

The Effectiveness of Yoga for Depression: A Critical Literature Review

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In the United States, the prevalence of depression is quite high—9% in the general population—with women, young adults, and seniors particularly vulnerable. In recent years, increasing numbers of people are turning to complementary and alternative medicine (CAM) for relief from depression and other mental health problems. One form of CAM, yoga, has been growing in popularity; this rise in popularity has, in part, been driven by interest in how this practice, with its mindfulness and meditation aspects, may decrease depression. This critical literature review examines six recent studies on yoga as an intervention; specifically, this review focuses on yoga styles in which the practice of yoga poses, called asanas, is the core component. Although the significant positive findings are promising, the studies had methodological limitations; identification of these limitations can inform future studies.

The most recent available data from the National Health Interview Survey (NHIS) indicate that 38% of American adults utilize complementary and alternative medicine (CAM; National Institutes of Health [NIH], National Center for Complementary and Alternative Medicine [NCCAM], US Department of Health and Human Services [USDHHS], 2012). The NHIS, which surveys 35,000 households, is conducted by the Centers for Disease Control and Prevention (CDC); the survey is developed by the National Center for Complementary and Alternative Medicine (NCCAM). CAM includes 36 types of therapies (e.g., acupuncture, chiropractic, herbal supplements, and meditation). Researchers have recently begun to examine the efficacy of CAM in treating mood problems. Consumers indicate that their reasons for using CAM include (a) a preference for self-treatment over clinical intervention, (b) the perception that CAM is more effective than medication, (c) the perception that CAM has fewer side effects than medication, and (d) the perception that medication produces little or no benefit (da Silva, Ravindran, & Ravindran, 2009). Yoga falls in the CAM subcategory of mind-body medicine—practices and interventions that take advantage of the interactions among the brain, body,

mind, and behavior in order to maintain and improve physical functioning and health (NCCAM, USDHHS, 2012).

The NHIS also reports that of all the CAM used in 2007, yoga was the sixth most commonly used (NIH, NCCAM, USDHHS, 2012). The numbers of people practicing yoga has grown dramatically in the past several years. The 2012 Yoga in America (YIA) survey estimates that 8.7% of the US population—over 20 million American adults—practice yoga, a 25% rise from the 15 million yoga practitioners estimated in the 2008 YIA survey. In addition to YIA survey respondents who indicated that they already practice yoga, another 44% indicated a desire to try yoga (Yoga Journal, 2013). Approximately 82% of the survey respondents were women. Practitioners indicated that their leading motivations for starting yoga were flexibility (78% of respondents), general conditioning (62%), and stress relief (60%). These findings are consistent with studies noting that musculoskeletal problems, mental health conditions, and asthma are the most common medical conditions for which yoga practitioners seek help through yoga (Birdee et al., 2008; Büssing, Michalsen, Khalsa, Telles, & Sherman, 2012).

BACKGROUND AND THEORY OF YOGA

Yoga, with origins in ancient India, is a generic term that refers to specific physical, mental, and spiritual disciplines that are practiced in order to establish a state of permanent inner peace (Bryant, 2009). Yoga is described in its foundational text, the *Yoga Sutras*, as a holistic health system; in written form, the *Yoga Sutras* are credited to Patanjali (circa 300 CE), a Hindu philosopher, Sanskrit scholar, and medical physician (Broad, 2012; Feuerstein & Miller, 1998). The teachings of yoga are sometimes likened to a tree with eight limbs or aspects: yama (universal ethics), niyama (individual ethics), asana (physical poses), pranayama (breath control), pratyahara (control of the senses), dharana (steadiness of mind), dhyana (meditation), and samadhi (bliss; Iyengar, 1966; Ross & Thomas, 2010). What is referred to as “yoga” in the West usually comprises asanas, pranayama, and dhyana (i.e., meditation). Here, the term “asanas” refers to specific bending, standing, twisting, and balancing postures to improve flexibility and strength; pranayama refers to controlled breath exercises performed while

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focusing on body awareness; and dhyana refers to the mental practice of voluntary concentration of thoughts (Rocha et al., 2012). The numerous yoga styles approach these three facets of yoga in myriad ways. This literature critique considers two well-recognized styles of yoga, Iyengar and Vinyasa. Iyengar yoga is a precise style of yoga that focuses on alignment and holding each pose in a series of poses; this style of yoga is also distinguished by its use of blocks, straps, and blankets to assist a person and to avoid injury (Broad, 2012). In Vinyasa yoga, a person moves from one pose to another with coordinated breath in a continuous flow for an intense mind-body workout (Broad, 2012).

Research in the West on the use of yoga for reducing depression appears to have begun with a 1988 study by Berger and Owen (Berger & Owen, 1998), and in the past ten years, the numbers of empirical studies has grown. Given the burgeoning popularity of CAM, including the rising use of yoga for mood improvement, the question at hand is: "Is yoga effective for depression?"

SIGNIFICANCE OF THE TOPIC

The *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV-TR; American Psychiatric Association [APA], 2000) describes Major Depressive Disorder (MDD) as a "depressed mood or loss of interest or pleasure for more than two weeks;" this affective experience is different from the individual's baseline mood (APA, 2000, p. 356). In addition, individuals with MDD experience five or more symptoms (among nine possible symptoms listed in the DSM definition) that cause significant impairment in social or work spheres or in other important areas of their lives. Symptoms may include weight loss or gain, low energy, insomnia or oversleeping, decreased ability to concentrate, psychomotor agitation or retardation, low self-esteem, feelings of worthlessness, or recurrent thoughts of death.

The most recent CDC report estimates that the prevalence of current depression is 9.1% and the prevalence of MDD is 4.1% (CDC, 2010). The CDC defines "current depression" as depression that meets the criteria for either *DSM-IV-TR* MDD or "other depression;" "other depression" is defined as depression in which two, three, or four of the MDD criteria are met, including at least one of two specified criteria (i.e., depressed mood or decreased interest or pleasure in doing things). In 2008, the 12-month prevalence of current depression for individuals 18–25 years of age was 8.7%; for those 26–49 years, 7.4%; and for those over age 50 years, 4.5% (National Institute of Mental Health [NIMH], 2013). A striking finding from the same data was the marked gender difference in the 12-month prevalence of depression: among females, 8.1%; among males, 4.6%. Depression in late life increases the risk for medical illness but can often be missed and untreated, resulting in fatal consequences (National Alliance on Mental Illness, 2009). Estimates for the yearly salary-equivalent of human capital value lost due to depression range from \$30 billion to over \$50 billion (Kessler,

2012) in the United States alone. Depression exacts a high toll in human and economic costs.

Addressing depression is critical because MDD is the psychiatric diagnosis most strongly associated with suicide (McGirr, Renaud, Séguin, Alda, & Turecki, 2008). NIMH 2007 suicide statistics indicate that the vulnerable age groups are young adults 20–24 years of age (12.7 suicides per 100,000) and older adults 65 years and older (14.3 suicides per 100,000; NIMH, NIH, 2009). These two figures are higher than the national average of 11.3 suicides per 100,000 in the general population.

Although the mechanisms of depression are not well understood, stress and stress-related factors appear to contribute to the experience of depression (Kinser, Goehler, & Taylor, 2012). Kinser et al. note that most people with MDD reported that antidepressants, the standard treatment for depression, provided only a 50% reduction of depressive symptoms. The NIMH-funded Sequenced Treatment Alternatives to Relieve Depression (STAR*D) trial reported remission in only one third of patients with MDD after a trial of a first antidepressant; the study reported progressively lower response rates with each subsequent antidepressant trial (Balasubramaniam, Telles, & Doraiswamy, 2012).

MDD is described as episodic, but prospective studies show that recurrence rates are fairly high. Among 1,500 patients with MDD in the STAR*D Project, 74% reported more than one lifetime episode of depression (Maletic et al., 2007). Maletic et al. assert that recurrence of MDD appears to have a neurobiological vulnerability component. In describing this vulnerability, the "kindling effect" model has been used to characterize the chronic nature of depression and the manner in which one episode of depression increases the likelihood of subsequent episodes with suggestive long-term neurobiological effects and ramifications (Kinser et al., 2012). Because the environment influences gene expression (i.e., via epigenetic mechanisms), and epigenetics in turn can impact an individual's perception of the environment, the neuroregulation of mood and stress responsivity are probably reciprocally and cyclically related (Kinser et al., 2012). In this view, depression arises because of life stressors, and the deleterious effects of life stressors may be exacerbated by depression. In this regard, using yoga as a complementary therapy may interrupt this cycle and alleviate depression.

DISCUSSION OF THEORY

Neurobiology of the Effects of Yoga on Depression

A growing body of research indicates that yoga may offer mental health benefits via the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic nervous system (Büssing et al., 2012; Ross & Thomas, 2010). A psychological stressor triggers the response of the HPA axis and the sympathetic nervous system (SNS) to activate a cascade of events that results in the release of cortisol and catecholamines (namely, epinephrine and norepinephrine) to gather energy to cope with the stressor in a "fight-or-flight" reaction. Ross and Thomas (2010) have posited

that repeated activations of the HPA axis and SNS can result in hypervigilance and subsequent dysregulation of the system; this dysregulation leads to depression and to other health problems, such as cardiovascular disease and diabetes. Ross and Thomas (2010) found several studies that show that yoga has a down-regulating impact on both the HPA axis and the SNS, and, in addition, reduces levels of salivary cortisol. Acute psychological stressors may produce an increased cortisol response, and cortisol levels are associated with an increase in negative emotions (West, Otte, Geher, Johnson, & Mohr, 2004).

Streeter, Gerbarg, Saper, Ciraulo, and Brown (2012) have proposed that yoga ameliorates depression via a neurobiological mechanism that reduces allostatic load in stress response. They refer to McEwen's (2007) definition of allostatic load as the cost to the body for keeping stability during fluctuations from the usual homeostatic range; this cost often results in pathophysiological conditions and disease advancement. Researchers have noted that γ -aminobutyric acid (GABA) concentration is typically low in depressed individuals (Streeter et al., 2012). Streeter and colleagues (2012) posit that yoga stimulates parasympathetic activity; this increased parasympathetic activity results in a calming effect on the central nervous system and activates mechanisms of the inhibitory GABA neurotransmitter system. When people with depression are treated with serotonin selective reuptake inhibitors (SSRIs), they show symptom improvement and increased GABA levels (Bhagwagar, 2004). Streeter and colleagues' 2007 study showed that yoga asanas increase brain levels of GABA by 27%; in contrast, no change was seen in a comparison group that had a reading session in place of yoga.

Mindfulness is a component of many styles of yoga (Uebelacker et al., 2010). A commonly used definition of mindfulness is from Kabat-Zinn: "paying attention in a particular way: on purpose, in the present moment, and non-judgmentally" (Kabat-Zinn, 1994, p. 4). Mindfulness meditation renders long-term changes in the brain by decreasing the density of amygdala gray matter. This, in turn, reduces concentrations of stress-signaling molecules and increases dopamine levels (Chan, Immink, & Hillier, 2012). These effects improve the potential for better control over emotions, mood, and anxiety and for increased relaxation.

METHOD

A search of the PubMed, CINAHL, and PsycINFO databases was conducted to identify related research about the use of yoga for depression. Searches that used the term "yoga + depression" yielded 215, 210, and 186 results in the respective databases. A sampling of review articles revealed that most studies on the effectiveness of yoga in treating depression have examined yoga styles that emphasized breathing and meditation and not yoga styles in which the practice of asanas (i.e., yoga poses) is the core component. The present depression intervention literature review examines six studies of yoga styles that emphasize

the practice of yoga asanas. To clarify, although most of these styles of yoga use all three components—*asanas*, *pranayama*, and *meditation*—the emphasis of the yoga styles in these reviewed studies is *asana* practice. Two articles from da Silva and colleagues' (2009) review were used in the present literature review. Four other, more recent, articles were identified via the PubMed, CINAHL, and PsycINFO searches. The initial selection criteria for all six studies were that the studies (a) used randomized controlled trial design, (b) examined yoga styles that emphasize *asana* practice (but that also use *meditation* and *pranayama*), and (c) examined the applicability and implications of the yoga interventions for the treatment of depression. However, due to the paucity of studies satisfying these criteria, two studies that were not randomized and controlled were included in the review. One of these studies used a within-subject repeated measures design; the other used a mixed-methods uncontrolled qualitative study design.

The investigations selected for this critical literature review were published in three nursing journals, two complementary and alternative medical journals, and an interdisciplinary journal that spans areas of psychiatry, clinical practice, education, and rehabilitation. All journals are peer-reviewed.

LITERATURE REVIEW

The literature review begins with critiques of the four studies that utilized randomized controlled trial (RCT) design, then presents a critique of a study that utilized repeated measures design, and concludes with a critique of a study that utilized an uncontrolled qualitative design. Chen et al., 2008.

Chen et al., 2009

Among older adults, sleep problems, depression, and self-perceived poor health status are common (Foley et al., 2007; Fu, Liu, & Christensen, 2004). However, these conditions are often under-diagnosed or given inadequate recognition by clinicians (Jackson & Baldwin, 1993). Moreover, in older adults, pharmacological treatment of sleep disorder and depression is associated with hazardous side effects (Chen et al., 2009). In light of these issues, Chen and colleagues (2009) conducted an RCT to assess the effects of six months' practice of yoga exercises as a non-pharmacological intervention for improving older adults' sleep quality, depression, and self-perception of health status. The style of yoga examined in the study, Silver Yoga Exercise Program (SYEP), had been specifically developed for older adults by the study's principal investigator (PI) and colleagues in 2007; the SYEP approach accommodates older adults' decreased body flexibility.

The study was conducted in eight activity centers in southern Taiwan. A total of 139 participants were recruited from the centers, and the centers were randomly assigned (i.e., via cluster randomization) to the Silver Yoga experimental group (SYEG) or to a waitlist control group (WCG). Participant inclusion criteria were (a) currently in residence in the community,

(b) 60 years of age or older, (c) no previous yoga experience, (d) ability to walk without assistance, (e) being cognitively alert, and (f) being independent or mildly dependent. Participants' mean age was 69 years, 73% of the participants were females, and 44% of participants had a high school education. A total of 130 participants completed the study; all centers contributed equally to the participants' 6.47% attrition rate.

Two certified Silver Yoga teachers provided the yoga instruction. The SYEG met three times a week for six months. The SYEP consisted of warm-up postures, yoga poses, relaxation, and guided-imagery meditation. WCG participants engaged in the centers' usual activity programs. WCG participants were informed that they could participate in the SYEP following the completion of the study.

Data were collected at baseline, three months, and six months. The Chinese Version of the Pittsburgh Sleep Quality Index (CPSQI) was used to assess quality of sleep. The Taiwanese Depression Questionnaire (TDQ) was used to assess depression. The SF-12 Health Survey, Chinese Version, measures self-perception of health status and was also used. A mixed-design two-way ANOVA found that the variables Time and Group had interaction effects in the CPSQI total score ($p = .001$), physical health perception ($p < .001$), mental health perception ($p < .001$), and depression state ($p < .001$). ANOVAs were used to analyze the simple main effect of the different time points in each group. An ANCOVA was used to examine group differences at 3- and 6-month points in which Time and Group had interaction effects. Analyses of the data showed that with the exception of sleep latency, all variables showed significant changes. The SYEG's mean depression state decreased ($p < .001$); the WCG's mean depression state changed significantly but in the opposite direction—depression worsened, $F = 5.13$ ($p = .010$).

An important strength of the study by Chen et al. (2009) was that the yoga intervention was specially developed for older adults and accommodated their physical limitations. Chen et al. also acknowledged that their study had limitations—for example, the significant differences between the SYEG and WCG in mean age, under-representation by male older adults, and demographic differences (i.e., age, gender, marital status, and number of chronic illnesses)—which may have affected the study results. In addition, during the course of the study, the WCG had worsening depressive symptoms that apparently were not treated until the end of the study; such an oversight, if it occurred, would of course raise an ethical concern. Nevertheless, despite the limitations of this study, this well-designed study reports encouraging results and identifies SYEP as a non-pharmacological method for improving depression and sleep for older adults.

Krishnamurthy and Telles, 2007

Depression in older adults is a compelling problem because among all age groups, older adults have the highest rates of suicide (NIMH, NIH, 2009). Furthermore, as Krishnamurthy

and Telles (2007) have noted, people over 60 years of age who reside in residential institutions and who have depression are at increased risk for mortality. Moreover, in older adults, antidepressant medications can have several adverse effects, including confusion, agitation, psychomotor performance deficits, daytime sleepiness, and falls (Coupland et al., 2011). Krishnamurthy and Telles have speculated that public awareness of the adverse effects of antidepressants may be a factor in consumers' interest in and use of traditional, nonpharmacologic, approaches—such as herbal or homeopathic remedies—for the treatment of depression. Two such approaches that have both historical use and research support are yoga and Ayurveda, a form of traditional, holistic health care that originated in India (Khalsa, 2013; Mukherjee & Wahile, 2006). To evaluate the efficacy of these two approaches for the treatment of depression, Krishnamurthy and Telles (2007) conducted a 24-month RCT study on seniors living in a residential home in Bangalore, India.

The residential home in Krishnamurthy and Telles's (2007) study cares for seniors, 60 years of age and older. Most of the residents had been displaced from their home, had insufficient resources, and were likely to live out the end of their life at residence. The sole inclusion criterion was residence as a patient in the home. Residents were excluded from the study if they had uncontrolled diabetes or hypertension, a neurological disorder, dementia, or hearing impairment. A total of 90 residents agreed to participate in the trial and to be randomly assigned into groups for the study; among this group, 69 residents (50 females, 19 males) met the inclusion-exclusion criteria and were enrolled in the study. Study participants had a medical screening (i.e., an electrocardiogram, a fasting blood glucose test, and blood pressure measurement) and a clinical exam. For the purpose of assignment to group, participants were then identified according to 5-year age strata. From each stratum, individuals of both genders were randomly assigned to three groups—yoga group (YG; $M_{\text{age}} = 70.1$ years), Ayurveda group (AG; $M_{\text{age}} = 72.1$ years), or waitlist control group (WCG; $M_{\text{age}} = 72.3$ years)—via lottery and use of a standard number table.

Yoga Intervention: The yoga intervention was a multimodal, integrated program conducted in a series of 75-minute classes. During the classes, participants engaged in loosening exercises and standing, sitting, and supine yoga poses; breathing exercises and regulated breathing; yoga-based relaxation; philosophical discussion; and devotional singing. YG participants attended this program six days a week. The intervention was conducted by a trained yoga instructor; other than teaching and tracking attendance, the instructor had no other role in the study.

Ayurveda Intervention: The Ayurveda intervention was Rasayana Kalpa, an herbal preparation that is taken as a rejuvenating tonic drink in the morning and evening. Rasayana Kalpa is prepared as a powder made from the root of *Withania somnifera* (commonly known as "ashwagandha" or Indian ginseng); to prepare the beverage, the powder is mixed with

fresh fruit, honey, and clarified butter. Ayurvedic physicians recommend Rasayana Kalpa for promotion of good physical and mental health (including mood stability) in older adults.

Waitlist Control: The WCG group was not given an intervention; individuals were informed they could attend either group after the study ended.

The dependent variable—depression level—was measured with the Geriatric Depression Scale-Short Version (GDS-S). All participants were found to have severe depression; a baseline one-way ANOVA found no significant between-group difference. A repeated measures ANOVA found a statistically significant Time by Group interaction ($p < .001$): This interaction revealed that, over time, the between-group assessment changed. During the course of the intervention, between-group differences in average depression levels increased significantly. Specifically, YG participants had significant reductions in depression scores at three months ($p < .001$) and at six months ($p < .001$). The AG group and the WCG group displayed no significant change ($p > .05$).

The study's strengths include its RCT design, age stratification in group assignment, and its attempt to balance gender representation in group assignment. Notably, although prior CAM research has reported little benefit for treatment of severe depression, the repeated measures assessment in Krishnamurthy and Telles's (2007) study found a clear effect trend associated with the YG intervention—a progressive decrease in depression at three months and at six months.

The Krishnamurthy and Telles (2007) study had several limitations. The study report did not provide potentially important information about the yoga poses (e.g., whether they were modified for use by older adult participants, whether the same pose sequence was taught in every class). The study's small sample size limits statistical power. The sample's homogeneous composition (i.e., participants of Indian descent) and the fact that participants had no chronic health problems limit generalizability of the study's conclusions. Two attentional factors may have contributed as confounders to the observed reduction in depression: (a) between-participant social contact (which, during the intervention, increased in both frequency and duration) and (b) participant-researcher contact (i.e., the Hawthorne effect—resulting from almost daily participation in group classes for 24 weeks). Moreover, the influence of these two factors may have been contextually amplified by the general inadequacy of institutional and participant resources. Similarly, atypical components of the study's yoga program—devotional singing and philosophical discussion—may have contributed to participants' reduced depression. On the other hand, the significance of the study's findings is strengthened by the fact that all of the participants suffered from severe depression, a condition that is difficult to treat—particularly in older adults.

Michalsen et al., 2012

The rationale for a study conducted by Michalsen and colleagues (2012) was their observation that, in Western society,

increasing numbers of people are reporting distress and stress-related complaints, and increasing numbers of people are using yoga for personal health care. However, in surveying the mental health literature on yoga interventions, these investigators found few RCTs that examined the effectiveness of yoga on perceived stress. Accordingly, Michalsen et al. conducted an RCT that examined the effects of Iyengar yoga on perceived stress, physical and psychological measures of depression, and psychological well-being. In addition, the study assessed a possible yoga dose-effect relationship. The study participants were distressed women; the study was conducted in Essen, Germany.

Volunteers were recruited by local newspaper advertisements and flyers that offered women who had high levels of stress a free, 3-month course in yoga. The inclusion criteria were being female; being 20–60 years of age; experiencing current distress as indicated by a total CPSS score greater than 18; experiencing three or more specified stress symptoms (i.e., insomnia, disturbed appetite, back or neck pain, tension headache, decreasing daytime alertness, digestive problems, frequent cold hands or feet), and not being engaged in yoga practice or other stress management modality. Exclusion criteria were having a current psychiatric diagnosis, having medical contraindications to physical exercise, currently taking medication for any disease, evident alcohol or substance abuse, and current pregnancy. Of 238 women who initially inquired about the study, 72 were qualified (according to inclusion-exclusion criteria) for study participation. After written consent was obtained from these women, they were randomly assigned to the groups in the study.

Participants completed questionnaires at baseline and at 12 weeks. The primary outcome of subjective stress was measured with the Perceived Stress Scale (PSS). Secondary outcomes included depression, state-trait anxiety, psychological and physical quality of life, mood states, well-being, and bodily complaints. For the purposes of this literature review, only the findings concerning subjective stress and depression were examined. Depression was measured with the Center for Epidemiological Studies Depression Inventory (CES-D) instrument.

The 12-week study had three arms, involving two yoga groups and a waitlist control group. Yoga Group 1 (YG1) participated in one 90-minute yoga class per week; Yoga Group 2 (YG2) participated in two 90-minute classes a week. Waitlist control group (WCG) participants did not attend a yoga class, but were given the option to participate in yoga classes after the study ended. In the yoga classes, the sequence of poses emphasized standing, forward bending, backbending, and inversion postures that alleviate stress; the classes ended with 15 minutes of meditation. The yoga classes were taught by a certified Iyengar instructor.

Through a power analysis, Michalsen et al. (2012) determined that a sample comprising 23 participants would be adequate for detection of effects. Outcomes were analyzed on an intention-to-treat basis by ANCOVA; group and baseline values, as well as outcome expectation, were covariates. The main analysis compared the outcomes among the three groups.

However, because adherence in the yoga classes was only fair, a secondary analysis was conducted, in which the yoga groups were pooled and analyzed according to yoga class adherence.

The PSS scores of both yoga groups improved significantly, but the PSS score of the WCG did not. The difference between the mean of pooled YG1-YG2 PSS scores and the mean WCG PSS score was -5.7 ($p = 0.003$). In addition, in comparison to the WCG, the yoga groups' depression scores were significantly lower. Regarding CES-D scores, the difference between YG1 and WCG was -4.2 , $p = 0.028$ and between YG2 and WCG, it was -4.6 , $p = 0.02$. The difference between the mean of pooled YG1 and YG2 CES-D scores and the mean WCG CES-D score was -5.7 , $p = 0.003$. Notably, the two yoga groups did not significantly differ in their measures of perceived stress and depression. This may indicate that, for ameliorating perceived stress or depression, two yoga classes per week were not more beneficial than one class per week.

One strength of this investigation by Michalsen et al. (2012) is the fact that the study length—12 weeks—was both adequate for assessing between-group differences and practicable for the participants. An acknowledged limitation is that the trial was non-blinded—a design limitation that is common in non-pharmacological investigations.

Woolery, Myers, Sternlieb, and Zeltzer, 2004

Although practitioners of yoga have long noted that yoga has an uplifting effect on mood, few empirical studies have investigated the effect of yoga on depression. For example, Woolery, Myers, Sternlieb, and Zeltzer noted that, as of 2004, no prior prospective studies had compared possible differential effects of yoga asanas, pranayama (yogic breathing techniques), and meditation on mood in depressed individuals. Accordingly, these investigators conducted a pilot study to assess the effects of a particular yoga intervention—Iyengar yoga—on mood in mildly depressed young adults.

A sample of 28 young adult volunteers was recruited from an unspecified American university campus; participants ranged in age from 18 to 29 years ($M = 21$ years), and most (79%) were female. Of these enrolled participants, 13 were assigned to a yoga group (YG), and 15 to a waitlist control group (WCG). The inclusion criterion was diagnosis of mild depression reflected by the Beck Depression Inventory (BDI). Exclusion criteria were (a) current diagnosis of a psychiatric condition, (b) current engagement in mental health treatment, (c) current practice of yoga or CAM, (d) current medical contraindications to exercise, or (e) current alcohol or substance abuse.

The yoga intervention examined in this RCT consisted of two 60-minute Iyengar yoga classes attended weekly for five weeks. The WCG maintained usual activities. In the Iyengar yoga classes, the pose sequences were chosen for depression reduction and included standing poses, backbends, and inverted poses that expand the chest; each class ended with relaxation poses. The yoga instructor was a certified Iyengar teacher. In

order to time-match data collected for the two groups, YG participants and WCG participants attended data collection meetings on the same pre-test, mid-course, and post-test dates. The assessment instruments used in the study included (a) the self-reported BDI, administered pre- and post-test; and (b) the Profile of Mood States (POMS), administered at pre-test to evaluate interest, motivation, and expected benefits of taking yoga.

Paired *t*-tests conducted for each group showed that, in YG participants, depression decreased from baseline to the end of the study (mean BDI scores decreased from 12.77 to 3.90; $p < .001$); depression did not change in the WCG participants during this period ($p = .45$). A one-way analysis of variance (ANOVA) was used to test for group differences on depression at baseline, mid-course, and at the end of the yoga course. The ANOVA found that reduction of depression was greater in the YG participants than in the WCG participants.

Woolery et al. (2004) acknowledged several limitations in their study. The pilot study's small sample size limited the statistical power of the BDI and POMS assessments. Use of a waitlist control group—rather than a placebo group or an alternate treatment group—exacerbated the difficulty of distinguishing the effects of the yoga intervention from possible effects of attention and expectation. The study's brevity, sole reliance on subjective report, and non-use of clinician assessment of participants' mood were additional study limitations. Strengths of this study include the investigators' use of two measures of depression and that the outcomes of both measures were mutually supportive of significant positive outcomes. Should future, larger, asana-based yoga intervention studies reveal similar reductions of mild depression in young adults, an important implication would be that mood-targeting yoga classes should be offered in colleges.

Harner, Hanlon, and Garfinkel, 2010

In comparison with the general population, incarcerated women have a higher prevalence of mental illness; this higher prevalence is due to pre-incarceration social, environmental, and behavioral risk factors associated with limited education, limited access to medical and psychiatric services, poverty, and homelessness (Beck & Maruschak, 2001). Among mental conditions commonly experienced by incarcerated women, depression and anxiety are highly prevalent (Bloom, Owen, & Covington, 2003); in this regard, a small but growing body of studies suggest that Iyengar yoga may decrease depression and anxiety symptoms (Michalsen et al., 2005; Shapiro et al., 2007; Woolery et al., 2004). In light of this evidence, Harner, Hanlon, and Garfinkel (2010) conducted a study to assess the effects of a twice-weekly Iyengar group yoga instruction on depression, anxiety, and perceived stress among women incarcerated at a medium-security state prison in the eastern United States.

For their study, Harner et al. (2010) used a repeated-measures design, in which each woman served as her own control. Assessments used the Beck Depression Inventory (BDI-II), the Beck Anxiety Inventory (BAI), and the Perceived Stress Scale (PSS);

these assessments were administered at baseline and during the treatment in Weeks 4, 8, and 12.

Inclusion criteria were (a) English speaking, (b) 35 years of age or older, (c) having completed at least three months of the current sentence, and (d) at least six months of remaining incarceration. Exclusion criteria were (a) pregnancy, (b) postpartum less than three months, (c) not cleared medically, (d) on suicide watch, (e) residence in security lock-up, (f) receipt of a disciplinary report within one month prior to the intervention, and (g) being at risk for flight. The Department of Corrections generated a list of 60 inmates who qualified for study participation according to the inclusion-exclusion criteria; an invitation letter sent to these women informed them of the purpose of the study. Interested women were interviewed and asked to sign a participation consent form. This recruitment process resulted in enrollment of 21 women in the study. Participants' mean age was 43 years; more than 70% of the participants were White; 25% were high school graduates, and 10% were college graduates. A total of 17 participants attended the first intervention, and 6 participants completed the entire 12-week intervention.

The 12-week yoga intervention comprised two-hour Iyengar yoga classes held twice each week, for a total of 24 classes. The class was designed for beginning students and was conducted by a certified Iyengar yoga instructor.

Descriptive statistics were used to quantify and examine distributions of outcomes measured on a continuum. The study's report included a descriptive table of the raw mental health outcomes; the table showed a steady decline in unadjusted mean values for depression—from 24.90 to 7.33. Mean anxiety scores declined from baseline to Week 4 and increased steadily from Week 4 to Week 12. Regression analysis for linear trends over time was performed for every outcome measure. BDI score decreased linearly and significantly throughout the intervention period ($p < .001$). BAI scores declined but not significantly ($p = .06$). Trends in stress scores declined linearly; a nonlinear model showed mean scores initially decreasing but then returning to baseline levels at Week 12.

A strength of this study by Harner et al. (2010) is that no adverse medical or psychiatric incident occurred during the study. However, the study had a few limitations. The lack of a control group limited the study's conclusion of the effect of the intervention. The low completion rate of the study limited statistical analyses. The sample's demographics were relatively homogeneous (i.e., the majority of participants were well-educated white women), another limitation; Harner et al. wondered whether their sample's relative homogeneity reflected general cultural biases regarding participation in yoga. The investigators speculated that, in addition, financial factors may have contributed to the low percentage of non-white participants and to the dropout rate, because participants who lacked financial support may have been less able or less willing to modify their paid prison work schedules in order to accommodate yoga class participation. Other limitations of the study include its small sample size and its constrained generalizabil-

ity. Even though the study's generalizability is limited (because the 525 population of women incarcerated in medium-security prisons is small), the study's positive findings may inspire future studies that utilize asana-based yoga intervention for other, larger subpopulations of depressed women with trauma histories.

Uebelacker et al., 2010

In considering the prevalence of major depression, Uebelacker et al. (2010) noted that current treatment strategies are inadequate. Only about half of the people with MDD respond to antidepressant treatment, and among those who do respond, many continue to have residual depressive symptoms. In light of growing public interest in yoga for dealing with depression, the researchers conducted a study to assess a particular style of yoga, Vinyasa yoga, as an adjunctive treatment for depressed patients with inadequate response to antidepressants. The study had several aims: (a) to assess the acceptability and feasibility of this yoga intervention; (b) to elicit qualitative feedback from study participants on their experience in the class; this feedback was to be used in developing a yoga intervention manual for depression; (c) to evaluate changes in depressive symptoms over time; and (d) to assess the change in the potential mechanisms of action (e.g., practice of mindfulness, activation of behavior, and reduction of rumination). The study was conducted in Providence, Rhode Island.

Uebelacker et al. (2010) used a mixed-methods, non-controlled, open trial design in their qualitative acceptability and feasibility study. Participants were recruited via local newspaper advertisements, notices sent to local mental health professionals, and postings in both university graduate listservs and Craigslist. Inclusion criteria were current use of an antidepressant and anticipated continuation of this regimen for the next two months; experience of mild-to-moderate levels of depression, being yoga naïve, and able to commit to two yoga classes per week. Exclusion criteria were prior history of bipolar disorder or schizophrenia or a current health issue that contraindicated yoga practice. Recruitment yielded 11 participants who met the inclusion-exclusion criteria ($M_{\text{age}} = 34$ years; 10 females). The sample's racial composition was nine white participants, one Asian participant, and one biracial participant. Among the participants, one was a high school graduate, one had attended some college, six had undergraduate degrees, and three had master's degrees. All participants had been taking antidepressant medications ($M = 54$ weeks). A research assistant made follow-up telephone assessments at 2, 4, 6, and 8 weeks to assess participants' depression.

Uebelacker et al. (2010) considered a variety of yoga styles and selected Vinyasa yoga because of the combined benefits of this style's (a) movement and pranayama components (both of which entail mindfulness practice) and (b) exercise component. Participants were encouraged to attend the 12 beginning-level classes within an 8-week period.

Depression severity was assessed pre- and post-intervention with the Quick Inventory of Depression Symptoms-Clinician Rating (QIDS). Also, a self-reporting tool for assessing depression—the Patient Health Questionnaire-9 (PHQ-9)—was administered at the four time points of 2, 4, 6, and 8 weeks. The Treatment Response to Antidepressant Questionnaire (TRAQ) was used to record medication names, dosages, dates of use, adherence to regimen, and the participant's response to his or her antidepressant. The Rumination Response Scale (RSS) was used to evaluate brooding and reflection. The Behavioral Activation for Depression Scale was used to assess both avoidance and activation as contributors to depression. Mindfulness was assessed with the self-report Five-Facet Mindfulness Questionnaire (FFMQ).

Statistical analyses of the data were performed using *t*-tests, paired sample *t*-tests, and the Cohen's *d* statistic. The post-yoga intervention test scores reflected statistically significant improvements with both QIDS ratings ($t = 4.36, p < .01$, Cohen's $d = 1.35$) and PHQ-9 score ($t = 3.28, p < .05$, Cohen's $d = 0.80$). Significant improvements also were found in the mindfulness aspects of activation ($t = -5.06, p < .01$, Cohen's $d = -3.14$), and non-judging ($t = -2.52, p < .01$, Cohen's $d = -0.78$). Uebelacker et al. acknowledged that because the study was an open trial, they were not able to determine whether participants' practice of Vinyasa yoga was the cause of the changes. However, the investigators pointed out that the STAR*D study found a similar effect size of .80 for individuals who used cognitive behavioral therapy augmentation after an insufficient response to citalopram. Uebelacker et al. (2010) also saw significant enhancements in the hypothesized mediators of change associated with practice of Vinyasa yoga—specifically, regarding behavioral activation and non-judgment. From the qualitative feedback, several themes emerged: (a) a kind and caring instructor is important; (b) participants liked the combination of the physical and meditative aspects of the yoga intervention; they also liked the intervention's additional attention on breath; (c) the participants noticed emotional benefits (i.e., increased relaxation and less crying); physical benefits (i.e., better sleep, weight loss, and pain reduction); and social benefits (i.e., socially connecting with others in class); and (d) many participants wanted more classes and felt that the 8-week intervention was too short, as they felt the benefits they received warranted extension of the intervention period.

One strength of the study arose from the fact that the participants had both a diagnosis of MDD and an inadequate response to medications. These two characteristics made these participants a particularly challenging subset of the population with depression and therefore a good subpopulation on which to test the efficacy of Vinyasa yoga for ameliorating depression. The study was the first research that has attempted to ascertain which aspects of yoga classes are helpful to people with depression. The study's limitations were its lack of a control group and small sample size.

DISCUSSION

The purpose of this review is to discuss research findings on the therapeutic effectiveness of yoga as an intervention for treatment of depression; specifically, the studies in this review examined yoga styles in which the practice of asanas is the core component. Investigations of yoga interventions are challenging to consider as a group, given the variations in (a) study designs, (b) styles of yoga, (c) sample baseline values of depression severity, and (d) measurement instrument used. Regarding variations in study methods, four out of the six studies were RCTs (i.e., Chen et al., 2009; Krishnamurthy & Telles, 2007; Michalsen et al., 2012; Woolery et al., 2004); the fifth study used a repeated measures design, in which each participant served as her own control (Harner et al., 2010), and the sixth study used a mixed-method quantitative-qualitative design (Uebelacker et al., 2010). In only one study was the yoga intervention an adjunct treatment to pharmacotherapy (Uebelacker et al., 2010); in the other five studies, the yoga intervention was monotherapy. Three of the studies used Iyengar yoga as their intervention (Harner et al., 2010; Michalsen et al., 2012; Woolery et al., 2004); one study used the Silver Yoga Exercise Program (Chen et al., 2009); one study used Vinyasa yoga (Uebelacker et al., 2010); and one study did not specify its style of yoga (Krishnamurthy & Telles, 2007). In two studies, all sample participants were female (Harner et al., 2010; Michalsen et al., 2012); in the rest of the studies, the majority of sample participants were female. The samples of two study samples comprised older adults (Chen et al., 2009; Krishnamurthy & Telles, 2007); the sample of one study comprised young adults (Woolery et al., 2004). Three studies had a waitlist control design; the other three studies did not. Samples ranged in size from 11 to 139 subjects; study periods ranged in length from 5 to 26 weeks. Notably, in the longer trials, improvements in depression became apparent by the time of the first collection point (e.g., at 12 weeks), and improvement continued throughout the remainder of study periods. Among the yoga interventions in the various studies, attendance frequency—either required or suggested—varied widely, from one class per week to six classes per week. The studies in which yoga classes were held more frequently were those conducted at the senior centers and the prison; in these settings, potential participants were more readily available. The study with the most frequent intervention sessions—yoga classes six days per week—was conducted in a residential home.

Notably, in all of the studies, depression levels decreased significantly; in four of the studies, depression levels decreased to a lower depression category. In the Krishnamurthy and Telles (2007) study, the mean baseline depression level was "severe;" by the end of the study period, the depression level had decreased to "mild." In the studies by Harner et al. (2010) and by Uebelacker et al. (2010), the yoga group participants' mean depression level began as "moderate" and by the conclusion of the yoga interventions, the samples' mean depression level had decreased to "mild." The Woolery et al. (2004) study with

young adults began with a mild depression level and decreased to the not depressed level. This literature review has noted that positive findings have resulted from yoga interventions for depressive symptoms; the efficacy of yoga interventions is better substantiated in studies whose yoga group participants had mean baseline depression levels in the mild-to-moderate range. In addition to amelioration of depression, the yoga interventions had other positive aspects. The study articles contained no reports of injury and, by and large, the studies had no ethical issues. Generally, the yoga classes were moderately well attended.

As noted earlier, limitations common to all of the studies were the use of small samples and homogeneous participant demographics—factors that limited the power of statistical analysis and limited generalizability, respectively. Although the four RCT studies were fairly well designed, they did not use attention-controls. Because the yoga interventions were conducted as group classes, experimental masking of participants was impracticable (due to the nature of the yoga asanas when practiced as an experimental intervention). Moreover, measuring the specific, discrete effects of the individual components of the multimodal yoga interventions would likewise have been impracticable (i.e., experimentally isolating the effects of the individual intervention components—from each other and from the synergistic effects of interventions as a whole—would be difficult if not impossible). This concern is particularly relevant for the three studies with waitlist controls (Chen et al., 2009; Michalsen et al., 2012; Woolery et al., 2004).

CONCLUSIONS AND IMPLICATIONS

People elect to use CAM for depression for a variety of reasons: insufficient remission with antidepressants, adverse effects from antidepressants, and a preference to avoid medications (da Silva et al., 2009). Other reasons include lack of medical insurance and lack of financial resources for out-of-pocket costs of psychiatric care, primary care, and medications (Nahin, Dahlhamer, & Stussman, 2010). The CAM of yoga is emerging as an alternative to standard treatment for depression as reflected by the increasing number of studies assessing yoga as a treatment for depression (Mehta & Sharma, 2010).

General Conclusions

Despite the limitations of the studies considered in this review, the studies' findings support several conclusions regarding the appropriateness of yoga for treatment of depression. Collectively, the research sites' diverse geographical and cultural representation—Asia, Europe, and the United States—and the research samples' wide age range speak to yoga's broad appeal. The study participants' moderate-to-very good attendance speaks to yoga's effectiveness and practicability. The study samples' representations of subpopulations at high risk for depression (i.e., women, young adults, older adults) and the study interventions' positive outcomes also speak to yoga's effectiveness and to yoga's utility.

The fact that in all six studies, most of the participants were women may not be problematic for generalizability, because the prevalence of depression in women as a subpopulation is higher than that in the general population. Furthermore, the percentage of female yoga participants of the four studies that had mixed-gender samples is the same as the percentage of female participants in typical urban yoga classes (i.e., approximately 80%).

Although the Woolery et al. (2004) study used a small sample, their study's outcomes are compelling, suggesting that treatment of mildly depressed young adults with a relatively brief (5-week) yoga intervention may prevent or ameliorate future moderate or severe depressive episodes. These findings and their potential implications warrant further examination. Future research should investigate whether yoga can have a role in primary, secondary, or tertiary prevention of chronic depression.

Conclusions from Specific Findings

Given the high prevalence of depression and suicide in older adults, the findings of this review suggest that senior centers may be natural settings for yoga classes. Chen et al.'s (2009) finding of improved sleep justifies further study because about 50% of older adults complain of sleep problems (Neikrug & Ancoli-Israel, 2010). The two trials whose samples comprised older adults demonstrated that the yoga postures can be effectively modified for people in this age group and found that, in general, the older adults in the study liked yoga practice. Given older adults' common use of polypharmacy, yoga is a particularly attractive option for people in this age group. Yoga asanas also may substantially improve older adults' strength and flexibility, another important benefit.

The finding that one-class-per-week doses significantly reduced depression level is encouraging, because this dosage is a practicable frequency for most people. Although the longer studies in this review might be difficult to replicate, the shorter trials demonstrated the effectiveness of their interventions. However, no long-term follow-up assessments were conducted to determine whether the interventions' positive effects persisted and whether participants continued to adhere to their yoga asana practice; in light of the studies' findings, such follow-up assessments are clearly warranted.

With the exception of Iyengar yoga (examined in three studies in this review), the other styles of yoga discussed in this review have limitations. Key concepts presented in the Iyengar yoga teacher training include (a) the importance of safe practice and (b) education on how to modify asanas according to the ability of the yoga class participant (Broad, 2012). The Iyengar yoga style may have been selected in the studies because of its versatility in that classes can be designed with asana sequences to specifically target mood improvement. Given the positive findings in the three Iyengar yoga studies and the fact that Iyengar yoga can be modified in order to fulfill specific requirements, additional studies on this style of yoga are warranted. Yoga

practice comprises many diverse styles; most interested individuals will probably be able to identify a personally suitable style of yoga from among the numerous options.

Urban yoga classes are moderately affordable for most people. However, both the Harner et al. (2010) study and the Uebelacker et al. study (2010) revealed that yoga classes are predominantly attended by women, and that these women tend to be highly educated and white. These findings may indicate cultural biases that influence the demographic composition of yoga classes. In light of yoga's potentially broad, population-wide usefulness, these findings of demographically narrow utilization may have implications for future outreach and exposure strategies, should yoga's effectiveness for mental health problems become more robustly substantiated.

Previous studies suggest that the asana, pranayama, and meditation components of yoga produce synergistic neurobiological effects on neurotransmitters—effects that ameliorate depressed mood. Additional studies to identify and elucidate the specific mechanisms of yoga's effectiveness are needed.

Both yoga (Yoga for Anxiety and Depression, 2009) and physical exercise (Rimer et al., 2012) appear to ameliorate depression. With both of these approaches to reducing depressive symptoms, issues pertaining to motivation and compliance must be considered. In its qualitative research component, Uebelacker et al. (2010) included discussion of these important subjective factors in intervention effectiveness. The trial's participants reported that they wished they had received additional encouragement throughout the study to attend more classes (because it was left to the participants to decide how many classes to attend—up to a maximum of 12 classes in 8 weeks); by the study's end, the participants had come to realize that their yoga practice was helpful for mood improvement. Additional qualitative studies are necessary for informing and enhancing the design of subsequent studies of yoga interventions.

Collectively, the studies considered in this review demonstrate (a) that yoga in which practice of asanas is the core component is a safe, cost-effective, and popular method for ameliorating depression and (b) that yoga can be used monomodally or as an adjunct to medication. Yoga is versatile and allows for personalization. It can be practiced in diverse settings—in classes, gyms, outdoors, and at home. Additional studies of the effectiveness of yoga that have (a) larger samples, (b) designs that are more rigorous (e.g., using attention-controls), (c) participants who have varying degrees of depression severity, and (d) longer periods of follow-ups are warranted. For example, in cases involving partial remission of depressive symptoms, studies might usefully examine yoga interventions used as adjuncts to pharmacotherapy. Increasingly, health care providers are encouraging their clients and patients to use self-management approaches for the treatment and management of chronic diseases (e.g., depression). This encouragement coincides with the growing public interest in, and demand for, complementary health

options. In light of the positive findings regarding yoga's effectiveness in treating depression, yoga's future as a treatment modality shows promise.

SIGNIFICANCE FOR NURSING

The use of CAM, such as yoga, has increased over the past several years, and this trend is likely to continue. Not surprisingly, the Institute of Medicine's report on complementary and alternative medicine in the United States identified integration of CAM and conventional medicine as an important area for further research (Institute of Medicine, 2005). However, 63%–72% of consumers do not disclose their use of CAM to their health care providers, and it is likely that consumer's reticence to discuss their use of CAM with their providers includes discussion of yoga practice. Consumers' reasons for non-disclosure of CAM use are several: their medical providers do not inquire about patients' CAM use (suggesting clinician disinterest), belief that providers would not understand patients' CAM use, and concern that providers might have negative attitudes or responses to CAM use (Chao, Wade, & Kronenberg, 2008). Given the high incidence of undisclosed CAM use, it is imperative that all health providers become proficient in sensitively inquiring about their patients' CAM use, including the practice of yoga. Individualized patient-based care and holistic care are core values in nursing; in addition, health care approaches must minimize potential for adverse effects and decrease costs. Accordingly, consideration of integrated approaches that are safe, cost-effective, and versatile, such as asana-based yoga practice, is good practice—an important dimension of APNs' therapeutic armamentarium.

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