Review

YOGA FOR DEPRESSION: A SYSTEMATIC REVIEW AND META-ANALYSIS

Holger Cramer, Ph.D.,* Romy Lauche, Ph.D., Jost Langhorst, M.D., and Gustav Dobos, M.D.

Background: *Mind–body medical interventions are commonly used to cope with depression and yoga is one of the most commonly used mind–body interventions. The aim of this review was to systematically assess and meta-analyze the effectiveness of yoga for depression.* **Methods:** *Medline/PubMed, Scopus, the Cochrane Library, PsycINFO, and IndMED were searched through January 2013. Randomized controlled trials (RCTs) of yoga for patients with depressive disorders and individuals with elevated levels of depression were included. Main outcomes were severity of depression and remission rates, secondary outcomes were anxiety, quality of life, and safety.* **Results:** *Twelve RCTs with 619 participants were included. Three RCTs had low risk of bias. Regarding severity of depression, there was moderate evidence for short-term effects of yoga compared to usual care (standardized mean difference (SMD) = −0.69; 95% confidence interval (CI) −0.99, −0.39; P < .001), and limited evidence compared to relaxation (SMD = −0.62; 95%CI −1.03, −0.22; P = .003), and aerobic exercise (SMD = −0.59; 95% CI −0.99, −0.18; P = .004). Limited evidence was found for short-term effects of yoga on anxiety compared to relaxation (SMD = −0.79; 95% CI −1.3, −0.26; P = .004). Subgroup analyses revealed evidence for effects in patients with depressive disorders and in individuals with elevated levels of depression. Due to the paucity and heterogeneity of the RCTs, no meta-analyses on long-term effects were possible. No RCT reported safety data.* **Conclusions:** *Despite methodological drawbacks of the included studies, yoga could be considered an ancillary treatment option for patients with depressive disorders and individuals with elevated levels of depression. Depression and Anxiety 30:1068–1083, 2013.*

Key words: *Depression; Depressive disorder; Meta-analysis; Review; Yoga.*

INTRODUCTION

DESCRIPTION OF THE CONDITION

With a global annual incidence of 3.0%,[1] major depressive disorder is a common and disabling mental disorder. Subthreshold depression, i.e. elevated levels of depression that do not fulfill full criteria of a depressive disorder, is even more common.[2] Elevated levels of depression without a formal diagnosis of a depressive disorder have consistently been associated with increased disability, reduced quality of life, and increased healthcare costs[3–5] and often predict a later depressive disorder.[6]

DESCRIPTION OF THE INTERVENTION

Mind–body medical interventions, i.e. interventions that focus on the interactions among the brain, the

Department of Internal and Integrative Medicine, Kliniken Essen-Mitte, Faculty of Medicine, University of Duisburg-Essen, Essen, Germany

Contract grant sponsor: Rut- and Klaus-Bahlsen Foundation.

*Correspondence to: Dr. Holger Cramer, Kliniken Essen-Mitte, Department of Internal and Integrative Medicine, Kliniken Essen-Mitte, Faculty of Medicine, University of Duisburg-Essen, Am Deimelsberg 34a, 45276 Essen, Germany. E-mail: h.cramer@kliniken-essen-mitte.de

Received for publication 5 March 2013; Revised 10 July 2013; Accepted 13 July 2013

DOI 10.1002/da.22166
Published online 6 August 2013 in Wiley Online Library (wileyonlinelibrary.com).

rest of the body, the mind, and behavior,[7] are commonly used to cope with a wide range of depression severity[8] and yoga is one of the most commonly used mind–body interventions.[9] Recently, a call has been made to rigorously evaluate the effectiveness of yoga in psychiatry.[10–12]

Yoga has its roots in Indian philosophy and has been a part of traditional Indian spiritual practice for around 5000 years.[13] Traditional yoga is a complex intervention that comprises advice for ethical lifestyle, spiritual practice, physical activity, breathing exercises, and meditation.[13–15] While the ultimate goal of traditional yoga has been described as uniting mind, body, and spirit, yoga has become a popular means to promote physical and mental well-being.[13,14] In North America and Europe, yoga is most often associated with physical postures (asanas), breathing techniques (pranayama), and meditation (dyana).[14] Different yoga forms have emerged that put varying focus on physical and mental practices.[14] However, even exercise-based yoga interventions differ from purely gymnastic exercise as during yoga the practitioner focuses his mind on the postures with inner awareness and a meditative focus of mind.[16,17]

Systematic reviews have shown that yoga can improve comorbid mental symptoms in physical conditions such as cancer,[18,19] menopausal symptoms,[20] or pain.[21] As well, yoga has been shown to improve mental disorders such as anxiety disorders[22] and perhaps schizophrenia.[23,24]

HOW THE INTERVENTION MIGHT WORK

Depression has been described as reflecting a primary disorder of biochemical and neurophysiological functions and there is evidence that alterations in monoamine (noradrenaline, serotonin, dopamine) metabolism play a major role in the pathophysiology of depression.[25] Other central neurotransmitters such as gamma-aminobutyric acid (GABA) have also been shown to be involved in depression.[26,27] There is preliminary evidence from imaging studies that yoga practice can increase endogenous dopamine release in the ventral striatum[28] and thalamic GABA levels.[29] Moreover, yoga practice was associated with increased plasma serotonin in depressed patients.[30]

Another proposed mechanism of yoga for depression is the decrease of dysregulation in the hypothalamic-pituitary-adrenal axis; this is the stress response.[27,31] Many depressed patients present with increased levels of plasma cortisol that decrease to normal levels after effective treatment.[32] Findings on salivary cortisol levels in depressed patients are inconsistent with some studies finding a higher cortisol awakening response[33] and other studies showing flatter diurnal cortisol slopes.[34,35] Studies have shown that yoga can reduce subjective stress in healthy adults[36] and reduce levels of plasma cortisol in individual with depression[30] or alcohol abuse.[37] In cancer patients, reduced morning salivary cortisol levels have been found after a yoga intervention[38,39] together with a steeper diurnal salivary cortisol slope.[39] The latter finding is however limited by the small sample size of the study.[39] While findings on effects of yoga on cortisol levels are inconsistent and limited by methodological shortcomings,[22] a regulation of the stress response might be involved in antidepressant effects of yoga.

AIMS OF THE STUDY

The aim of this review was to systematically assess and meta-analyze the effectiveness and safety of different yoga forms in patients with depressive disorders and individuals with elevated levels of depression.

MATERIALS AND METHODS

The review was planned and conducted in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines[40] and the recommendations of the Cochrane Collaboration.[41]

ELIGIBILITY CRITERIA

Types of Studies. Randomized controlled trials (RCTs) and randomized crossover studies (only data from the first active treatment phase were used). No language restrictions were applied.

Types of Participants.

1. Adults with depressive disorders diagnosed by the Diagnostic and Statistical Manual, Fourth Edition (DSM-IV)[42] or the International Classification of Disease 10 (ICD-10).[43]
2. (a) Adults with elevated levels of depression diagnosed by validated clinician-based or self-report depression symptom questionnaire, such as Hamilton Rating Scale for Depression,[44] the Beck Depression Inventory,[45] or the Center for Epidemiological Studies Depression Scale.[46]
   (b) Adults with depression diagnosed using any other clinician-based diagnosis criterion.

Differences between the two types of participants were investigated in a subgroup analysis.

Studies involving participants with comorbid physical or mental disorders were eligible for inclusion, while studies that assessed depression as a comorbid symptom of a specific physical or mental disorder (e.g. depression in cancer patients) were excluded.

Types of Interventions.

Experimental.

1. Complex yoga interventions including physical exercise and at least one of the following: breath control, meditation, and/or lifestyle advice (based on yoga theory and/or traditional yoga practices).
2. Exercise-based yoga interventions (based on yoga theory and/or traditional yoga practices) without breath control, meditation, or lifestyle advice.
3. Yoga interventions including at least one of the following: breath control, meditation, and/or lifestyle advice (based on yoga theory and/or traditional yoga practices) without an exercise component.

Differences between the three types of experimental interventions were investigated in a subgroup analysis.

No restrictions were made regarding yoga tradition, length, frequency, or duration of the program. Studies allowing individual co-interventions besides the intervention that was formally included in the study were eligible.

While mindfulness-based stress reduction (MBSR) is rooted in Buddhist spiritual tradition, it has been developed in the USA as a highly structured secular behavioral medicine intervention.[47] MBSR is mainly based on mindfulness meditation; although gentle yoga postures are included in the MBSR program, they are only a minor part of the intervention.[47] Mindfulness-based cognitive therapy (MBCT) has been specifically developed for relapse prevention in major depression and combines MBSR with cognitive-behavioral techniques.[48] Therefore, it is normally regarded as part of the "third wave" of cognitive-behavioral therapy.[49] While there are conceptual and technical overlaps, MBSR and MBCT are mostly regarded as distinct from yoga and not normally included in reviews of yoga interventions.[19–24,50] On the other hand, reviews on mindfulness-based interventions normally do not include yoga interventions.[49,51–53] As the effects of those interventions on depression have been extensively reviewed,[49,52,53] studies on MBSR or MBCT for depression were excluded from this review.

Control. Studies comparing yoga to usual care or any active control intervention were eligible. Separate meta-analyses were conducted for different control conditions.

Types of Outcome Measures. For inclusion, RCTs had to assess at least one primary outcome:

1. Improvement in the severity of depression or symptoms of depression, measured by self-rating scales such as the Beck Depression Inventory,[45] or by clinician-rated scales, such as the Hamilton Rating Scale for Depression,[44] or any other validated scale.
2. Improvement in depression measured as the number of patients who reach remission as measured by Beck Depression Inventory,[45] Hamilton Rating Scale for Depression,[44] or any other validated depression scale.

Secondary outcomes included:

1. Improvement in anxiety symptoms, measured using clinician-rated scales, such as the Hamilton Anxiety Scale[54] or self-report scales, such as the Beck Anxiety Inventory[55] or any other validated scale.
2. Health-related quality of life, measured by any validated scale such as the Medical outcomes study short-form 36.[56]
3. Safety of the intervention assessed as number of adverse effects.

SEARCH METHODS

The following electronic databases were searched from their inception through January 17, 2013: Medline/PubMed, Scopus, the Cochrane Library, PsycINFO, and IndMED. The literature search was constructed around search terms for "yoga" and search terms for "depression." For PubMed, the following search strategy was used: *("Depression"[Mesh] OR "Depressive Disorder"[Mesh] OR depress*[Title/Abstract] OR dysthymi*[Title/ Abstract]) AND ("Yoga"[Mesh] OR yog*[Title/Abstract] OR asana*[Title/Abstract] OR pranayama[Title/Abstract] OR dhyana[Title/Abstract])*. The search strategy was adapted for each database as necessary. The System for Information on Grey Literature in Europe (http://www.opengrey.eu/), CAM-Quest (www.cam-quest.org), CAMbase (http://www.cambase.de), and ResearchGate (www.researchgate.net) were additionally searched to locate gray literature.

Reference lists of identified original articles or reviews were searched manually. Additionally, the tables of contents of the *International Journal of Yoga Therapy and the Journal of Yoga and Physical Therapy* were reviewed.

Abstracts identified during literature search were screened by two review authors independently. Potentially eligible articles were read in full by two review authors to determine whether they met the eligibility criteria. Disagreements were discussed with a third review author until consensus was reached. If necessary, additional information was obtained from the study authors.

DATA EXTRACTION AND MANAGEMENT

Data on patients (e.g. age, gender, diagnosis), methods (e.g. randomization, allocation concealment), interventions (e.g. yoga type, frequency, and duration), control interventions (e.g. type, frequency, duration), outcomes (e.g. outcome measures, assessment time points), and results were extracted by two authors independently using an a priori developed data extraction form. Discrepancies were discussed with a third review author until consensus was reached. If necessary, the study authors were contacted for additional information.

RISK OF BIAS IN INDIVIDUAL STUDIES

Risk of bias was assessed by two authors independently using the risk of bias tool proposed by the Cochrane Back Review Group.[57] This tool assesses risk of bias on the following domains: selection bias, performance bias, attrition bias, reporting bias, and detection bias using 12 criteria. For each criterion, risk of bias was assessed as (1) low risk of bias, (2) unclear, (3) high risk of bias. Conflicts of opinion were discussed with a third review author until consensus is reached. If necessary, additional information was retrieved from the study authors. Studies that met at least six of the 12 criteria and had no serious flaw were rated as having low risk of bias. Studies that met fewer than six criteria or had a serious flaw were rated as having high risk of bias.[57]

DATA ANALYSIS

Effects of yoga compared to different control interventions were analyzed separately as were short-term and long-term effects. Short-term outcomes were defined as outcome measures taken closest to 12 weeks after randomization and long-term outcomes as measures taken closest to 12 months after randomization.

Assessment of Overall Effect Size. Meta-analyses were conducted using Review Manager 5 software (Version 5.1, The Nordic Cochrane Centre, Copenhagen) if at least two studies assessing this specific outcome were available. As only a limited number of studies was expected to be eligible and random effects tests are regarded as only approximate if the number of studies is small,[58] a fixed effects model was used.

For continuous outcomes, standardized mean differences (SMD) with 95% confidence intervals (CIs) were calculated as the difference in means between groups divided by the pooled standard deviation.[41,59] Where no standard deviations were available, they were calculated from standard errors, CIs or *t*-values,[41] or attempts were made to obtain the missing data from the trial authors by email.

A negative SMD was defined to indicate beneficial effects of yoga compared to the control intervention for all outcomes (e.g. decreased depression) except for health-related quality of life where a positive SMD was defined to indicate beneficial effects (e.g. increased well-being). If necessary, scores were inverted by subtracting the mean from the maximum score of the instrument.[41]

Cohen's categories were used to evaluate the magnitude of the overall effect size with (1) SMD = 0.2 to 0.5: small; (2) SMD = 0.5 to 0.8: medium, and (3) SMD > 0.8: large effect sizes.[59] Levels of evidence were determined as (1) strong evidence: consistent findings among multiple RCTs with low risk of bias; (2) moderate evidence: consistent findings among multiple high-risk RCTs and/or one low-risk RCT;

(3) limited evidence: one RCT with high risk of bias; 4) conflicting evidence: inconsistent findings among multiple RCTs; and (5) No evidence: no RCTs.[60]

For dichotomous outcomes, risk ratios (RR) with 95% CI were calculated by dividing the risk of event in the experimental group (i.e. the number of participants with the respective outcome divided by the total number of participants) by the risk of event in the control group.[41]

ASSESSMENT OF HETEROGENEITY

Statistical heterogeneity between studies was analyzed using the I^2 statistics, a measure of how much variance between studies can be attributed to differences between studies rather than chance. The magnitude of heterogeneity was categorized as (1) I^2 = 0–24%: low heterogeneity; I^2 = 25–49%: moderate heterogeneity; I^2 = 50–74%: substantial heterogeneity; and I^2 = 75–100%: considerable heterogeneity.[41,61] The χ^2 test was used to assess whether differences in results are compatible with chance alone. Given the low power of this test when only few studies or studies with low sample size are included in a meta-analysis, a P-value $\leq$.10 was regarded to indicate significant heterogeneity.[41]

SUBGROUP AND SENSITIVITY ANALYSES

Subgroup analyses were conducted for:

1. Type of participants (patients with depressive disorders; individuals with elevated levels of depression).
2. Type of yoga intervention (complex; exercise-based; meditation-based).

To test the robustness of significant results, sensitivity analyses were conducted for studies with high versus low risk of bias. If statistical heterogeneity was present in the respective meta-analysis, subgroup and sensitivity analyses were also used to explore possible reasons for heterogeneity.

RISK OF BIAS ACROSS STUDIES

If at least 10 studies were included in a meta-analysis, funnel plots were generated using Review Manager 5 software. Funnel plots are scatter plots of the intervention effect estimates from individual studies against the studies' sample size.[41] As the precision of effect estimates normally increases with sample size, effect estimates from studies with smaller size will scatter more widely than those of larger studies. Unpublished smaller studies with nonsignificant results, i.e. publication bias, will therefore result in asymmetrical funnel plots.[41,62] Meta-analyses with substantial publication bias will likely overestimate the effect sizes.[41,62] Publication bias was assessed by visual analysis with roughly symmetrical funnel plots regarded to indicate low risk and asymmetrical funnel plots regarded to indicate high risk of publication bias.[36,52]

RESULTS

LITERATURE SEARCH

Nine hundred and sixty-three records were retrieved through the literature search; two additional records were retrieved from reference lists of identified original articles; and one additional record was retrieved from the *Journal of Physical Therapy and Yoga*. After exclusion of duplicates, 923 records were screened and 896 records were excluded because they were no RCTs, participants were not depressed, and/or yoga was not an intervention. Out of 27 full texts assessed for eligibility, 15 articles were excluded, because they were not randomized,[63–65] participants did not need to be depressed to be included,[66–75] or no relevant outcome measures were assessed.[76,77] Twelve full-text articles with a total of 619 patients were included in the qualitative analysis.[78–89] One RCT did not provide raw data of outcome measures; and these data could not be retrieved from trial authors.[78] Two RCTs had unique control groups that could not be compared to other RCTs in meta-analysis.[80,82] Finally, nine studies with 452 patients were included in the meta-analysis (Fig. 1).

STUDY CHARACTERISTICS

Characteristics of the sample, interventions, outcome assessment and results are shown in Table 1.

Setting and Participant Characteristics. Of the 12 RCTs that were included, six originated from Asia (five from India[78,82,83,85,87], and one from Iran[86]), five from North America (USA),[79–81,84,89] and one from Europe (UK).[88] Patients were recruited from psychiatric outpatient services,[78,87] psychiatric inpatient services,[82,85] local physicians and mental health professionals,[79] medical school prenatal ultrasound clinics,[80,81] community cultural centers for older women,[86] student hostels,[83] or by press releases.[79] Two RCTs did not report the setting patients were recruited from.[88,89] One study each included only older women,[86] female students,[83] or dementia caregivers[84]; and two studies included only women with prenatal depression.[80,81]

Six RCTs included patients with a DSM-IV diagnosis of a depressive disorder[79–82,85,87]; three of those included only patients with a major depression diagnosis.[82,85,87] Six RCTs included adults with elevated levels of depression diagnosed by the Hamilton Rating Scale for Depression,[82] the Clinical Interview Schedule,[88] the Beck Depression Inventory,[89] the Yesavage Geriatric Depression Scale,[86] the Amritsar Depressive Inventory and the Zung Depression Self Rating Scale,[83] or a clinician.[78]

Patients' mean age ranged from 21.5 years to 66.6 years with a median age of 33.7 years. Between 36.7 and 100.0% (median: 76.5%) of patients in each study were female. Race was reported in only one RCT.[80]

Intervention Characteristics. Three RCTs used complex yoga interventions including physical postures and either breathing exercises or meditation; one RCT each used the Inner Resources program,[79] laughter yoga,[87] and the Broota Relaxation Technique.[78] Four RCTs used exercise-based yoga interventions; one of those used Iyengar yoga,[89] the other three RCTs did not define the yoga form used.[80,81,88] The remaining five RCTs used yoga without physical component including Kirtan Kriya,[84] Sudarshan Kriya

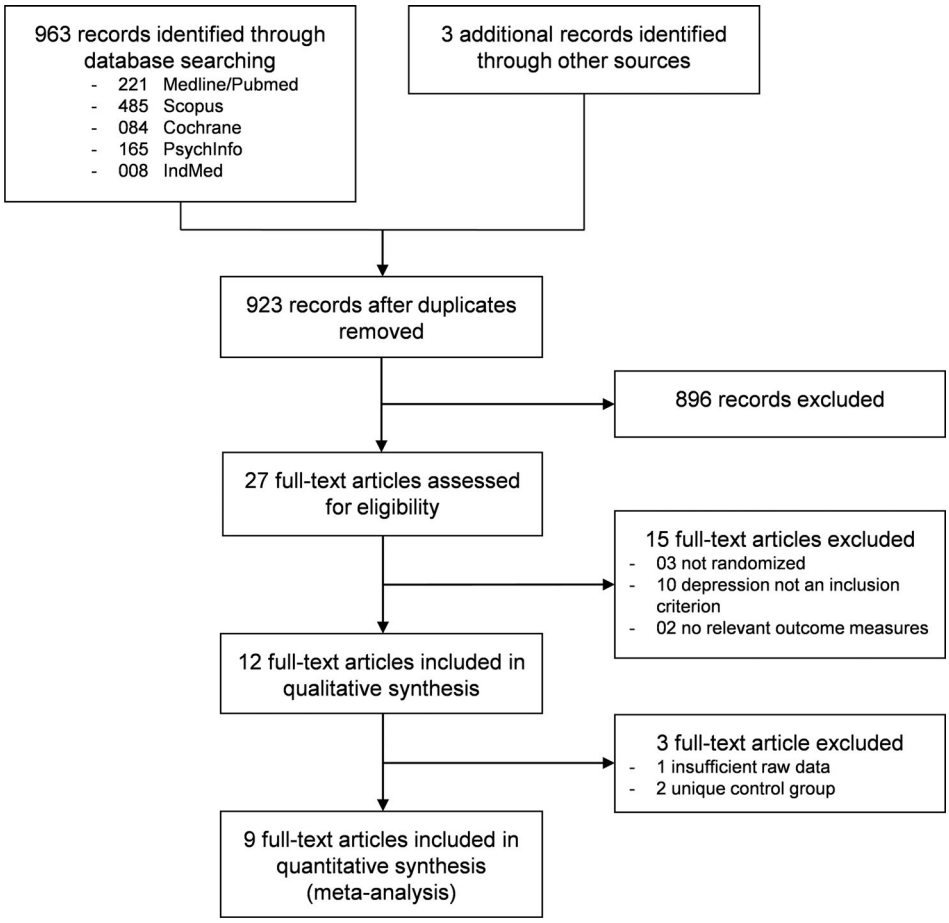

Figure 1. Flowchart of the results of the literature search.

Yoga,[82,85] Sahaj yoga meditation,[87] and Shavasana yoga.[83] The length of the programs ranged from 3 days to 12 weeks with a median of 8 weeks. Yoga was conducted by certified yoga teachers,[81,83,85,87,89] or clinical psychologists.[79] Four RCTs did not report the qualification of interventionists.[78,82,86,88]

Six RCTs compared yoga to no specific treatment, including no treatment,[83,89] standard care,[58] or a control group that was not further specified.[78,79,86] Four RCTs compared yoga to a relaxation intervention including progressive muscle relaxation,[78] listening to relaxation music,[71] partial Sudarshan Kriya Yoga,[85] and sitting quietly.[87] Two RCTs compared yoga to aerobic exercise including stretching and running.[86,88] One RCT each compared yoga to a pharmacological treatment,[82] group therapy with hypnosis,[79] unsupervised social support groups,[80] electroconvulsive therapy,[82] or massage.[81] Control interventions were conducted by licensed massage therapists,[81] psychiatrists,[79] clinical psychologists,[79] or yoga teachers.[85] Four RCTs did not report the qualification of interventionists.[78,82,86,88]

Antidepressant comedication was allowed in three RCTs[78,79,87]; any co-intervention in one RCT[86]; and no co-interventions in six RCTs.[78,80,82,83,85,89] Two RCTs did not report co-interventions.[81,86]

OUTCOME MEASURES

All 12 RCTs assessed severity of depression using the Beck Depression Inventory,[82,85,88,89] the Hamilton Rating Scale for Depression,[79,82,84,87] the Yesavage Geriatric Depression Scale,[86] the Cornell Dysthymia Rating Scale Self Report,[79] the Center for Epidemiological Studies Depression Scale,[80,81] the Clinical Interview Schedule,[88] the Zung Depression Self Rating Scale,[83] the Edinburgh Postnatal Depression Scale,[80] or an unvalidated symptom check list.[78] Remission rates were assessed by four RCTs.[79,82,83,87] Five RCTs assessed anxiety using the Beck Anxiety Inventory,[85] the Hamilton Anxiety Rating Scale,[82] or Spielberger's State Anxiety Inventory.[80,81,89] Health-related quality of life was assessed by one RCT using the Short Form 36 Health Survey mental component score.[84] While all RCTs reported short-term effects, only two RCTs also reported long-term effects.[79,80] No RCT reported safety data.

TABLE 1. Characteristics of the included studies

Reference	Patients (N, Diagnosis, Age)	Co-interventions	Intervention groups (program length, frequency, duration)		Followup	Outcome measures 1. Severity 2. Remission 3. Anxiety 4. Health-related quality of life 5. Safety	Results	
			Treatment	Control			Short term	Long term
Broota & Dir (1990) (78)	30 individuals with depression Diagnosed by clinician 19–49 years	Antidepressant medication	Broota Relaxation Technique 3 day session (breathing exercises, postures, autosuggestion)	1) Progressive muscle relaxation 3 day session 2) Control group Not specified	3 days	1) Symptom check list (no validated instrument)	1) Significant difference favoring Broota Relaxation Technique over control group	
Butler et al. (2008) (79)	52 individuals with depression DSM IV, ≥ 2 years without remission 50.4 ± 14.8 years	Antidepressant medication allowed, no psychotherapy	Mediation and Hatha Yoga 8 weeks, 1 × 2 hr/week, 1 × 4 hr retreat, 1 × 2 hr booster session in week 12 (meditation, postures, breathing exercises, mantra repetition, discussion) Home practice (6 × 30 min per week)	1) Group therapy with hypnosis 10 weeks, 1 × 1.5 hr/week, 1 × 2 hr booster session in week 12 (hypnosis, self-hypnosis, discussion) 2) Control group Not specified	1) 6 months 2) 9 months	1) HAM-D; CDRS-SR 2) MDE; Remission > 2 months	1) No significant group differences	1) No significant group differences 2) MDE: No significant group differences; Remission: Significant difference favoring yoga over control group
Field et al. (2012a) (80)	92 prenatally depressed females DSM IV Yoga: 24.4 years Support group: 24.5 years	None	Yoga 12 weeks, 1 × 20 min/week (postures)	Social support group 12 weeks, 1 × 20 min/week	1) 12 weeks 2) Postpartum	1) CES-D, EPDS 2) STAI	1) No significant group differences 2) No significant group differences	1) No significant group differences 2) No significant group differences
Field et al. (2012b) (81)	84 prenatally depressed females DSM IV; depression from onset of pregnancy or longer 26.6 years	Not specified	Yoga 12 weeks, 2 × 20 min/week (postures)	1) Massage 12 weeks, 2 × 20 min/week (head, back, legs, arms) 2) Standard prenatal care Not specified	12 weeks	1) CES-D 2) STAI	1) Significant difference favoring yoga over control group 2) Significant difference favoring yoga over control group	

TABLE 1. Continued

Reference	Patients (N, Diagnosis, Age)	Co-interventions	Intervention groups (program length, frequency, duration)		Followup	Outcome measures 1. Severity 2. Remission 3. Anxiety 4. Health-related quality of life 5. Safety	Results	
			Treatment	Control			Short term	Long term
Janakiramaiah et al. (2000) (82)	45 individuals with melancholic depression DSM IV, HRSD ≥ 17 SKY: 36.0 ± 7.8 years ECT: 36.7 ± 2.5 years IMN: 43.4 ± 11.9 years	None	Sudarshan Kriya Yoga (SKY) 4 weeks, 6 × 45 min/week (breathing exercises, meditation)	1. Electro-convulsive therapy (ECT) 4 weeks, 3×/week 2. Imipramin (IMN) 4 weeks, 1 × 150 mg/day	4 weeks	1) BDI; HAM-D 2) Remission	1) Significant difference favoring ECT over SKY 2) No significant group differences	
Khumar et al. (1993) (83)	50 female students with severe depression since 2–3 months ADI, ZGS, personal interview schedule 20–25 years	No other therapy allowed	Shavasana yoga 30 days, 30 min/day (Relaxation, breathing exercises)	Wait-list 30 days	30 days	1) ZGS 2) Free from symptoms of depression	1) Significant difference favoring yoga over wait-list 2) 11 students in the yoga group; 0 students in the wait-list group	
Lavretsky et al. (2012) (84)	49 family caretakers with mild-moderate depression HRSD between 5–17 60.3 ± 14.8 years	Not specified	Yogic meditation Kirtan Kriya 8 weeks, 7 × 12 min/week (Mudras, chanting, silent meditation, breathing meditation using a CD)	Relaxation music 8 weeks, 7 × 12 min/week (Instrumental music using a CD)	8 weeks	1) HAM-D 2) SF-36	1) Significant difference favoring yoga over relaxation (15 vs. 5 responders) 2) Significant difference favoring yoga over relaxation (12 vs. 3 responders)	

TABLE 1. Continued

Reference	Patients (N, Diagnosis, Age)	Co-interventions	Intervention groups (program length, frequency, duration)		Followup	Outcome measures 1. Severity 2. Remission 3. Anxiety 4. Health-related quality of life 5. Safety	Results	
			Treatment	Control			Short term	Long term
Rohini et al. (2000) (85)	30 individuals (18–60 years) with major depression DSM IV, HRSD ≥ 18 SKY: 29.5 ± 8.2 years Partial SKY: 34.2 ± 11.7 years	None	Sudarshan Kriya Yoga (SKY) 4 weeks (breathing exercises, meditation)	Partial Sudarshan Kriya Yoga (partial SKY) 4 weeks (breathing exercises, meditation)	4 weeks	1) BDI 2) BAI	1) No significant group differences 2) No significant group differences	
Shahidi et al. (2010) (86)	70 elderly (60–80 years) with depression GDS ≥ 10 66.56 years	Not specified	Laughter Yoga 10 × 30 min. (Stretching, yogic breathing, laughter)	1. Aerobic exercise 10 × 30 min. (jogging, stretching) 2. Control group Not specified	Not specified	1) GLS	1) Significant difference favoring yoga over control group; no difference between yoga and exercise	
Sharma et al. (2005) (87)	30 individuals (18–45 years) with major depression DSM IV Yoga: 31.87 ± 8.78 years Control group: 31.67 ± 8.46 years	Antidepressant medication	Sahaj yoga meditation 8 weeks, 3 × 30 min/week (meditation)	Control group 8 weeks, 3 × 30 min/week (sitting quietly)	8 weeks	1) HAM-D 2) Remission HAM-D 3) HAM-A	1) Significant difference favoring yoga over control group 2) Significant difference favoring yoga over control group 3) Significant difference favoring yoga over control group	

TABLE 1. Continued

Reference	Patients (N, Diagnosis, Age)	Co-interventions	Intervention groups (program length, frequency, duration)		Followup	Outcome measures 1. Severity 2. Remission 3. Anxiety 4. Health-related quality of life 5. Safety	Results	
			Treatment	Control			Short term	Long term
Veale et al. (1992) (88)	89 individuals (18–60 years) with depression CIS total score ≥ 17, CIS depression severity ≥ 2 35.5 years	Not specified	Low intensity exercise 12 weeks, 3×/week (relaxation, stretching, yoga)	High intensity aerobic exercise 12 weeks, 3×/week (warm up, stretching, running)	12 weeks	1) BDI, CIS 2) STAI-S	1) No significant group differences 2) No significant group differences	
Woolery et al. (2004) (89)	28 young adults (18–29 years) with mild depression BDI between 10–15 21.5 ± 3.23 years	No treatment	Iyengar Yoga 5 weeks, 2 × 1 hr/week (Postures)	Wait-list 5 weeks	5 weeks	1) BDI; POMS Depression 2) STAI; POMS anxiety	1) Significant difference favoring yoga 2) Significant difference favoring yoga	

Abbreviations: ADI: Amritsar Depressive Inventory; BAI: Beck Anxiety Inventory; BDI: Beck Depression Inventory; CES-D: Center for Epidemiological Studies Depression Scale; CIS: Clinical Interview Schedule; CDRS-SR: Cornell Dysthymia Rating Scale Self Report; EPDS: Edinburgh Postnatal Depression Scale; GDS: Geriatric Depression Scale; HAM-A: Hamilton Anxiety Rating Scale; HAM-D: Hamilton Rating Scale for Depression; MDE: major depressive episode; POMS: Profile Of Mood States; STAI: State-Trait Anxiety Inventory; STAI-S: Spielberger's State Anxiety Inventory; SF36: Short Form 36 Health Survey; ZGE: Zung Depression Scale.

RISK OF BIAS IN INDIVIDUAL STUDIES

Three RCTs had low risk of bias,[80,82,85] and nine RCTs had high risk of bias[78,79,81,83,84,86–89] (Table 2). Risk of selection bias generally was high as only three RCTs reported adequate random sequence generation[79,80,84]; and no RCT reported adequate allocation concealment. No RCT reported blinding of participants or providers; and only three RCTs reported adequate blinding of outcome assessors.[79,80,85] Co-interventions were adequately reported and comparable between groups in seven RCTs.[79–83,85,89] Attrition bias was high in most studies as only five RCTs had acceptable and described dropout rates[80,82–85]; and only three RCTs used an intention-to-treat analysis.[82,83,85]

ANALYSES OF OVERALL EFFECTS

Depression. Meta-analyses revealed moderate evidence for short-term effects of yoga compared to usual care on severity of depression (SM = −0.69; 95% CI −0.99 to −0.39; $P < .001$; heterogeneity: $I^2 = 86\%$; $\chi^2 = 28.81$; $P < .001$) (Fig. 2). Limited evidence for effects on severity of depression was found for yoga compared to relaxation (SMD = −0.62; 95% CI −1.03 to −0.22; $P = .003$; heterogeneity: $I^2 = 0\%$; $\chi^2 = 0.22$; $P = .90$) and aerobic exercise (SMD = −0.59; 95% CI −0.99 to −0.18; $P = .004$; heterogeneity: $I^2 = 68\%$; $\chi^2 = 3.08$; $P = .08$). Based on Cohen's categories, these effects were of medium size.

Single RCTs found no significant short-term group differences when comparing yoga to either group therapy,[79] social support groups,[80] massage,[81] or pharmacological treatment.[82] One RCT reported significant group differences favoring electroconvulsive therapy over yoga.[82]

At long-term follow-up, no significant group differences were found when comparing yoga to usual care,[79] group therapy,[79] or social support groups.[80]

Remission Rates. One RCT compared yoga to usual care and reported 11 patients that were free of symptoms of depression after the intervention compared to none in the control group at the short-term.[83] Another study found no significant short-term differences in remission rates when comparing yoga to pharmacological treatment and electroconvulsive therapy.[82] A third RCT reported significant short-term group differences favoring yoga over relaxation.[87]

At long-term follow-up, one RCT reported significantly higher remission rates in the yoga group than in the usual care group but no significant differences when comparing yoga to group therapy.[79]

Anxiety. No evidence for short-term effects on anxiety was found when comparing yoga to usual care (SMD = −0.00; 95% CI −0.44 to 0.44; $P = .99$; heterogeneity: $I^2 = 86\%$; $\chi^2 = 7.04$; $P = .008$). Limited evidence was found for short-term effects of yoga compared to relaxation on anxiety (SMD = −0.79; 95%CI −1.3, −0.26; $P = .004$; heterogeneity: $I^2 = 6\%$; $\chi^2 = 1.06$; $P = .30$).

TABLE 2. Risk of bias assessment of the included studies using the Cochrane Back Review Group risk of bias tool

Author, year \ Bias	Selection bias:			Performance bias:			Attrition bias:		Reporting bias:	Detection bias:		Total: (max. 12)[a]
	Adequate random sequence generation	Adequate allocation concealment	Similar baseline characteristics	Adequate participant blinding	Adequate provider blinding	Similar or no co-interventions	Acceptable compliance	Acceptable and described drop-out rate	Inclusion of an intention-to-treat analysis	No selective outcome reporting	Adequate outcome assessor blinding	Similar timing of outcome assessment	
Broota & Dir (1990)[78]	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	Unclear	No	No	Yes	Unclear	Yes	2
Butler et al. (2008)[79]	Yes	No	Unclear	Unclear	Unclear	Yes	Unclear	No	No	Yes	Yes	Yes	5
Field et al. (2012a)[80]	Yes	Unclear	Yes	Unclear	Unclear	Yes	Unclear	Yes	No	Yes	Yes	Yes	7
Field et al. (2012b)[81]	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	Yes	Unclear	Yes	4
Janakiramaiah et al. (2000)[82]	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	7
Khumar et al. (1993)[83]	Unclear	Unclear	Unclear	Unclear	Unclear	Yes	Unclear	Yes	Yes	Yes	Unclear	Yes	5
Lavretsky et al. (2012)[84]	Yes	Unclear	Yes	Unclear	Unclear	Unclear	Unclear	Yes	No	Yes	Unclear	Yes	5
Rohini et al. (2000)[85]	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	7
Shahidi et al. (2010)[86]	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	Unclear	No	No	Yes	Unclear	Unclear	2
Sharma et al. (2005)[87]	Unclear	Unclear	Yes	Unclear	Unclear	Unclear	Yes	Unclear	Unclear	No	Unclear	Yes	3
Veale et al. (1992)[88]	No	Unclear	Yes	Unclear	Unclear	Unclear	Unclear	No	No	Yes	Unclear	Yes	3
Woolery et al. (2004)[89]	Unclear	Unclear	Yes	Unclear	Unclear	Yes	Unclear	No	No	Yes	Unclear	Yes	4

[a] Higher scores indicate lower risk of bias.

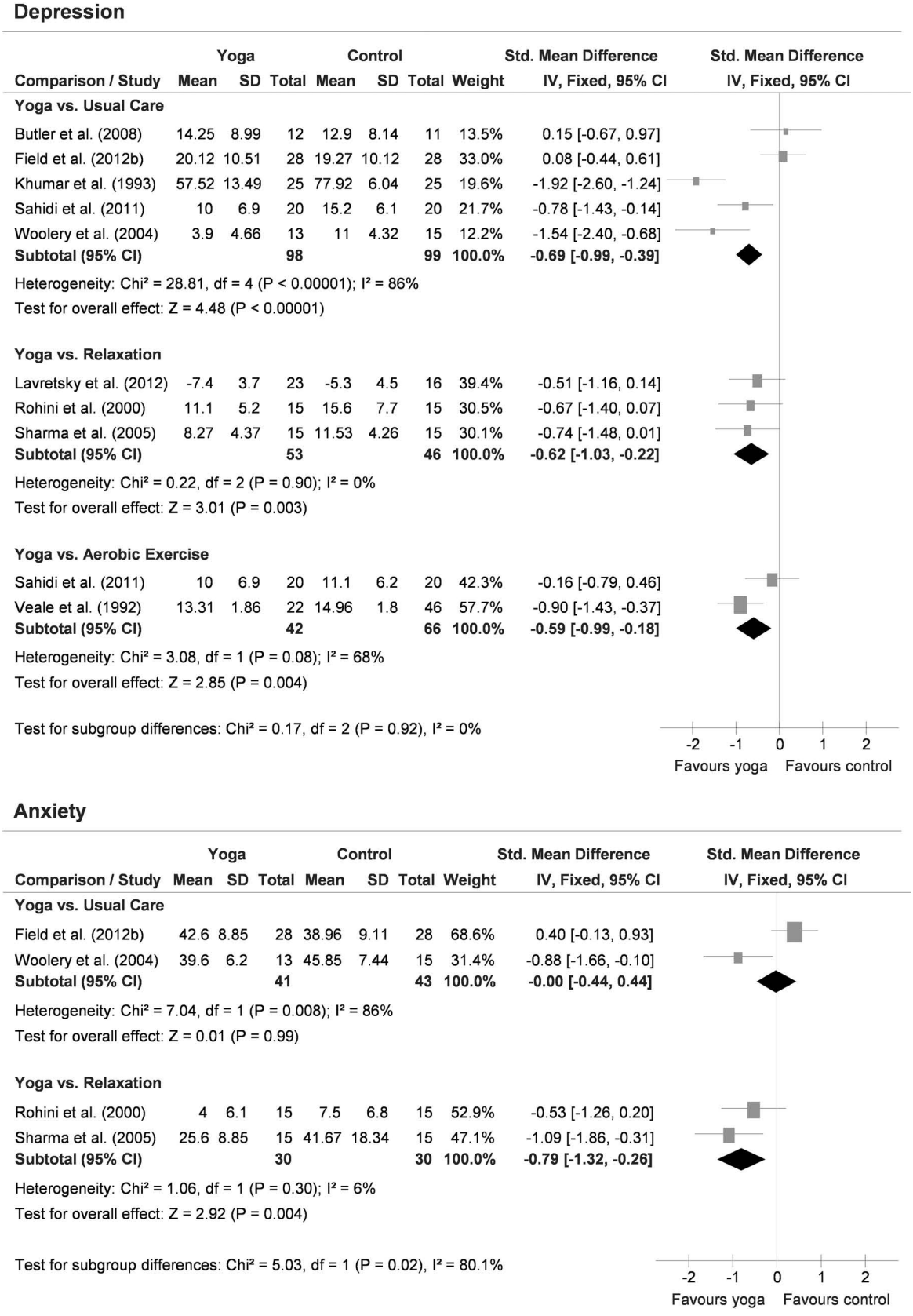

Figure 2. Forest plots of short-term effects of yoga on severity of depression and anxiety.

TABLE 3. Effect sizes of (A) different patient samples and (B) different yoga interventions

Outcome[a]	No. of studies	No. of patients (yoga)	No. of patients (control)	Standardized mean difference (95% confidence interval)	*P* (overall effect)	Heterogeneity I^2; χ^2; *P*
A) Patient sample						
Depressive disorder						
Depression						
Yoga vs. usual care	2	40	39	0.10 (−0.34; 0.54)	.65	0%; 0.02; .89
Yoga vs. relaxation	2	30	30	−0.70 (−1.22; −0.18)	.009	0%; 0.02; .90
Anxiety						
Yoga vs. relaxation	2	30	30	−0.79 (−1.32; −0.26)	.004	6%; 1.06; .30
Elevated levels of depression						
Depression						
Yoga vs. usual care	3	58	60	−1.37 (−1.78; −0.96)	<.001	66%; 5.86; .05
Yoga vs. aerobic exercise	2	42	66	−0.59 (−0.99; −0.18)	.004	68%; 3.08; .08
B) Yoga intervention						
Complex yoga interventions						
Depression						
Yoga vs. usual care	2	32	31	−0.42 (−0.93; 0.08)	.10	68%; 3.08 ; .08
Exercise-based yoga interventions						
Depression						
Yoga vs. usual care	2	41	43	−0.36 (−0.80; 0.09)	.12	90% ;9.93; .002
Anxiety						
Yoga vs. usual care	2	41	43	−0.00 (−0.44; 0.44)	.99	86%; 7.04; .008
Meditation-based yoga interventions						
Depression						
Yoga vs. relaxation	3	53	46	−0.62 (−1.03; −0.22)	.003	0%; 0.22; .90
Anxiety						
Yoga vs. relaxation	2	30	30	−0.79 (−1.32; −0.26)	.004	6%; 1.06; .30

[a]Outcomes are only shown if sufficient data for meta-analysis were available.

Single RCTs found no short-term group differences when comparing yoga to massage[81]; and no short- or long-term group differences when comparing yoga to social support groups.[80]

Health-Related Quality of Life. In one RCT, significantly more patients in the yoga group reported an improvement of 50% or greater on mental quality of life than in the relaxation control group.[84]

SUBGROUP ANALYSES

Type of Participants. In RCTs that included patients with depressive disorders diagnosed by DSM-IV, there was no evidence for short-term effects on severity of depression when comparing yoga to usual care. There was limited evidence for short-term effects on severity of depression and anxiety when comparing yoga to relaxation (Table 3). In RCTs that included individuals with elevated levels of depression, limited evidence for effects on severity of depression was found when comparing yoga to usual care or aerobic exercise (Table 3).

Type of Yoga Interventions. In RCTs that compared complex yoga interventions to usual care, no evidence for short-term effects on severity of depression was found (Table 3). In RCTs that compared exercise-based yoga interventions to usual care, there was no evidence for short-term effects on severity of depression or anxiety (Table 3). In RCTs that compared meditation- or breathing-based yoga interventions to relaxation, there was limited evidence for short-term effects on severity of depression and anxiety (Table 3).

SENSITIVITY ANALYSES

Sensitivity analyses demonstrated a significant short-term effect on severity of depression in RCTs with high risk of bias that compared yoga to usual care,[79,81,83,86,89] relaxation,[84,87] or aerobic exercise[86,88]; and one RCT with high risk of bias found significant group differences in anxiety favoring yoga over relaxation.[87] A single RCT with low risk of bias that compared yoga to relaxation found significant short-term effects on severity of depression and anxiety.[85]

RISK OF BIAS ACROSS STUDIES

As less than 10 studies were included in each meta-analysis, funnel plots were not analyzed.

DISCUSSION

SUMMARY OF EVIDENCE

In this systematic review of 12 studies on yoga for depression, limited-to-moderate evidence for short-term improvements in severity of depression and anxiety was found. A subgroup analysis revealed evidence of

effectiveness for studies on individuals with elevated levels of depression as well as for studies on patients with depressive disorders. However, a further subgroup analysis found evidence only for studies with meditation-based yoga interventions but not for studies with complex or exercise-based yoga interventions. Only sparse evidence was found for effects on remission rates or health-related quality of life. Effects of yoga were comparable to that of pharmacological treatment, group therapy, social support groups, and massage. No RCT reported adverse events; therefore the safety of yoga in this patient population cannot be evaluated. However, prior systematic reviews of yoga interventions in other conditions found no evidence for severe adverse events.[19–24,90]

AGREEMENTS WITH PRIOR SYSTEMATIC REVIEWS

The results of this review are in line with those of prior qualitative reviews on yoga for depression: an early systematic review that included RCTs that were published before 2005 concluded that yoga might be effective for depressive disorders but that the findings must be interpreted with caution due to heterogeneity of yoga interventions and poor methodological reporting.[91] Another more recent qualitative review also found evidence of effectiveness of yoga for both major depression and other mood disorders.[92] This review concluded that yoga should be considered a treatment option for affective disorders but that more RCTs were needed. Another prior qualitative review on yoga for depression concluded that yoga might be effective in improving depression in individuals with major depression or elevated levels of depression but that methodological drawbacks and heterogeneity of yoga interventions hindered definite conclusions.[93] More specifically, this review asked to investigate the contribution of physical postures, breathing exercises, and meditation to the overall effect of yoga.[93] No prior review included a meta-analysis and/or subgroup analyses.

EXTERNAL AND INTERNAL VALIDITY

Patients with diagnosed depressive disorders in the included studies were recruited from psychiatric inpatient and outpatient services, physicians, and mental health professionals in North America and Asia. Participants with elevated levels of depression were recruited from somatic clinics, cultural centers for older women, and student hostels in North America, Europe, and Asia, and included participants from the general population, prenatal women,[80,81] older women,[86] caregivers,[84] and students.[83] The majority of patients were females and in the reproductive age range. Four RCTs specifically included only women.[80,81,83,86] The results of this review therefore seem to be applicable to the vast majority of patients with depressive disorders in clinical practice. Applicability might however be limited for males.

All but three RCTs[80,82,85] had high risk of bias. Most importantly, no RCT reported adequate allocation concealment. As it has been demonstrated that inadequate allocation concealment is the most important source of bias in RCTs,[94] this strongly limits the interpretability of results. High risk of attrition and performance bias further limits the quality of evidence found in this review. The evidence for reduced severity of depression and anxiety was present in studies with high risk of bias as well as in the only study with low risk of bias that could be included in the meta-analyses. Therefore, the effects found in this review seem to be robust against potential methodological bias. However, more studies with low risk of bias are necessary before firm conclusions can be drawn.

STRENGTHS AND WEAKNESSES

This is the first meta-analysis available on yoga for depression. Subgroup analyses were conducted to assess the effects of different forms of yoga, and in different participant groups. The applicability of the results[95] was assessed. No language restrictions were imposed.

The primary limitation of this review is the low methodological quality of the included RCTs. As prior reviews have concluded,[92,93] the interpretation of the findings is clearly limited due to the insufficient reporting of research methodology. As only two RCTs reported longer-term effects, the results of this review are only applicable to the short-term. As no RCT reported safety adverse events, the preplanned analysis of safety of yoga interventions in this patient population could not be conducted. Forms and intensity of yoga interventions were heterogeneous. While subgroup analyses were conducted to analyze effectiveness of different yoga forms, the small number of RCTs in each subgroup limits their expressiveness. The exclusion of studies on MBSR and MBCT could be regarded as a further limitation. Although mindfulness-based interventions are mostly excluded from systematic reviews on yoga interventions and vice versa, the distinction between mindfulness (Buddhist) meditation and yogic meditation could be regarded as artificial.

IMPLICATIONS FOR FURTHER RESEARCH

In line with prior reviews,[91,93] the interpretability of evidence found in this meta-analysis is limited by the low methodological quality of the included studies. Future RCTs should ensure rigorous methodology and reporting, mainly adequate sample size, adequate randomization, allocation concealment, intention-to-treat analysis, and blinding of at least outcome assessors.[96] As exercise seems to be an effective means to improve depressive symptoms in depressed individuals and patients with depressive disorders[97,98] it is somewhat surprising that complex and exercise-based yoga interventions seem to be less effective in this patient population than meditation-based yoga interventions. It might be worthwhile to directly compare different yoga forms to eliminate possibly confounding context effects in this comparison. Further RCTs that compare

yoga to standard intervention for depression such as psychotherapy or pharmacotherapy seem warranted.

IMPLICATIONS FOR CLINICAL PRACTICE

Yoga, in particular meditation-based yoga forms seem to be effective for treating depression. While the low methodological quality of the included studies limits the interpretability of the results and safety of the intervention remains unclear, yoga, especially meditation-based yoga forms, could be considered an ancillary treatment option for patients with depressive disorders and individuals with elevated levels of depression.

Acknowledgments. This review was supported by a grant from the Rut- and Klaus-Bahlsen Foundation. The funding source had no influence on the design or conduct of the review; the collection, management, analysis, or interpretation of the data; or in the preparation, review, or approval of the manuscript.

REFERENCES

1. Ferrari AJ, Somerville AJ, Baxter AJ, et al. Global variation in the prevalence and incidence of major depressive disorder: a systematic review of the epidemiological literature. Psychol Med 2012:1–11.
2. Rucci P, Gherardi S, Tansella M, et al. Subthreshold psychiatric disorders in primary care: prevalence and associated characteristics. J Affect Disord 2003;76:171–181.
3. Broadhead WE, Blazer DG, George LK, Tse CK. Depression, disability days, and days lost from work in a prospective epidemiologic survey. JAMA 1990;264:2524–2528.
4. Hybels CF, Blazer DG, Pieper CF. Toward a threshold for subthreshold depression: an analysis of correlates of depression by severity of symptoms using data from an elderly community sample. Gerontologist 2001;41:357–365.
5. Spitzer RL, Kroenke K, Linzer M, et al. Health-related quality of life in primary care patients with mental disorders. Results from the PRIME-MD 1000 Study. JAMA 1995;274:1511–1517.
6. Karsten J, Hartman CA, Smit JH, et al. Psychiatric history and subthreshold symptoms as predictors of the occurrence of depressive or anxiety disorder within 2 years. Br J Psychiatry 2011;198:206–212.
7. National Center for Complementary and Alternative Medicine. What Is Complementary and Alternative Medicine? 2011. Available at: http://nccam.nih.gov/health/whatiscam.
8. Bertisch SM, Wee CC, Phillips RS, McCarthy EP. Alternative mind–body therapies used by adults with medical conditions. J Psychosom Res 2009;66:511–519.
9. Barnes PM, Bloom B, Nahin RL. Complementary and Alternative Medicine Use Among Adults and Children: United States, 2007. Natl Health Stat Report 2008:1–23.
10. Lovisi GM. Do the effects of yoga therapy improve positive and negative symptoms and emotion recognition abilities in antipsychotic-stabilized patients with schizophrenia? Acta Psychiatr Scand 2011;124:234–235.
11. Verma AK, Basu D. Does yoga therapy actually improve the emotion recognition deficits in schizophrenia? Acta Psychiatr Scand 2011;124:234.
12. Landers SJ. Alternative therapy use documentated in new survey. Am Med News 2009.
13. Iyengar BKS. Light on Yoga. New York, NY: Schocken Books; 1966.
14. Feuerstein G. The Yoga Tradition. Prescott, AZ: Hohm Press; 1998.
15. Yogi Hari. Hatha Yoga Pradipika. Miramar, FL: Nada Productions, Inc.; 2006.
16. Büssing A, Edelhäuser F, Weisskircher A, et al. Inner correspondence and peacefulness with practices among participants in eurythmy therapy and yoga: a validation study. Evid Based Complement Alternat Med 2011;2011:329023.
17. Cramer H, Lauche R, Haller H, et al. "I'm more in balance." A qualitative study of yoga for patients with chronic neck pain. J Altern Complement Med 2013;19:536–542.
18. Smith KB, Pukall CF. An evidence-based review of yoga as a complementary intervention for patients with cancer. Psychooncology 2009;18:465–475.
19. Cramer H, Lange S, Klose P, et al. Yoga for breast cancer patients and survivors: a systematic review and meta-analysis. BMC Cancer 2012;12:412.
20. Cramer H, Lauche R, Langhorst J, Dobos G. Effectiveness of yoga for menopausal symptoms—a systematic review and meta-analysis of randomized controlled trials. Evid Based Complement Alternat Med 2012;2012:863905.
21. Büssing A, Ostermann T, Lüdtke R, Michalsen A. Effects of yoga interventions on pain and pain-associated disability: a meta-analysis. J Pain 2012,13:1–9.
22. Li AW, Goldsmith CA. The effects of yoga on anxiety and stress. Altern Med Rev 2012;17:21–35.
23. Vancampfort D, Vansteelandt K, Scheewe T, et al. Yoga in schizophrenia: a systematic review of randomised controlled trials. Acta Psychiatr Scand 2012;126:12–20.
24. Cramer H, Lauche R, Klose P, et al. Yoga for schizophrenia: a systematic review and meta-analysis. BMC Psychiatry 2013;13:32.
25. Syvälahti EK. Biological aspects of depression. Acta Psychiatr Scand Suppl. 1994;377:11–15.
26. Kalueff AV, Nutt DJ. Role of GABA in anxiety and depression. Depress Anxiety 2007;24:495–517.
27. Streeter CC, Gerbarg PL, Saper RB, et al. Effects of yoga on the autonomic nervous system, gamma-aminobutyric-acid, and allostasis in epilepsy, depression, and post-traumatic stress disorder. Med Hypotheses 2012;78:571–579.
28. Kjaer TW, Bertelsen C, Piccini P, et al. Increased dopamine tone during meditation-induced change of consciousness. Brain Res Cogn Brain Res 2002;13:255–259.
29. Streeter CC, Whitfield TH, Owen L, et al. Effects of yoga versus walking on mood, anxiety, and brain GABA levels: a randomized controlled MRS study. J Altern Complement Med 2010;16:1145–1152.
30. Devi SK, Chansauria JPN, Udupa KN. Mental depression and Kundalini yoga. Anc Sci Life 1986;6:112–118.
31. Carroll BJ, Iranmanesh A, Keenan DM, et al. Pathophysiology of hypercortisolism in depression: pituitary and adrenal responses to low glucocorticoid feedback. Acta Psychiatr Scand 2012;125:478–491.
32. Thase ME, Jindal R, Howland RH. Biological aspects of depression. In: Gotlib IH, Hammen C, editors. Handbook of Depression. New York, NY: Guilford Press; 2002:192–218.
33. Vreeburg SA, Hoogendijk WJ, van Pelt J, et al. Major depressive disorder and hypothalamic-pituitary-adrenal axis activity: results from a large cohort study. Arch Gen Psychiatry 2009;66:617–626.
34. Jarcho MR, Slavich GM, Tylova-Stein H, et al. Dysregulated diurnal cortisol pattern is associated with glucocorticoid resistance in women with major depressive disorder. Biol Psychol 2013;93:150–158.

35. Gartside SE, Leitch MM, McQuade R, Swarbrick DJ. Flattening the glucocorticoid rhythm causes changes in hippocampal expression of messenger RNAs coding structural and functional proteins: implications for aging and depression. Neuropsychopharmacology 2003;28:821–829.
36. Chong CS, Tsunaka M, Tsang HW, et al. Effects of yoga on stress management in healthy adults: a systematic review. Altern Ther Health Med 2011;17:32–38.
37. Vedamurthachar A, Janakiramaiah N, Hegde JM, et al. Antidepressant efficacy and hormonal effects of Sudarshana Kriya Yoga (SKY) in alcohol dependent individuals. J Affect Disord 2006;94:249–253.
38. Vadiraja HS, Raghavendra RM, Nagarathna R, et al. Effects of a yoga program on cortisol rhythm and mood states in early breast cancer patients undergoing adjuvant radiotherapy: a randomized controlled trial. Integr Cancer Ther 2009;8:37–46.
39. Banasik J, Williams H, Haberman M, et al. Effect of Iyengar yoga practice on fatigue and diurnal salivary cortisol concentration in breast cancer survivors. J Am Acad Nurse Pract 2011;23: 135–142.
40. Moher D, Liberati A, Teztlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Ann Intern Med 2009;51:1–7.
41. Higgins JPT, Green S, eds. Cochrane Handbook for Systematic Reviews of Interventions. West Sussex, UK: Wiley; 2010.
42. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders – DSM-IV-TR, 4th edition. Washington, DC: American Psychiatric Association; 2000.
43. World Health Organization. The ICD-10 Classification of Mental and Behavioural Disorders – Diagnostic Criteria for Research. Geneva, Switzerland: World Health Organization; 1993.
44. Hamilton M. A rating scale for depression. J Neurol Neurosurg Psychiatr 1960;23:56–62.
45. Beck AT, Ward CH, Mendelson M, et al. An inventory for measuring depression. Arch Gen Psychiatry 1961;4:561–71.
46. Roberts RE, Vernon SW. the center for epidemiologic studies depression scale: its use in a community sample. Am J Psychiatr 1983;140:41–46.
47. Kabat-Zinn J. Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness. New York, NY: Delta Trade Paperback/Bantam Dell; 1990.
48. Teasdale JD, Segal ZV, Williams JM, et al. Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. J Consult Clin Psychol 2000;68:615–623.
49. Churchill R, Moore THM, Davies P, et al. Mindfulness-based 'third wave' cognitive and behavioural therapies versus treatment as usual for depression. Cochrane Database Syst Rev 2010;9:CD008705.
50. McCall MC, Ward A, Roberts NW, Heneghan C. Overview of systematic reviews: yoga as a therapeutic intervention for adults with acute and chronic health conditions. Evid Based Complement Alternat Med 2013;2013:945895.
51. Khoury B, Lecomte T, Fortin G, et al. Mindfulness-based therapy: a comprehensive meta-analysis. Clin Psychol Rev 2013;33:763–771.
52. Piet J, Hougaard E. The effect of mindfulness-based cognitive therapy for prevention of relapse in recurrent major depressive disorder: a systematic review and meta-analysis. Clin Psychol Rev 2011;31:1032–1040.
53. Merchand WR. Mindfulness meditation practices as adjunctive treatments for psychiatric disorders. Psychiatr Clin North Am 2013;36:141–152.
54. Hamilton M. The assessment of anxiety states by rating. Br J Med Psychol 1959;32:50–55.
55. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. J Consult Clin Psychol 1988;56:893–897.
56. Ware JE, Snow KK, Kosinski M, Gandek B. SF-36® Health Survey Manual and Interpretation Guide. Boston, MA: New England Medical Center, The Health Institute; 1993.
57. Furlan AD, Pennick V, Bombardier C, van Tulder M; Editorial Board, Cochrane Back Review Group. 2009 updated method guidelines for systematic reviews in the Cochrane Back Review Group. Spine 2009;34:1929–1941.
58. Hedges LV, Vevea JL. Fixed- and random-effects models in meta-analysis. Psychological Methods 1998;3:486–504.
59. Cohen J. Statistical Power Analysis for the Behavioral Sciences. Hillsdale, MI: Lawrence Erlbaum Associates; 1988.
60. van Tulder M, Furlan A, Bombardier C, et al. Updated method guidelines for systematic reviews in the cochrane collaboration back review group. Spine 2003;28:1290–1299.
61. Higgins JP, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. BMJ 2003;327:557–560.
62. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ 1997;315:629–634.
63. Ghooshchy, S.G., Jahromi, M.K. Comparison of influence of aerobic exercise, in water walking and yogic exercise, on 3-methoxy-4-hydroxy phenyl glycol-sulfate in depressed girls. Procedia Soc Behav Sci 2010;5:958–961.
64. Smith JA, Greer T, Sheets T, Watson S. Is there more to yoga than exercise? Altern Ther Health Med 2011;17:22–29.
65. Janakiramaiah N, Gangadhar, BN, Nagavenkatesha Murthy PJ, et al. Therapeutic efficacy of Sudarshan Kriya Yoga (SKY) in dysthymic disorder. NIMHANS J 1998;17:21–28.
66. Franzblau, S.H., Echevarria, S., Smith, M., Van Cantfort, T.E. A preliminary investigation of the effects of giving testimony and learning yogic breathing techniques on battered women's feelings of depression. J Interpers Violence 2008;23:1800–1808.
67. Rani K, Tiwari S, Singh U, et al. Yoga Nidra as a complementary treatment of anxiety and depressive symptoms in patients with menstrual disorder. Int J Yoga 2012;5:52–56.
68. Chen KM, Chen MH, Chao HC, et al. Sleep quality, depression state, and health status of older adults after silver yoga exercises: cluster randomized trial. Int J Nurs Stud 2009;46:154–163.
69. Chen KM, Chen MH, Lin MH, et al. Effects of yoga on sleep quality and depression in elders in assisted living facilities. J Nurs Res 2010;18:53–61.
70. Javnbakht M, Hejazi Kenari R, Ghasemi M. Effects of yoga on depression and anxiety of women. Complement Ther Clin Pract 2009;15:102–104.
71. Kozasa EH, Santos RF, Rueda AD, et al. Evaluation of Siddha Samadhi Yoga for anxiety and depression symptoms: a preliminary study. Psychol Rep 2008;103:271–274.
72. Krishnamurthy MN, Telles S. Assessing depression following two ancient Indian interventions: effects of yoga and ayurveda on older adults in a residential home. J Gerontol Nurs 2007;33:17–23.
73. Vedamurthachar A, Janakiramaiah N, Hegde JM, et al. Antidepressant efficacy and hormonal effects of Sudarshana Kriya Yoga (SKY) in alcohol dependent individuals. J Affect Disord 2006;94:249–253.
74. Platania-Solazzo A, Field TM, Blank J, et al. Relaxation therapy reduces anxiety in child and adolescent psychiatric patients. Acta Paedopsychiatr 1992;55:115–120.
75. Blumenthal JA, Emery CF, Madden DJ, et al. Long-term effects of exercise on psychological functioning in older men and women. J Gerontol 1991;46:P352–P361.

76. Sharma VK, Das S, Mondal S, et al. Effect of Sahaj Yoga on neurocognitive functions in patients suffering from major depression. Indian J Physiol Pharmacol 2006;50:375–383.
77. Sharma, V.K., Das, S., Mondal, S., Goswami, U. Effect of Sahaj yoga on autonomic functions in healthy subjects and patients of major depression. Biomedicine 2008;28:139–141.
78. Broota A, Dir R. Efficacy of two relaxation techniques in depression. J PersClin St 1990;6:83–90.
79. Butler LD, Waelde LC, Hastings TA. Meditation with yoga, group therapy with hypnosis, and psychoeducation for long-term depressed mood: a randomized pilot trial. J Clin Psychol 2008;64:806–820.
80. Field T, Diego M, Delgado J, Medina L. Yoga and social support reduce prenatal depression, anxiety and cortisol. J Yoga Phys Ther 2012;2:124.
81. Field T, Diego M, Hernandez-Reif M, et al. Yoga and massage therapy reduce prenatal depression and prematurity. J Bodyw Mov Ther 2012;16:204–109.
82. Janakiramaiah N, Gangadhar BN, Naga Venkatesha Murthy PJ, et al. Antidepressant efficacy of Sudarshan Kriya Yoga (SKY) in melancholia: a randomized comparison with Electroconvulsive Therapy (ECT) and imipramine. J Affect Disord 2000;57:255–259.
83. Khumar SS, Kaur P, Kaur S. Effectiveness of Shavasana on depression among university students. Indian J Clin Psychol 1993; 20:82–87.
84. Lavretsky H, Epel ES, Siddarth P, et al. A pilot study of yogic meditation for family dementia caregivers with depressive symptoms: effects on mental health, cognition, and telomerase activity. Int J Geriatr Psychiatry 2013;28:57–65.
85. Rohini V, Pandey RS, Janakiramaiah N, et al. A comparative study of full and partial Sudarshan Kriya Yoga (SKY) in major depressive disorder. NIMHANS J 2000;18:53–57.
86. Shahidi M, Mojtahed A, Modabbernia A, et al. Laughter yoga versus group exercise program in elderly depressed women: a randomized controlled trial. Int J Geriatr Psychiatry 2011;26:322–327.
87. Sharma VK, Das S, Mondal S, et al. Effect of Sahaj Yoga on depressive disorders. Indian J Physiol Pharmacol 2005;49:462–468.
88. Veale D, Le Fevre K, Pantelis C, et al. Aerobic exercise in the adjunctive treatment of depression: a randomised controlled trial. J Roy Soc Med 1992;85:541–544.
89. Woolery A, Myers H, Sternlieb B, Zeltzer L. A yoga intervention for young adults with elevated symptoms of depression. Altern Ther Health Med 2004;10:60–63.
90. Cramer H, Lauche R, Haller H, Dobos G. A systematic review and meta-analysis of yoga for low back pain. Clin J Pain 2013;29:450–460.
91. Pilkington K, Kirkwood G, Rampes H, Richardson J. Yoga for depression: the research evidence. J Affect Disord 2005;89:13–24.
92. Meyer HB, Katsman A, Sones AC, et al. Yoga as an ancillary treatment for neurological and psychiatric disorders: a review. J Neuropsychiatry Clin Neurosci 2012;24:152–164.
93. Uebelacker LA, Epstein-Lubow G, Gaudiano BA, et al. Hatha yoga for depression: critical review of the evidence for efficacy, plausible mechanisms of action, and directions for future research. J Psychiatr Pract 2010;16:22–33.
94. Schulz KF, Chalmers I, Hayes RJ, Altman DG. Empirical evidence of bias: dimensions of methodological quality associated with estimates of treatment effects in controlled trials. JAMA 1995;273:408–412.
95. Gartlehner G. Assessment of adverse effects and applicability two areas not (yet) covered adequately in Cochrane reports. Z Evid Fortbild Qual Gesundhwes 2008;102:497–502.
96. Schulz KF, Altman DG, Moher D, CONSORT Group. CONSORT 2010 statement: updated guidelines for reporting parallel group randomized trials. Ann Intern Med 2010;152:726–732.
97. Krogh J, Nordentoft M, Sterne JA, Lawlor DA. The effect of exercise in clinically depressed adults: systematic review and meta-analysis of randomized controlled trials. J Clin Psychiatry 2011;72:529–538.
98. Bridle C, Spanjers K, Patel S, et al. Effect of exercise on depression severity in older people: systematic review and meta-analysis of randomised controlled trials. Br J Psychiatry 2012;201:180–185.