: Posttraumatic stress disorder (PTSD) is a debilitating condition that affects many who have experienced trauma. In addition to skills-focused treatments, exposure-based treatments, cognitive therapy, combination treatments, and EMDR, a number of alternative treatments for PTSD have emerged in recent years. The search for alternative treatments is justified based on the empirical observation that a large percentage of individuals fail to benefit optimally from existing treatments (e.g., between 30 and 60). Moreover, current studies often utilize stringent inclusion criteria (e.g., absence of comorbid disorders), raising the likelihood that results will not generalize to many individuals currently experiencing PTSD. The primary objective of the current paper was to explore the effects of one type of alternative treatment: yoga.

Design: A comprehensive review of the literature was conducted targeting research examining yoga postures and PTSD. Seven randomized controlled trials (RCTs) were identified and reviewed, and effect sizes were computed for the post-test assessments.

Results: Cohen's *d* for each study ranged (in absolute value) from a low of -0.06 to a high of 1.42 (average weighted *d* across studies was 0.48 ; 95% CI: $0.26, 0.69$).

Conclusions: Putative mechanisms of action for the possible beneficial effects of yoga for PTSD-related symptomatology and clinical implications are discussed.

Keywords: yoga, PTSD, trauma, intervention

Introduction

FOR MANY, THE response of a traumatic event is characterized by intrusive memories, avoidance of stimuli reminiscent of the trauma, changes in arousal, and alterations in negative cognitions and mood. When considered jointly, these clusters of symptoms denote post-traumatic stress disorder (PTSD).¹

PTSD prevalence, common comorbidities, and treatment

A large percentage of trauma survivors manifest PTSD-related symptoms following a traumatic event, although this

percentage dissipates over time.² General population prevalence estimates have varied over the past 20 years from a low of 6.8% to a high of 12.3%,^{3,4} with a projected lifetime prevalence rate at 8.7%.¹ These prevalence estimates vary by sex, with women reporting higher prevalence estimates (e.g., 9.7% vs. 3.6%).³ The occurrence is also higher among military personnel, with prevalence estimates ranging from 10% for Gulf War veterans to 31% in male Vietnam veterans.³

Individuals afflicted with PTSD often experience high levels of impairment across multiple domains of functioning (e.g., social, occupational, and interpersonal) and are 80% more likely to have a co-occurring mental health diagnosis¹

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such as substance use.⁵ In those with chronic traumatic exposure, commonly associated features of PTSD include impairments in affect regulation, interpersonal stressors,^{1,6} and dissociation.^{1,7,8} These affiliated difficulties coupled with pre-, peri-, and post-traumatic risk factors might exacerbate the development of the disorder due to a lack of effective coping skills.⁹ For instance, dissociation—or an experienced disconnection—at the time of a traumatic event is not in itself predictive of subsequent PTSD, rather it is the perpetual avoidance of stimuli reminiscent of the trauma that is associated with the onset of the disorder.⁷ Taken together, the presence of various associated features of PTSD illuminates the negative impact of ineffective coping in the aftermath of trauma, thereby emphasizing the need for alternative ways of managing experienced distress.

Many evidence-based techniques have been established for the treatment of PTSD, including skill-focused treatments, exposure-based treatments, cognitive therapy, combination treatments, and eye movement desensitization and reprocessing.² Despite the empirical support for these treatments, one meta-analytic review found that among participants meeting inclusion criteria for studies assessing treatment efficacy for PTSD, between 30% and 60% of participants failed to experience symptom reduction or experienced residual symptoms post-treatment.¹⁰ Moreover, many studies examining treatment efficacy for PTSD include comorbid disorders as an exclusion criteria, thereby producing results that might not be generalizable due to high co-occurrence of other disorders in this population.^{1,10} Recent trends in trauma therapy have focused on bottom-up approaches and the integration of traditional therapies with movement and other creative treatments to facilitate symptom reduction in trauma survivors with a history of multiple treatment episodes.^{6,11}

Yoga as a viable intervention for physical and mental health

To the layperson, yoga is associated with stretching, flexibility, and mindfulness or meditation. However, traditionally, the word *yoga* signifies union and is associated with a mental practice that utilizes physical postures (i.e., asanas) to expand consciousness.¹² Although yoga tends to refer to asana practice, myriad schools of yoga exist (e.g., Iyengar, Vinyasa, *yin*, Kundalini, and Sudarshan Kriya yoga [SKY]), each with a different emphasis on components of the practice (e.g., flexibility, strength, and meditation).

The benefits of exercise (e.g., cardiovascular) in alleviating various physical and mental health stressors have been long established in the literature.¹³ Recent studies and reviews have examined yoga as a treatment for physical and mental health problems, and results suggest that yoga holds some therapeutic promise.^{11,13–20} For example, when compared with physical exercise, one systematic review revealed that yoga interventions were of equal or greater benefit on various health-related variables.²⁰ Additionally, in a study examining the effects of yoga in depressed individuals, researchers discovered that yoga reduced depressed mood comparable to an antidepressant, a result that has been replicated.^{11–21} Specifically, the effect of yoga in reducing depressed mood was not only significant, but the difference between those in the yoga condition and those in the antidepressant medication-alone condition was also significant.^{21,22} Additionally, those in the yoga condition

demonstrated lower cortisol and stress levels than patients who did not practice yoga.²² Moreover, Büssing et al.¹⁴ systematically evaluated empirical studies on stress, depression, anxiety and related disorders, including PTSD, and various physical conditions. Although data in the studies reviewed suggest that yoga could be a beneficial treatment, the general absence of controlled trials and significant variability in study quality suggest that additional inquiry is warranted.¹⁴ A subsequent meta-analysis examining yoga's effectiveness in treating depression provided additional support for the effectiveness of yoga; results yielded small to medium effects of yoga on symptoms. However, due to the heterogeneity of yoga interventions, the authors recommended that definitive conclusions await further investigation.¹⁶ Consequently, continued assessment of yoga as an alternative or adjunctive intervention is warranted.

The literature seems to support the benefits of yoga in ameliorating difficulties associated with various mental illnesses. However, the validity of yoga as a viable intervention in the treatment of PTSD remains unclear, in part, due to the limited number of controlled trials and variability across studies.¹⁴ As a result, the primary objective of the current study was to explore the effectiveness of a yoga intervention with an asana practice as an alternative or complementary intervention in reducing PTSD symptoms.

Methods

Search strategy and selection criteria

A comprehensive review of the literature was conducted by three of the authors (i.e., N.A.S., K.M., and K.O.) through April 2017. Literature was searched across various search engines, including PsycINFO, Google Scholar, PubMed/MEDLINE, EBSCO, and Published International Literature on Traumatic Stress (PILOTS). Research examining yoga practice and PTSD was targeted. To capture the largest number of relevant publications, the following search terms were considered: *yoga AND PTSD*, *yoga AND trauma*, *yoga postures AND PTSD*, and *yoga postures AND trauma*.

Studies examining the efficacy of a yoga intervention are fairly heterogeneous with respect to treatment characteristics (e.g., style of yoga), participant characteristics (e.g., gender, ethnicity, type of trauma exposure, and age), and design (e.g., randomized controlled trial [RCT] vs. uncontrolled trial). Consequently, to reduce design-related heterogeneity, the current review selected studies that employed an RCT study design. Additional inclusion criteria consisted of a peer-reviewed publication, the use of physical yoga postures, a sample of adult (age 18+) individuals reporting some type of traumatic exposure, and the assessment of PTSD symptoms using a validated measure. Exclusion criteria included studies implementing an uncontrolled trial, utilizing breathwork or meditation only (i.e., no yoga postures), a nonvalidated measure of PTSD, and incomplete pre- and post-treatment data. Demographic characteristics of the sample (e.g., gender and ethnicity) were not taken into account when identifying appropriate studies for this review, although they were provided when available; attrition data were calculated for the yoga condition in each study and are reported in Table 1.

Duplicate articles were first eliminated, and remaining articles were eliminated based on title and abstract if they did not assess PTSD symptoms in adults participating in a yoga intervention, utilizing an RCT design. Full-text articles were

TABLE 1. OVERVIEW OF IDENTIFIED RANDOMIZED CONTROLLED TRIALS

<i>First author</i>	<i>Year</i>	<i>Type of trauma</i>	<i>Yoga style</i>	<i>CTL condition</i>	<i>Duration of treatment</i>	<i>Instruments</i>	<i>Tx sample size</i>	<i>Tx pre (M)</i>	<i>Tx pre (SD)</i>	<i>Tx post (—)</i>	<i>Tx post (SD)</i>	<i>CTL sample size</i>	<i>CTL pre (M)</i>	<i>CTL pre (SD)</i>	<i>CTL post (M)</i>	<i>CTL post (SD)</i>	<i>Total (N)</i>	<i>Attrition for TX (%)</i>
Quiñones ²³	2015	Military	Satyananda yoga	Demobilization program	60-min class 1×/week for 16 weeks	PCL-C	48	56.3	15.48	38.84	14.91	46	54.9	17.4	48.26	14.09	96	4
Jindani ¹⁷	2015	Various adverse traumas	KY	Waitlist	90-min class 1×/week for 10 weeks 15 min/day at home	PCL-17	29	59.5	9.3	41.8	12	21	55.1	11.9	53	11.6	50	50.8
van der Kolk ¹¹	2014	Unspecified	TSY	Women's Health Education Group Assessment control	60-min class 1×/week for 10 weeks	CAPS	32	73.9	21	49.5	25.2	32	76.7	20.83	63	25.48	64	3.1
Mitchell/Dick ²⁶	2014	Military and civilian	Kripalu	Assessment control	75-min class: 6 or 12 weeks (total 12 classes)	PCL-C	20	51.9	14	39.1	16	18	53.4	10.56	39	12.65	38	30
Thordardottir ²⁸	2014	Natural disaster	Hatha	Waitlist	60-min classes 2×/week for 6 weeks	PDS	26	19	13.58	12.86	9.80	32	17.54	13.46	12.23	11.09	58	16.1
Kim ¹⁸	2013	Nursing	MBX + yoga postures	Three-arm study, no intervention reported	60-min class 1×/week for 16 weeks	PCL-C	11	43.1	11	24.3	3.3	11	42.6	12.7	41	16.3	22	0
Carter ¹⁵	2013	Military	SKY + yoga postures	No intervention reported, maint. meds. regimen	22h of yoga over 5 days	CAPS	14	56.3	12	26.2	14.8	11	56.6	18.7	31	27.8	25	12.5

CTL, control; KY, Kundalini yoga; MBX, mindfulness-based stretching and deep breathing exercise; M, mean; maint. meds. regimen, maintain medication regimen; SD, standard deviation; SKY, Sudarshan Kriya yoga; TSY, trauma-sensitive yoga; TX, treatment.

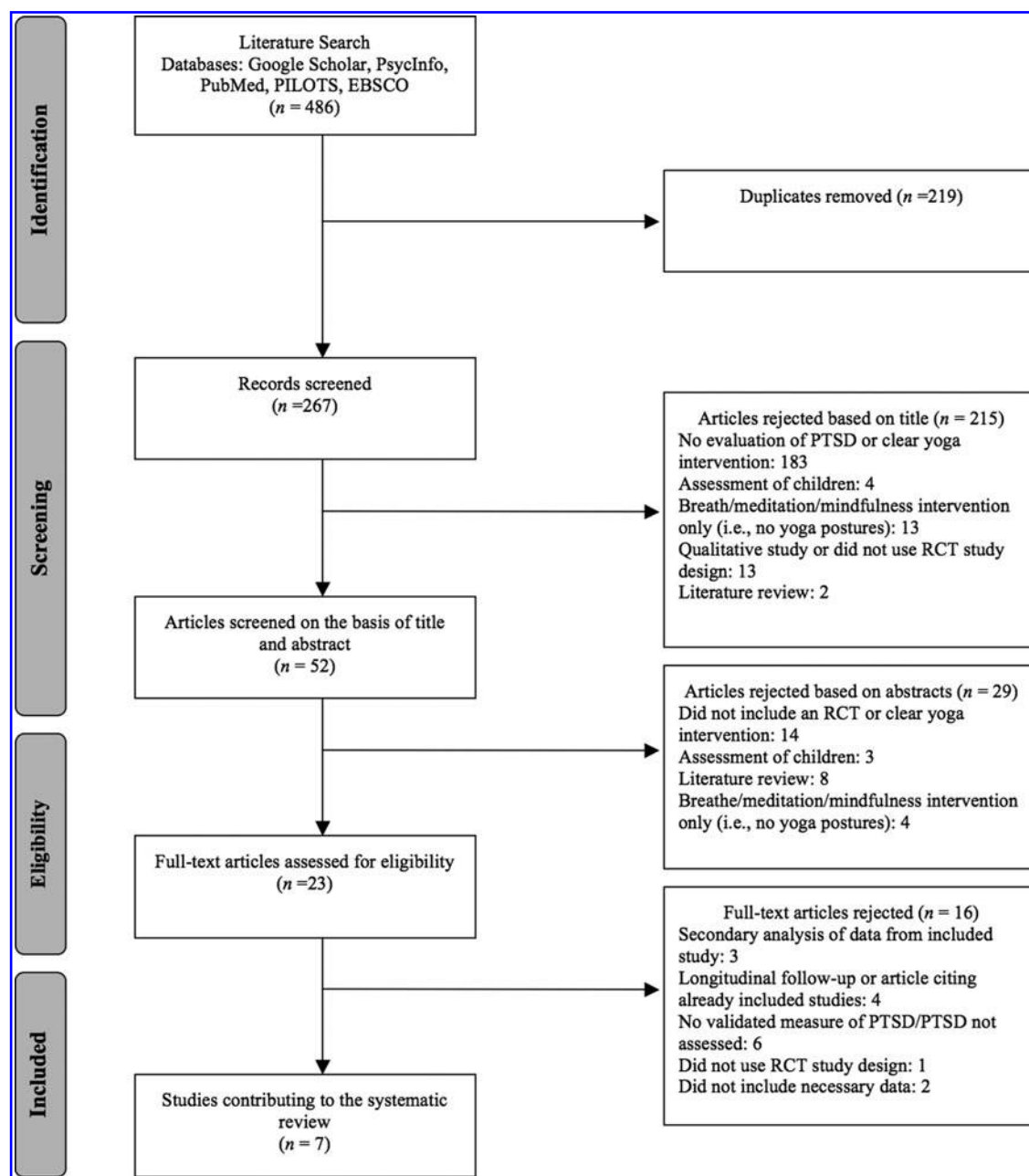


FIG. 1. Flowchart of relevant study identification.

obtained for all relevant articles, which were further screened to ensure that they met all of the abovementioned inclusion criteria for the current review. Refer to Figure 1 for identification and selection process of relevant articles. Following the identification of appropriate articles, at least two of the authors extracted relevant data for quantitative analysis and compared results for accuracy. If necessary data were not included (e.g., preassessment means and standard deviations), outreach attempts were made to the affiliated authors (see Table 1 for included studies and study characteristics).

Results

Four hundred and eighty-six articles were identified through the search strategy employed across five databases

after controlling for peer-reviewed articles. These articles were screened based on title, abstract, and full text, and relevant data were extracted for the review and synthesis. These seven RCTs represent studies examining the effectiveness of yoga interventions employing yoga postures in a variety of traumatized populations (e.g., veterans, survivors of childhood abuse and interpersonal violence, and survivors of natural disasters) in the amelioration of PTSD symptomatology utilizing a validated assessment of PTSD.

Qualitative synthesis: description of identified studies

Efficacy of a Satyananda yoga intervention for reintegrating adults diagnosed with PTSD. The study aimed to evaluate the effectiveness of a 16-week Satyananda yoga

protocol in reducing symptoms of PTSD in excombatants from the illegal arms group in Colombia.²³ One hundred participants were assigned using computerized randomization to either the yoga intervention ($n=50$) or the regularly implemented demobilization program (i.e., control) ($n=50$) group; six participants dropped out of the study (two from the intervention [$n=48$] and four from the control [$n=46$] groups). Symptoms of PTSD were assessed utilizing the PTSD Checklist-Civilian (PCL-C²⁴) Version that was administered pre- and post-treatment. Results of the intervention denote a significant reduction in PTSD symptoms for those in the intervention group as well as a significant difference in improvement between groups (i.e., 31.01% clinical improvement in the yoga condition compared with 12.10% improvement in the control group).

A yoga intervention for post-traumatic stress: a preliminary randomized control trial. This study examined the impact of an 8-week Kundalini yoga (KY) program as an intervention for PTSD in a sample of participants with diverse traumatic exposures.¹⁷ Eighty participants consented to study participation; however, 10 dropped out before the study began. As a result, 70 participants were randomly assigned to an active KY intervention that focused on improving PTSD symptoms ($n=59$) or to a waitlist control group ($n=21$). PTSD symptoms were assessed using the PTSD Checklist (PCL-17).²⁴ Fifty of the original 80 participants completed the program from the yoga ($n=29$) and control ($n=21$) groups—62.5% of initial sample. Although results indicated that both groups showed changes in PTSD symptomatology over time, participants in the intervention condition exhibited significantly greater symptom improvement.

Yoga as an adjunctive treatment for PTSD: RCT. The study assessed adult women with chronic treatment-resistant PTSD, who had previously been in trauma-focused therapy.¹¹ Sixty-four participants were randomly assigned to two groups with classes of equal length and duration; the treatment group ($n=32$) consisted of a 10-week yoga class focusing on trauma-sensitive yoga (TSY) and the control condition ($n=32$) consisted of a 10-week women's health education class. PTSD symptoms were assessed utilizing the Clinician-Administered PTSD Scale (CAPS²⁵) at pretest, mid-test or week 5, and again at post-test (week 10). Results indicated that both conditions experienced significant symptom reduction; however, only participants in the yoga group were able to maintain this symptom amelioration at post-treatment follow-up when compared with those in the women's health education group. Of the 64 participants who began the study, 60 completed the pre- and post-treatment measures, and there were no significant differences in dropout rates between groups; yoga ($n=1$) and control ($n=3$).

A pilot RCT of yoga as an intervention for PTSD symptoms in women. This study examined the effects of a yoga intervention for veteran and civilian adult women with PTSD.²⁶ Thirty-eight participants were randomized to either a 12-week Kripalu yoga group ($n=20$) or a no-treatment control group ($n=18$). The Primary Care PTSD (PC-PTSD²⁷) Screen was used to assess PTSD symptom severity. Twenty-six of the original 38 participants completed both pretest and post-test measures (68%) for the yoga ($n=14$) and control

groups ($n=12$). Seven individuals withdrew during the course of the study—three from treatment and four from the control group—and five individuals were lost to follow-up—three from treatment and two from control group. Although results indicated that those in the yoga condition experienced a significant reduction in reexperiencing and hyperarousal symptoms, no significant differences were observed between the intervention and control groups on PTSD-related symptom reduction postintervention.

Yoga intervention in the aftermath of an earthquake in Iceland: the effects of a 6-week Hatha yoga program on psychological complications following an earthquake. Researchers were interested in understanding how a 6-week Hatha yoga practice (i.e., physical activities involving yogic breathing, relaxation, mindfulness, and meditation) would decrease stress-related symptoms among those living in an area that was recently affected by an earthquake.²⁸ Sixty-six participants were randomly assigned to either a Hatha yoga condition ($n=31$) or a waitlist control group ($n=35$). The Post-traumatic Stress Diagnostic Scale (PDS²⁹) was used to assess PTSD symptomatology. Fifty-eight of the original 66 participants completed the study (88%) from the yoga ($n=26$) and control ($n=32$) groups. Both the intervention and waitlist control groups demonstrated a significant reduction in symptoms post-treatment; however, there was no significant difference in the reported change between groups.

PTSD symptom reduction with mindfulness-based stretching and deep breathing exercise: randomized, controlled clinical trial of efficacy. This efficacy trial explored the improvement of PTSD symptoms through examining neuroendocrinological mechanisms related to symptom severity.¹⁸ Twenty-nine participants were nurse volunteers in a 3-arm randomized controlled study: a BASE—healthy group ($n=7$), a mindfulness-based stretching and breathing (MBX) intervention group ($n=11$), and a control group ($n=11$). The MBX intervention was an 8-week intervention and consisted of movements structured around balance poses and stretching with an additional emphasis on breathing and mindful focus. The seven participants in the healthy group, receiving no intervention, were used as normative data controls for cortisol level concentrations. The PCL-C²⁴ was used to assess PTSD symptomatology in participants. Those who participated in the MBX group showed a 41% reduction in PCL-C scores and a 67% reduction in serum cortisol concentration. Furthermore, participants in the MBX group showed a significantly greater reduction in PTSD symptomatology when compared with those in the control group, who experienced no significant symptom reduction. Twenty-eight participants completed the study; one member from the control group withdrew due to family conflict.

Multicomponent yoga breath program for Vietnam veteran PTSD: RCT. This study examined the impact of SKY with physical postures on PTSD symptoms among Australian veterans who had at least one failed treatment episode.¹⁵ Thirty-one participants were assigned to two groups; the treatment group consisted of a 6-month yoga class ($n=16$), which decreased in intensity over the course of 6 months, and a 6-month waitlist control group ($n=15$). The CAPS²⁵

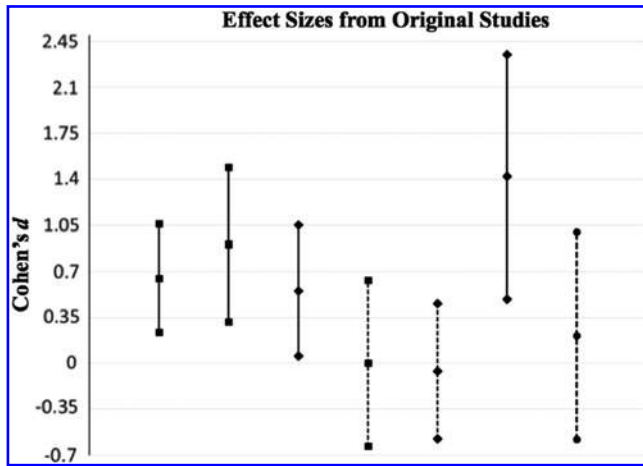


FIG. 2. Relevant effect size estimates. Point estimates of Cohen's *d* with 95% CI are provided for Quiñones et al.,²³ Jindani et al.,¹⁷ van der Kolk et al.,¹¹ Mitchell et al.,²⁶ Thordardottir et al.,²⁸ Kim et al.,¹⁸ and Carter et al.,¹⁵ respectively. CI, confidence intervals.

was administered to assess change in PTSD symptom severity. Twenty-five of 31 participants completed the study (81%) from the yoga ($n=14$) and waitlist control ($n=11$) groups; two participants dropped from the treatment group and four participants dropped from the waitlist control group. Results indicated that those in the SKY condition experienced significant PTSD symptom reduction when compared with the control group and that these improvements were maintained at post-treatment follow-up. Those initially assigned to the control group were provided with the SKY intervention, following completion of the first phase of the study, and also exhibited a significant decrease in the presence of PTSD-related symptoms following treatment.

Quantitative description: examination of effect size estimates

To supplement the qualitative description of the seven RCTs, effect sizes were computed for the post-test assessments based on Cohen's *d* (using pooled standard deviation as the standardizing agent). The relevant effect sizes are displayed along with 95% confidence intervals (CI) in Figure 2. Dashed lines denote the effect was nonsignificant in the original study, whereas solid lines denote the effect was significant in the original study. Cohen's *d* ranged from a low of -0.06 to a high of 1.42 . Although not displayed in the figure, the average weighted *d* across studies was 0.48 (95% CI: $0.26-0.69$). Although variability is noted in the magnitude of effects from the original studies, the quantitative results pictured can be regarded with optimism. Several of the effects would be considered moderate in magnitude based on Cohen's original interpretive guidelines and are on par with effects noted in controlled treatment outcome studies across a wide variety of disciplines.³⁰

Discussion

PTSD affects a nontrivial percentage of the U.S. population, with certain groups experiencing higher prevalence rates (e.g., women relative to men and military personnel

relative to civilians). Treatments that are regarded as empirically supported or evidence based are not optimally beneficial to a sizable percentage of individuals exposed to them (e.g., between 30% and 60%).¹⁰ Moreover, given the stringent inclusion criteria included in many evidence-based treatments (e.g., limiting the presence of individuals with comorbid disorders), these estimates are likely attenuated. Consequently, the empirical study (and validation) of complementary and alternative treatment modalities for PTSD remains an important public health concern. The current paper focused on the emerging evidence base for one such treatment, varying styles of yoga.

Several conclusions follow from the authors' review of seven RCTs evaluating yoga as a treatment for PTSD. First, the treatment seems generally well tolerated, as suggested by a limited amount of aversive experiences reported by participants. That is, participants with chronic obstructive pulmonary disease expressed minimal difficulties with breathing techniques.¹⁵ However, despite a lack of aversive experiences, attrition rates for the intervention conditions are variable across studies (range: 0%–50.8%). Additionally, an approach such as yoga might be particularly appealing for individuals apprehensive about seeking psychotherapy due to stigma. For example, someone fearful of how receiving mental health treatment services might be perceived by others may be more likely to attend a yoga class compared with traditional psychotherapy. In addition, studies are fairly heterogeneous with regard to trauma exposure and style of yoga, among other study characteristics. These variations place limits on current knowledge and may contribute to the range of effect sizes across studies. For example, different trauma exposures were examined (e.g., sexual abuse, military trauma, and natural disaster) across studies; yoga may prove more effective with specific exposures compared with others. Last, the weighted average effect of studies is in the moderate range, which indicates that these results are promising and warrant additional empirical inquiry.

Yoga as a viable intervention for PTSD: putative mechanisms of action

Considering the moderate average effect size, yoga could potentially be a viable alternative treatment for PTSD for several reasons. First, there are reasonable conceptual linkages between possible physical and psychological benefits of yoga and a number of PTSD-related symptoms. For instance, dialectical behavior therapy (DBT)—an empirically validated skill-focused treatment, which has been deemed effective in facilitating trauma processing in individuals with PTSD^{31,32}—has adopted aspects of Eastern philosophy as fundamental to its therapeutic process (i.e., mindfulness and distress tolerance).³³ These skills highlight the importance of experiencing the present moment without judgment and accepting reality, a difficult feat for anyone desiring change and escape from emotionally laden experiences, and have been supported empirically with yoga.³⁴ Likewise, in yoga, there exists not only an ability to connect to the body but there also exists mindfulness; a practice that has been theorized to encourage emotion regulation, which can produce reductions in avoidance,¹¹ and negative emotional states in those with PTSD.¹⁵ As was noted in the current review, yoga contributed to a significant overall

reduction in PTSD symptoms.^{11,15} Specifically, one study emphasized mindfulness skills (i.e., MBX), which revealed a 41% decrease in PTSD symptoms.¹⁸

Yoga practice encourages choice, a construct that is inherently absent in those exposed to trauma.⁶ In providing variations for different postures, feelings of empowerment are fostered through the option to choose the modification or variation of a pose in which the survivor *feels* most comfortable. In this way, not only is having choice empowering but it also encourages connectedness and introspection during the physical yoga practice through mindfulness and bodily awareness.⁶ TSY, a trauma-informed yoga practice, emphasizes choice and the benefits of specifying the impending completion of a posture (e.g., hold a posture for 15 sec, three breaths).⁶ Alerting trauma survivors that a posture, which may be inducing physical or emotional discomfort, is temporary may facilitate nonjudgmental acceptance of the current experience (akin to the distress tolerance skill in DBT). This is bolstered by results from one of the studies in the current review, in which participants assigned to the TSY condition experienced significantly greater symptom reduction when compared with those in a women's education group.¹¹

It has been postulated that due to alterations in cognitive functioning at the time of trauma, the incident is encoded as sensations and perceptions rather than memories that can be readily articulated.³⁵ Therefore, as yoga is a practice that emphasizes the mind-body connection, it is possible that enhancing connectedness with these sensations may facilitate assimilating traumatic experiences, resulting in a reduction of intrusive symptoms—a finding that was revealed in one of the studies reviewed.²⁶ Additionally, impaired bodily awareness has been linked to dissociation in trauma and other related disorders, the improvement of which is often an examined outcome in mind-body interventions.³⁶ Taken together, the opportunity for enhanced connectedness may reduce the likelihood for avoidance and dissociative symptoms, a theory further supported by the effect sizes in reported studies incorporating yoga postures with styles of yoga that traditionally emphasize meditation (i.e., KY),¹⁷ mindfulness (i.e., MBX),¹⁸ and breathwork (i.e., SKY).¹⁵

Last, yoga practice has demonstrated neurological implications, such as alterations in sympathetic and parasympathetic nervous system responses,²⁶ heart rate variability (i.e., a measure of nervous system activation),³⁷ reduction in cortisol levels,²² muscle strength, blood pressure, and improvements in arousal regulation, among other physiological and neurological changes.¹⁹ These changes decrease reac-

tivity to minor stressors, which previously may have been responded to as threats to the individuals' safety associated with symptoms of PTSD. In addition to modulating survivors' level of arousal to various stimuli, these neurological changes may reduce dissociation and be beneficial in reducing the physiological effects of stress-related disorders. Results from the current review lend additional support, such that Kripalu yoga most notably contributed to reductions in symptoms of hyperarousal,²⁶ and the MBX intervention revealed a reduction in cortisol levels.¹⁸ See Figure 3 for a hypothesized heuristic model of the possible impact of yoga on core PTSD symptoms. In sum, there are positive implications for yoga in those with PTSD.

Limitations

The current review was limited, in that it focused on a small number of RCTs evaluating the effectiveness of a physical yoga practice on PTSD symptom reduction. In limiting the search to styles of yoga incorporating yoga postures as an intervention, many studies examining other components of yoga (e.g., mindfulness only and breathwork only) were eliminated. Despite the potential benefits of these other yoga components, this was done to reduce heterogeneity across studies and increase the generalizability of study results. Additionally, although the majority of studies reviewed in the current analyses involved yoga as a stand-alone intervention, some studies were conducted examining yoga as an adjunct to individual psychotherapy.¹¹ Another limitation is that the review was primarily qualitative in nature, utilizing effect size estimates to supplement the results. Due to the small number of studies, a formal meta-analysis was not conducted.

Suggestions for future research

Based on the current review, it is apparent that participation in a yoga intervention may prove effective in reducing PTSD symptoms. However, due to the heterogeneity across studies, several challenges in drawing definitive conclusions based on these results remain. For instance, it is unclear as to whether certain genres of yoga or sequences of postures prove more beneficial than others, if there is an appropriate minimum dose of yoga necessary to yield a positive effect, and if certain individuals with specific trauma exposures benefit more than others (e.g., interpersonal violence vs. natural disaster). The evaluation of individual characteristics or symptom presentations in those electing to participate in such an intervention may also

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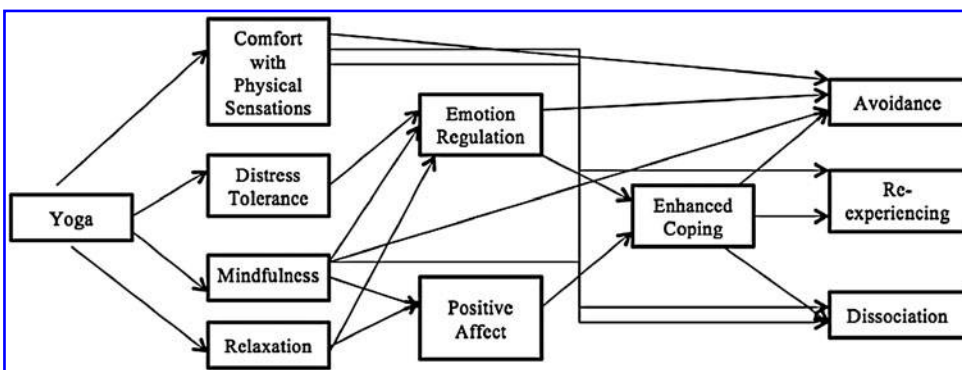


FIG. 3. Hypothesized putative mechanisms of action between yoga and PTSD. PTSD, post-traumatic stress disorder.

prove valuable. Consequently, in an effort to more accurately assess the impact of yoga on PTSD symptoms, future researchers might benefit from providing a thorough description of the class format (e.g., order and list of posture sequences), establishing to a set frequency and duration of yoga class. A clear understanding of the yoga intervention would reduce variability across studies and perhaps increase the number of relevant studies in subsequent reviews (e.g., studies utilizing SKY that also incorporate physical postures). Furthermore, the style of yoga utilized in such studies should be trauma informed (e.g., trauma-sensitive yoga⁶) so as to reduce the likelihood of any iatrogenic effects.

Due to the adverse effects of PTSD on overall functioning and ineffective coping, the efficacy of a yoga practice can also enhance opportunities for adaptive coping depending upon trauma-related risk factors. That is, individuals exhibiting pretraumatic, peritraumatic, and post-traumatic indicators might respond differently to yoga interventions when accounting for differences across class structures and styles. For example, an individual struggling with feelings of helplessness and powerlessness may benefit from a more strength-based yoga class to enhance feelings of self-efficacy and confidence. Consequently, future studies should aim to investigate how different styles of yoga impact not only PTSD symptoms but also how they impact individuals exposed to different trauma types.

In considering the varying effect sizes across RCTs included in this review and the implications for yoga in ameliorating the different symptom clusters of PTSD, future research may aim to better distinguish and understand the putative mechanisms of action at play in a yoga intervention. As a result, this might include RCTs designed to distinguish between various components of yoga (e.g., asana practice, mindfulness, or meditation component). For instance, in studies where yoga has been found to be efficacious in reducing PTSD-related symptomatology, the reduction may be due to behavioral activation associated with the exercise component, emotion regulation encouraged through breathwork, or a combination. Additionally, despite the moderate average effect size found in the current review, it is unclear how these effect size estimates translate into improvements in functioning beyond short-term symptom reduction and warrant additional attention in future investigations. As a result, subsequent studies should consider evaluating symptom reduction employing long-term follow-up (e.g., 1 year postintervention).

Last, as noted in the limitations, there was variability among the yoga intervention and control groups regarding concurrent psychotherapy. Future empirical studies should continue to examine yoga as an adjunct to traditionally validated therapies, rather than a replacement, for various disorders. This will enhance understanding of the mechanisms of change in alleviating various mental health stressors and may provide added benefits for those not receiving significant symptom amelioration while in therapy alone. Furthermore, an examination of chair yoga may prove beneficial as this may be more feasibly implemented in therapeutic contexts.

It is evident that more research is necessary to draw definitive conclusions; however, the results of the current study provide promising insights into the benefits of utilizing a yoga intervention with trauma survivors. The preva-

lence of PTSD and lack of adequate treatments warrant further exploration toward understanding the impact of yoga practice in ameliorating PTSD symptoms.

Author Disclosure Statement

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