

REVIEW ARTICLES

Mind–Body Therapy for Military Veterans with Post-Traumatic Stress Disorder: A Systematic Review

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Abstract

Objective: About one-third of service members returning from post-9/11 deployment in Afghanistan and Iraq report combat-related mental health conditions, but many do not seek conventional treatment. Mind–body therapies have been offered as alternative approaches to decreasing post-traumatic stress disorder (PTSD), but no review of studies with veterans of post-9/11 operations was found. The objective of this study was to fill that gap.

Design: A systematic literature review was conducted following the preferred items for systematic reviews and meta-analyses (PRISMA) guidelines. PubMed MeSH terms were used to capture articles reporting on the military population (veteran and veterans) with PTSD who received a portable mind–body intervention (e.g., mindfulness, mind–body therapy, and yoga). PubMed/MEDLINE and PsycINFO were searched. Studies were included if participants were a mixed group of war veterans, as long as some post-9/11 veterans were included. In addition, participants must have had a diagnosis of PTSD or subthreshold PTSD, and the PTSD must have been attributable to combat, rather than another event, such as sexual trauma or natural disaster.

Results: Of 175 records identified, 15 met inclusion criteria. Studies reported on seated or gentle yoga that included breath work, meditation, mantra repetition, or breathing exercises. For 14 of the 15 studies, study retention was 70% or higher. Overall, studies reported significant improvements in PTSD symptoms in participants in these interventions. Although each study included post-9/11 veterans, about 85% of participants were from other conflicts, predominantly Vietnam.

Conclusion: Although findings were positive, future studies are needed to evaluate the short- and long-term impact of mind–body therapies on larger samples of post-9/11 veterans and to address research questions related to broadening service member and veteran participation in these therapies.

Keywords: military, mind–body, veterans, PTSD

Introduction

THE PREVALENCE of post-traumatic stress disorder (PTSD), a serious psychiatric disorder causing emotional, mental, behavioral, and physiologic disturbances, appears to be increasing among service members participating in military operations in the Middle East. Studies have reported that PTSD diagnoses among veterans increased from 0.2% in 2001 to 21.8% in 2009.¹ In fact, PTSD has become a common term in the military domain and has been labeled as one of the leading injuries that military soldiers are sustaining from combat, with as many as 24% being diagnosed from current deployments.²

There have been many reports documenting the effects of war on the psychologic health of the soldier. During the Civil War, soldiers with PTSD-like symptoms were diagnosed with “effort syndrome,” “irritable heart,” or “soldier’s heart.”³ In World War I, soldiers suffering from tremors, fatigue, ticks, and memory loss were diagnosed with the mental condition called shell shock.⁴ With the Vietnam War, researchers documented many veterans suffering from chronic psychologic problems and termed this condition “combat fatigue.”⁵ A recent survey examining PTSD among Vietnam war veterans estimated lifetime PTSD prevalence of 31% for male veterans and 26% for female veterans of this war.⁶ This survey brought to light the invisible wounds that PTSD can

cause and resulted in greater appreciation of PTSD as a mental health disorder. Many of these Vietnam veterans continue to suffer from alcohol abuse, high rates of unemployment, and intimate partner violence.⁷

After the attacks on New York City on September 11, 2001, the United States responded by sending troops to Afghanistan as part of Operation Enduring Freedom (OEF) and to Iraq as part of Operation Iraqi Freedom (OIF) and Operation New Dawn (OND). As of 2014, more than 2.5 million U.S. soldiers have been deployed to these Middle East countries (www.nato.int/cps/en/natohq/topics_69366.htm). A study conducted with more than 100,000 OEF/OIF veterans demonstrated that one-third received care for at least one mental health condition, and 13% had the diagnosis of PTSD.⁸

The Diagnostic and Statistical Manual of Mental Disorders states the diagnosis criteria for PTSD, which include a history of exposure to a traumatic event and the portrayal of symptoms from each of three clusters: reexperiencing symptoms (e.g., traumatic nightmares and flashbacks), hyperarousal symptoms (e.g., feeling irritable and having an exaggerated startle response), and avoidance symptoms (e.g., feeling numb and feeling depressed). To be diagnosed with full PTSD, a soldier would have to have at least one symptom in the reexperience cluster, two or more symptoms in the hyperarousal cluster, and three or more symptoms in the persistent avoidance cluster.⁹ Subthreshold PTSD or partial PTSD describes a veteran who has troubling PTSD symptoms, but does not meet the full criteria of PTSD diagnosis. Individuals with PTSD or subthreshold PTSD will tend to experience dissociative symptoms (e.g., feeling that things don't appear real or that something is not happening). For the military soldier in war situations, horrific combat events are common occurrences, and these can trigger symptoms of PTSD.

A leading public health concern for the Department of Defense and the Veterans Affairs is the high prevalence of combat-related PTSD, with its associated negative alterations in cognition, mood, and arousal. Both agencies are supporting research, programs, and services to treat PTSD and subthreshold PTSD. Current treatments of PTSD symptoms include cognitive behavioral therapy such as psychoeducation, stress management, prolonged image exposure, and antidepressants such as serotonin reuptake inhibitors.¹⁰

Unfortunately, there are many barriers to service members seeking these treatments. A study published in 2004 suggests that only 23% to 40% service members who return with mental health complaints will actually seek out care.¹¹ Barriers that prevent military soldiers from seeking mental healthcare include self-stigma (such as feelings of shame), public stigma, and stigma from a service member's unit.¹² Others worry that seeking PTSD treatment will negatively affect promotion or future employment options. Per Army Regulation 40-501, some of the current PTSD treatments involve placing soldiers on a limited-duty profile, which could further impact military medical readiness. With the high rate of mental health issues associated with OEF/OIF/OND deployment, it is vital to increase treatment options for military soldiers that will allow their continued duty, and these treatment options need to be portable and acceptable to service members.

In response to an anonymous survey distributed to military outpatient clinics in 2004, 72% of 291 respondents reported using a form of complementary and alternative medicine (CAM) to treat pain, stress, and anxiety.¹³ Mind–body ther-

apies and other CAM therapies are increasing in popularity as an alternative or adjunct treatment for soldiers suffering from mental health conditions. Many mind–body therapies are moveable, invisible, do not require any special equipment, and are nontoxic. These advantages may help soldiers who do not want to seek out traditional PTSD treatments.

The literature suggests that a type of mind–body therapy known as mindfulness-based stress reduction (MBSR) is effective in reducing stress, depression, and anxiety.¹⁴ However, to our knowledge, there are currently no reviews to determine if mind–body therapies can decrease PTSD symptoms in veterans of post 9/11 conflicts. Therefore, the purpose of this systematic review is to summarize literature testing the effect of mind–body therapies in decreasing PTSD symptoms in veterans of OEF/OIF/OND.

Materials and Methods

This literature review was guided by the preferred items for systematic reviews and meta-analyses (PRISMA) guidelines.¹⁵ The search was conducted in Fall 2016 through PubMed/MEDLINE and PsycINFO. PubMed MeSH terms were used to capture articles reporting on the military population (veteran and veterans) with mental health disorders who received a portable mind–body intervention for PTSD (mindfulness, mind–body therapy, and yoga).

The PICOS (participants, interventions, comparisons, outcomes, and study design) framework was used to set article inclusion criteria. Studies must have included OEF/OIF/OND veterans with PTSD or subthreshold PTSD attributed to combat, but also may have included veterans from other conflicts. Articles must have presented findings from tests of mind–body interventions, including mindfulness programs such as MBSR, mind–body bridging (MBB), meditation, and yoga. Participants may have received concurrent behavioral or pharmacologic care. Studies using experimental, quasi-experimental, and single-group designs were included as long as they reported findings from a PTSD-related outcome measure taken before and following the intervention (primary outcome measure). Studies also may have reported changes in depression, anxiety, sleep quality, and mindfulness (secondary outcome measures). Excluded were studies with no participants from post-9/11 conflicts, observational studies, studies on mind–body therapy interventions that were not portable, and studies reported in languages other than English.

A three-stage review strategy was used. First, titles and abstract of identified articles were reviewed, and articles addressing nonrelevant participants or interventions and editorials and articles reporting on observational studies were excluded. The remaining articles were read in full, and inclusion/exclusion criteria were applied again. Finally, reference lists of included articles were reviewed to identify additional relevant studies.

Citation information, study population, intervention protocol, study design, duration of follow-up, measurements, and outcomes were abstracted from the included studies. Data abstracted about the participants included mean age, the percentage of males, and the percentage of OEF/OIF/OND veterans. Allowance of co-intervention, such as concurrent behavioral health therapy, was annotated if stated in the article. The intervention description, length, frequency, and duration were abstracted, as well as study outcomes. Outcome

measures were grouped by PTSD measures (primary outcome) and other outcomes (secondary outcomes). A number of secondary outcomes were tracked, but the authors report only those for depression, anxiety, sleep quality, and mindfulness. Timing of data collection and changes in baseline and postintervention values were noted. Because the authors included articles reporting on studies conducted with experimental, quasi-experimental, and pre-experimental designs, and because measures and follow-up periods differed across studies, a meta-analysis was not attempted.

Initial searching, screening, and abstracting were performed by the first author and checked by the second author. Disagreements were discussed and resolved during each phase of searching, screening, and abstracting.

To establish methodological quality of each study, internal and external validity were examined using the Critical Appraisal Skills Programme tool.¹⁶ This tool, which is publicly obtainable and used in systematic reviews, applies 11 specific questions when appraising controlled-design studies and was adapted for single-group studies by applying 7 of the 11 questions. Each is answered as “yes,” “no,” or “can’t tell.” For the purpose of this systematic review, each question that was given a “yes” response was given one point. Therefore the highest quality possible score for a

controlled trial was 11, and the highest possible quality score for a single group study was 7.

Results

Search results

From PubMed and PsycINFO, 175 articles were found once duplicates were removed (Fig. 1). After reviewing titles and abstracts, 62 articles were excluded because they reported on unrelated interventions, 82 articles were excluded because they targeted veterans from other wars, and 17 articles were excluded because the study was observational or the article was an editorial. The remaining 13 articles were read in full, and two additional articles were identified through citation chasing. Thus, 15 articles were included in the review. All 15 studies investigated mind-body therapy, such as meditation, yoga, and mindfulness, as an intervention and assessed PTSD in at least some OEF/OIF/OND veterans.

Interventions

Shown in Table 1, tests of seven different mind-body interventions were reported in the 15 articles. MBSR was the subject of five articles.^{17–21} Three more articles adapted

FIG. 1. PRISMA flowchart of results of literature review. PRISMA, Preferred Items for Systematic Reviews and Meta-Analyses.

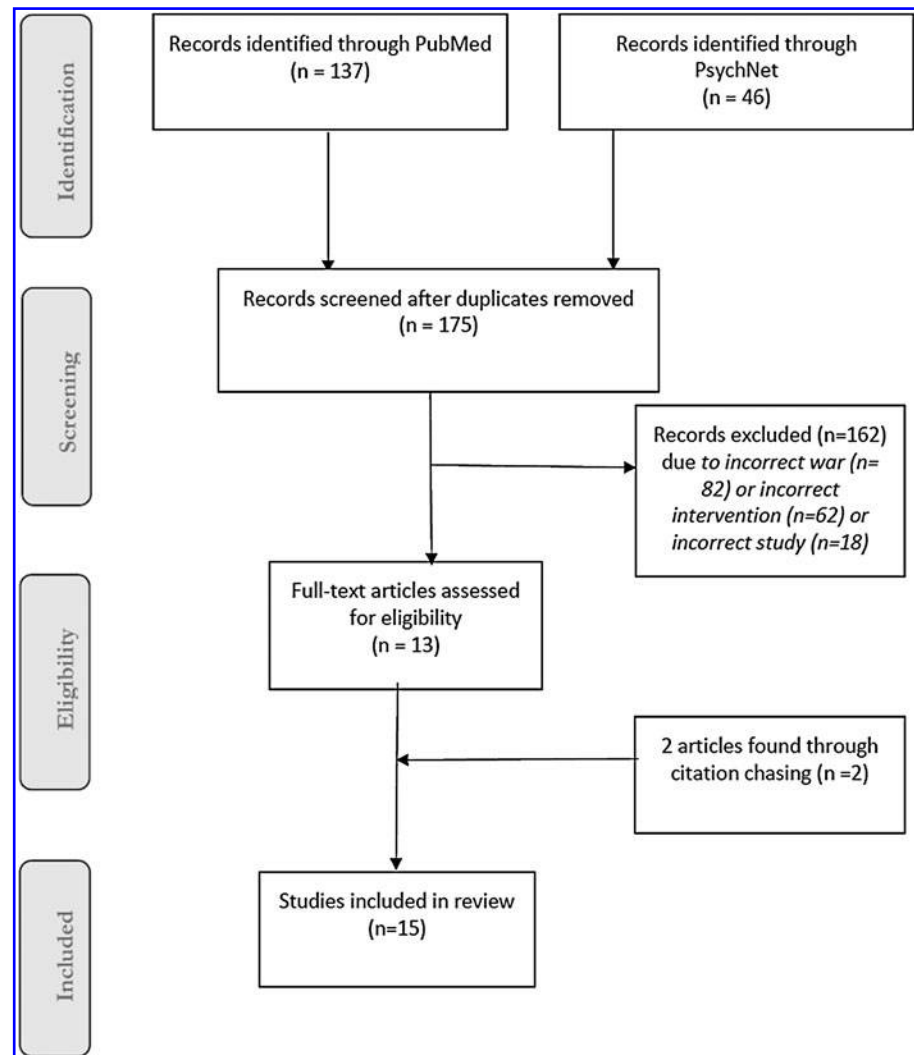


TABLE 1. CHARACTERISTICS OF INCLUDED STUDIES

Intervention	Reference	Mean age, % male, % OIF/OEF/OND	Study design	Intervention sample, frequency, duration	Control	Follow-up from baseline
MBSR	Bhatnagar et al. ¹⁷	60 y, 88% male 13% OEF/OIF/OND	Single group	N=8, once/wk@150 min for 8 wk		8 wk, 3 m
MBSR	Cole et al. ¹⁸	46 y, ?% male ? OEF/OIF/OND	Single group	N=9, once/wk@150 min for 8 wk, plus 1 day retreat		8 wk, 4.5 m
MBSR	Kearney et al. ¹⁹	52 y, 75% male 14% OEF/OIF/OND	RCT	N=25, once/wk@150 min for 8 wk, plus 1 full day retreat	N=22, usual tx	8 wk, 6 m
MBSR	Kearney et al. ²⁰	51 y, 75% male 14% OEF/OIF/OND	Single group	N=92, once/wk@150 min for 8 wk, plus 1 day retreat		8 wk, 6 m
MBSR	Polusny et al. ²¹	59 y, 84% male 10% OEF/OIF/OND	RCT	N=58, once/wk@150 min for 8 wk, plus 1 day retreat	N=58, present-centered therapy	9 wk, 4.25 m
MBSR by telehealth	Niles et al. ²²	52 y, 100% male 30% OEF/OIF/OND	RCT	N=17, once/wk@45 min in-person for 2 wk, plus once/wk@20 min by phone for 6 wk	N=16, psychoeducation	8 wk, 3.5 m
BMT adapted from MBSR	Possemato et al. ²³	54 y, 87% male 42% OEF/OIF/OND	RCT	n=36, Once/wk@90 min for 4 wk	N=26, usual tx	4 wk, 8 wk
Components of MBSR	Wahbeh et al. ²⁴	52 y, 95% male 30% OEF/OIF/OND	RCT	N=27, mindfulness meditation (MM) N=2, slow breathing (SB) N=25, MM+SB	N=25, sitting quietly (SQ)	6 wk
MRP	Bormann et al. ²⁵	57 y, 97% male 3% OEF/OIF/OND	RCT	All: once/wk@20 min for 6 wks N=66, once/wk@90 min for 6 wk	N=70, usual tx	6 wk
MRP	Bormann et al. ²⁶	56 y, ?% male ? OEF/OIF/OND	RCT	N=14, once/wk@90 min for 6 wks	N=15, delayed tx	6 wk
KHYF Yoga	Staples et al. ²⁷	62 y, 83% male 16% OEF/OIF/OND	Single group	N=12, twice/wk@60 min for 6 wk		6 wk
SKY Yoga	Seppälä et al. ²⁸	28 y, 100% male 100% OEF/OIF/OND	RCT	N=11, SKY, once/d@180 min for 7 d	N=10, delayed tx	1 m, 1 y
LKM	Kearney et al. ²⁹	54 y, 60% male ? OEF/OIF/OND	Single group	N=37, once/wk@90 min for 12 wk		3 m, 6 m
TM	Rosenthal et al. ³⁰	30 y, 100% male 100% OEF/OIF/OND	Single group	N=5, 3 TM instruction@60–90 min; TM practice twice/d@20 min; instructor meetings twice/wk for 12 wk		8 wk
MBB	Nakamura et al. ³¹	50 y, 95% male ? OEF/OIF/OND	RCT	N=35, once/wk@90 min for 2 wk	N=28, active sleep education	3 wk

BMT, brief mindfulness training; LKM, loving-kindness meditation; MBB, mind–body bridging; MBSR, mindfulness-based stress reduction; MRP, mantram repetition program; OEF, Operation Enduring Freedom; OIF, Operation Iraqi Freedom; OND, Operation New Dawn; TM, transcendental meditation; ?, no data.

portions of the MBSR intervention for testing.^{22–24} The mantram repetition program (MRP) was the subject of two articles.^{25,26} Yoga was examined in two articles, including a style called Krishnamacharya Healing and Yoga Foundation (KHYP) yoga²⁷ and a style called Sudarshan Kriya Yoga (SKY).²⁸ Meditation was examined in two articles, including one on loving-kindness meditation (LKM)²⁹ and one on transcendental meditation (TM).³⁰ The final article reported on the testing of a MBB intervention.³¹

The most common intervention was MBSR, with five of the studies testing this type of intervention and three testing portions of this intervention. The MBSR is conducted over 8 weeks with an additional all-day retreat. The aim of this program is to teach participants to attend to the present moment in a nonjudgmental way. Components of MBSR include mindfulness meditation (MM), gentle yoga, and slow breathing (SB). MBSR was originally developed to help people with chronic pain. Systematic reviews have demonstrated that MBSR may be helpful in alleviating chronic pain and alleviating mental health disorders.^{32,33} A recent study demonstrated that participants of 8 weeks of MBSR showed positive improvement in their psychological well-being and in the gray matter density within their brains.³⁴

Three of the articles tested adaptations of MBSR. Wahbeh et al. randomized participants to four arms as follows: MM, SB, MM plus SB (MM+SB), and a “sitting quietly” group as an inactive control.²⁴ Possemato et al. evaluated a condensed MBSR program known as brief mindfulness training, with four weekly, 90-min sessions.²³ Niles et al. conducted MBSR using telehealth.²²

The two studies of the MRP were conducted by a research team led by Bormann. MRP is a portable intervention that teaches mindfulness by repeating a word or a phrase called a mantram.²⁵ The mantram is silently repeated throughout the day, bringing attention and awareness to the individual. The MRP intervention helps individuals to concentrate on one thing, also known as one-point attention, and has been shown to decrease breathing rate and blood pressure.³⁵ Another aim of MRP is to help individuals slow down by acting with a purpose.

The two different yoga interventions—KHYP and SKY—were tested; these are specific types of yoga that focus on breathing. KHYP-style yoga links breath to movement and teaches a specific meditative focus.²⁷ The SKY method uses different breathing rates that are separated by normal breathing. Studies speculate that SKY helps with releasing prolactin, vasopressin, and oxytocin, which are important hormones that have been found to lower depression and regulate the hypothalamic–pituitary–adrenal axis.³⁶

LKM is a style of meditation that aims to enhance feelings of kindness and unselfish compassion to self and others. Studies demonstrated that LKM may enhance the frontal lobe of the brain that is involved in emotional processing and empathy.³⁷ The other form of meditation, called TM, involves two 20-min meditation sessions a day in a seated position. This is a mantra meditation that over time can decrease sympathetic drive, blood pressure, and stress reactivity³⁸ and may protect against chronic stress. Long-term use of TM has demonstrated decrease in cortisol level and in cortisol response to stress (<http://tmdoctors.info/eng/chronstress.htm>).

One article tested an intervention called MBB. Similar to MBSR, MBB trains participants to use awareness or present moment to help regulate their mental and physical state.³⁹ MBB aims to help veterans recognize and become aware of ruminating thoughts and impaired mental or physical functioning.

Intervention duration varied, from once a day for 7 days²⁸ to once a week for 12 weeks.^{29,30} However, the majority was once (or twice) a week for 6^{24–27} to 8 weeks.^{17–22}

Sample characteristics

Sample sizes were generally small. Three studies had fewer than 10 participants in the intervention group, and only four studies had more than 40. Of studies that specified gender of study participants, between 75% and 100% were male. Of the 15 studies, only two targeted OEF/OIF/OND veterans exclusively—the tests of SKY yoga²⁸ and TM³⁰ (Table 1). The mean ages of these samples were 28 years and 30 years, respectively, and 100% of these samples were male. Four studies said that they included OEF/OIF/OND veterans in their samples, but did not specify a percentage, but mean ages of the samples ranged from 46 to 54 years.^{18,26,29,31} In the other nine studies, OEF/OIF/OND veterans comprised as low as 3% to as high as 42% of the sample; the mean ages of these samples ranged from 51 to 62 years. These studies combined findings from OEF/OIF/OND and other veterans, limiting the ability to determine intervention impact on this group.

Study design

Nine articles reported results of controlled trials of the intervention.^{19,21–26,28,31} The condition of the control group varied; three control groups received usual treatment,^{19,23,25} two control groups received delayed treatment,^{26,28} and four control groups participated in another intervention, including present-centered therapy,²¹ psychoeducation,²² sitting quietly,²⁴ or active sleep education.³¹ The other six reported results from single-group, pre–post-test designs.^{17,18,20,27,29,30} Twelve of the 15 studies indicated that participants were expected to continue any concurrent treatment for PTSD while in the study; the other two studies did not provide this information.^{17,27,31} All studies measured participants at baseline and postintervention, and eight also took follow-up measures 3–6 months^{17–22,29} or a year²⁸ postbaseline.

Retention

Retention rates were generally high (not shown in table). The range was 44%²³ to 100%,¹⁷ with 14 of the 15 studies reporting retention rates of 70% or greater, including both studies that exclusively targeted post-9/11 veterans.^{28,30} Six studies reported rates of 86% or greater. Authors noted that compliance rates were higher than for conventional psychotherapy. Authors who measured these items reported high satisfaction with and/or acceptability of the intervention.

Study quality

Table 2 displays the results of the studies' quality scores. Quality scores for the nine controlled studies ranged from a low of 8.5 to a high of 10.5 out of 11. Quality scores for the six noncontrolled studies ranged from three to seven out of

TABLE 2. ASSESSMENT OF STUDY QUALITY

Study design	Clear focus	Random assignment	Blinding	Aside from experimental condition, groups treated equally			Retention tracked	Good treatment effect size	Precise treatment effect estimate	Generalizability	All clinically important outcomes considered	Benefits worth harms and costs	Total Score
				Equivalent groups	groups	treated							
Bhatnager et al. ¹⁷	>	>	>	>	>	>	>	>	>	>	>	3	
Rosenthal et al. ³⁰	>	>	>	>	>	>	>	>	>	>	>	5	
Staples et al. ²⁷	>	>	>	>	>	>	>	>	>	>	>	7	
Kearney et al. ²⁰	>	>	>	>	>	>	>	>	>	>	>	7	
Cole et al. ¹⁸	>	>	>	>	>	>	>	>	>	>	>	7	
Kearney et al. ²⁹	>	>	>	>	>	>	>	>	>	>	>	7	
Wahbeh et al. ²⁴	>	>	>	>	>	>	>	>	>	>	>	8.5	
Bormann et al. ²⁵	>	>	>	>	>	>	>	>	>	>	>	8.5	
Nakamura et al. ³¹	>	>	>	>	>	>	>	>	>	>	>	9	
Possemato et al. ²³	>	>	>	>	>	>	>	>	>	>	>	9.5	
Niles et al. ²²	>	>	>	>	>	>	>	>	>	>	>	9.5	
Seppala et al. ²⁸	>	>	>	>	>	>	>	>	>	>	>	10	
Kearney et al. ¹⁹	>	>	>	>	>	>	>	>	>	>	>	10	
Polusny et al. ²¹	>	>	>	>	>	>	>	>	>	>	>	10.5	
Bormann et al. ²⁶	>	>	>	>	>	>	>	>	>	>	>	10.5	

seven. Overall, studies most commonly lost points for not presenting a precise treatment effect estimate, having a low treatment effect, and not blinding participants and/or study personnel.

Study outcomes

Study outcomes are summarized in Table 3. To measure the primary outcome of PTSD symptoms, nine studies used a version of the self-reported PTSD Checklist [either PTSD Checklist Civilian (PCL-C) or the PTSD Checklist Military (PCL-M)],^{18–21,24,27,28,31,40} one used the Clinician-Administered PTSD Scale (CAPS),¹⁷ five used both PCL and CAPS,^{22,23,25,26,30} and one used the PTSD Symptom Scale Interview (PSS-I).²⁹

The nine controlled trials targeted veterans with a verified PTSD diagnosis, and sample sizes ranged from 21 to 146. One found significant improvement for the intervention group only in hyperarousal symptoms,²⁵ one in both hyperarousal and reexperiencing symptoms,²⁸ and four controlled trials found significant improvements in overall PTSD symptoms.^{21,23,26,31} The other three control trials found significant improvements in the intervention groups, but these were not significantly greater than improvements seen in the control groups at follow-up.^{19,22,24} For example, Niles et al. found greater improvement in PTSD symptoms in the intervention group than the control group immediately following the 8-week intervention, but not at follow-up 3.5 months from baseline.²² The study by Wahbeh et al., which tested different components of MBSR, showed decreases in PTSD symptoms within the MM arm, the MM+SB arm, and “sitting quietly” (SQ) arm, but no across-group differences.²⁴

All six interventions tested with one-group pre-post study designs demonstrated significant within-group improvements in PTSD measures. Again, sample sizes were relatively small, from 5 to 92. Cole et al.’s study of MBSR targeted participants with traumatic brain injury, as well as PTSD symptoms, and found sustained improvement in both attention and PTSD symptoms.¹⁸

Depression, anxiety, sleep quality, and mindfulness were recurring secondary measures. Of 15 studies, 10 included a measure of depression, and five showed significant improvement in scores between baseline and follow-up.^{20,23,25,29,30} The most commonly used measure of depression was the Patient Health Questionnaire-9(PHQ-9), a self-administered screening instrument that incorporates DSM-5 depression criteria and is designed for use in healthcare settings.⁴³ Three studies measured anxiety, and two showed improvement.^{26,28}

Three studies evaluated sleep quality. Sleep disturbances are a core clinical feature of PTSD. Two of the three PTSD clusters—hyperarousal and reexperiencing the traumatic event—reference sleep issues and nightmares, respectively.⁴⁴ Two of the studies used the Pittsburgh Sleep Quality Index (PSQI) to assess seven components of sleep quality—sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction.⁴⁵ One was a controlled trial,²⁴ and the other was a single-group study,²⁷ and both showed within-group improvement in sleep quality.

Mindfulness is defined as paying attention to the present moment in a nonjudgmental way.⁴⁶ A traditional Buddhism construct, mindfulness is thought to clear one’s

TABLE 3. OUTCOMES

Intervention	Reference	Study design	Primary measure	Secondary measures			
			PTSD	Depression	Anxiety	Sleep	Mindfulness
MBSR	Bhatnagar et al. ¹⁷	Single group	↑ CAPS				
MBSR	Cole et al. ¹⁸	Single group	↑ PCL-C				
MBSR	Kearney et al. ¹⁹	Controlled	↔ PCL-C	↔ PHQ-9			↑ FFMQ
MBSR	Kearney et al. ²⁰	Single group	↑ PCL-C	↑ PHQ-9			↔ FFMQ
MBSR	Polusny et al. ²¹	Controlled	↑ PCL	↔ PHQ-9			↑ FFMQ
MBSR by telehealth	Niles et al. ²²	Controlled	↑ PCL, ↑ CAPS at post-tx ↔ PCL, ↔ CAPS at follow-up				
BMT adapted from MBSR	Possemato et al. ²³	Controlled	↑ PCL, ↑ CAPS	↑ PHQ-9			↑ MAAS & FFMQ
Components of MBSR	Wahbeh et al. ²⁴	Controlled	↔ PCL	↔ BDI		↔ PSQI	↔ FFMQ
MRP	Bormann et al. ²⁵	Controlled	↑ PCL, ↑ CAPS	↑ BSI	↔ BSI		↑ FACIT-Sp
MRP	Bormann et al. ²⁶	Controlled	↑ PCL, ↑ CAPS		↑ BSI		↑ MAAS
KHYF Yoga	Staples et al. ²⁷	Single group	↑ PCL-M hyperarousal			↑ PSQI	
SKY Yoga	Seppälä et al. ²⁸	Controlled	↑ PCL-M reexperiencing ↑ PCL-M hyperarousal	↔ MASQ	↑ MASQ		
LKM	Kearney et al. ²⁹	Single group	↑ PSS-I	↑ PROMIS			↑ FFMQ
TM	Rosenthal et al. ³⁰	Single group	↑ PCL-M & CAPS	↑ BDI			
MBB	Nakamura et al. ³¹	Controlled	↑ PCL-M	↔ CES-D		↑ MOS-SS	↑ FFMQ

↑ = symptoms improved and were statistically significant from baseline or from the control group.

↔ = no or nonstatistically significant difference from baseline or from the control group.

BDI, Beck Depression Inventory; BSI-18, Brief Symptom Inventory-18; CES-D, Center for Epidemiological Studies Depression Scale; FACIT-Sp, Functional Assessment of Chronic Illness Therapy-Spiritual Well-being Scale; FFMQ, Five-Facet Mindfulness Questionnaire; f/u, follow-up; KHYF, Krishnamacharya Healing and Yoga Foundation; MASQ, Mood and Anxiety Symptoms Questionnaire with subscales for depression and anxiety; MM, mindfulness meditation; MM+SB, mindfulness meditation and slow breathing; MAAS, Mindfulness Attention Awareness Scale; MOS-SS, Medical Outcomes Study-Sleep Scale; PCL-C, PTSD Checklist-Civilian; PCL-M, PTSD Checklist-Military; PCL-S, PTSD Checklist-Specific; PHQ-9, Patient Health Questionnaire-9; PROMIS, Patient-Reported Outcomes Measurement Information System; PSQI, Pittsburgh Sleep Quality Index; PSS-I, PTSD Symptom Scale Interview; PTSD, post-traumatic stress disorder; SKY, Sudarshan Kriya Yoga; SQ, sitting quietly.

thinking by disengaging from strong attachment to beliefs, thoughts, and emotions. Of the 15 studies, nine studies measured mindfulness, with eight showing improvement in this measure.^{19,20,21,23,25,26,29,31} The most commonly used measure of mindfulness was the Five-Facet Mindfulness Questionnaire.⁴⁷

Discussion

To the authors' knowledge, this is the first systematic literature review examining the impact of mind-body interventions on post-9/11 veterans with PTSD. The evidence suggests that these interventions are effective in reducing PTSD symptoms, as significant improvements were seen in PTSD measures between the intervention group and the control in six of the nine controlled studies and over time in the six single-group studies. Thus, it appears that mind-body interventions are effective in reducing the severity of PTSD symptoms associated with combat. Secondary outcomes demonstrated that mind-body interventions can also reduce depression and anxiety symptoms and increase mindfulness and sleep quality in veterans in PTSD.

The evidence from participant retention and satisfaction (where measured) suggests that these interventions are simple to learn and not onerous to maintain. They are portable and designed to be practiced almost anywhere (e.g., they can be done on deployment, at home, or on a work break), eliminating stigma associated with going to a mental

health clinic for treatment. As previously stated, there are many service members and veterans who do not seek mental health treatment or drop out.^{11,12} These emerging interventions suggest innovative ways to address barriers to treatment and to help in reducing PTSD symptoms.

These interventions may be less costly to deliver than convention treatment because they can be taught and delivered to a dozen or more veterans at the same time, unlike prolonged exposure, cognitive processing therapy, and eye movement desensitization reprocessing. Although articles did not provide cost data on their interventions, several investigators suggested that their interventions were more cost-effective and easier to implement than traditional treatments for PTSD.

Limitations

The primary limitation was the small number of current OEF/OIF/OND veterans in many of the studies. Only two studies targeted OEF/OIF/OND veterans exclusively, and post-9/11 veterans comprised less than 20% of the participants in eight of the remaining 13 studies. Studies that included post-9/11 with other (primarily Vietnam) veterans combined findings from all participants, limiting the ability to determine intervention impact specific to OEF/OIF/OND veterans. Although treatment of Vietnam veterans also is important, combat-related traumatic events have shifted over time. The conflicts in the Middle East involve insurgent

attacks, suicide, and car bombs and improvised explosive devices. Another important factor is the age gap between Vietnam veterans and post-9/11 veterans. Vietnam veterans are now aged 60 and older and have other physical ailments affecting their quality of life. One article discussed potential barriers to implementing their intervention with the current veteran era, speculating that veterans from Iraq and Afghanistan conflicts may be unable to attend classes held during the day, as they are conflicted with employment or school.²⁶

Another significant limitation was lack of control in the six single-group studies. In these studies, reported improvements in the measures could have been due to regression to the mean or the placebo effect.³⁰ Most of the studies indicated that participants were able to continue other prescribed treatments, which may have explained improvements.

In addition, sample sizes were generally small; only six studies had more than 30 people in the intervention group. All subjects volunteered for and knew about the study in which they enrolled, and none of the studies were double blinded. Studies used different measures of the primary outcome; some reported findings for PTSD scores by cluster (i.e., hyperarousal, reexperiencing, and avoidance), while others reported total PTSD symptom scores. The timing of postintervention follow-up varied as well. Generally, studies did not follow participants long term, with only four reassessing participants 6 months postbaseline.^{19,20,28,29}

Recommendations for Future Research

Although mind–body interventions hold promise for reducing combat-related PTSD symptoms, the review identifies a number of new research questions. For example, would these same positive findings be obtained in controlled trials with larger samples of post-9/11 veterans? Are these interventions broadly appealing to military and veteran populations? If not, what are the barriers to participation, and how can they be overcome? Once trained in a mind–body regime, would service members and veterans continue to practice it outside of the intervention classroom? Are positive outcomes maintained over time? If taught before deployment, could practicing these mind–body therapies reduce onset of PTSD? Future studies should be designed to address these and other relevant research questions.

Conclusion

This systematic review found significant improvements in PTSD symptoms between the control and intervention group in six of the nine controlled trials and between pre- and post-test in six of the six single-group design studies. Secondary outcomes of depression, anxiety, sleep quality, and mindfulness also improved in most of the studies that measured these outcomes. Future studies should test mind–body interventions by controlled trial with larger samples of post-9/11 veterans and assess participants at least 6 months after the intervention to gauge long-term effectiveness.

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