



# Effect of Yoga in the Therapy of Irritable Bowel Syndrome: A Systematic Review

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**BACKGROUND & AIMS:** This review aims to systematically survey the effects of yoga on symptoms of irritable bowel syndrome (IBS), pain, quality of life, mood, stress, and safety in patients with IBS.

**METHODS:** MEDLINE/Pubmed, Scopus, the Cochrane Library, CAM-QUEST, CAMbase, and IndMED were screened through November 2015. Randomized controlled trials comparing yoga with usual care, nonpharmacologic, or pharmacologic interventions were analyzed for patients with IBS. Primary outcomes included gastrointestinal symptoms, quality of life, and pain. Anxiety, mood, and safety were defined as secondary outcomes. Risk of bias was assessed according to the Cochrane Collaboration recommendations.

**RESULTS:** Six randomized controlled trials with a total of 273 patients were included in the qualitative analysis. There was evidence for a beneficial effect of a yogic intervention over conventional treatment in IBS, with significantly decreased bowel symptoms, IBS severity, and anxiety. Furthermore, there were significant improvements in quality of life, global improvement, and physical functioning after yoga compared with no treatment. Two randomized controlled trials reported safety data stating that no adverse events occurred. Overall, risk of bias of the included studies was unclear.

**CONCLUSIONS:** The findings of this systematic review suggest that yoga might be a feasible and safe adjunctive treatment for people with IBS. Nevertheless, no recommendation can be made regarding yoga as a routine intervention for patients with IBS because of major flaws in study methods. More research is needed with respect to a high-quality study design and consensus in clinical outcome measurements in IBS. [ClinicalTrials.gov](http://ClinicalTrials.gov) number, NCT02721836.

*Keywords:* Irritable Bowel Syndrome; IBS; Yoga; Review.

**See editorial on page 1732.**

Irritable bowel syndrome (IBS) is a condition characterized by the following symptoms: abdominal pain, often in combination with constipation or diarrhea, bloating, and changes in stool appearance. Aggravation of symptoms is frequently reported after meals, which are not limited to the lower abdominal tract but can also include nausea, belching, and pyrosis.<sup>1,2</sup> Although pathophysiological diagnostics are lacking for most cases, patients suffer from abdominal pain and comorbidities that have a strong impact on life quality.<sup>3,4</sup> It is the most common functional gastrointestinal (GI) disorder with worldwide prevalence rates ranging from 9% to 23%, it accounts for up to 12% of total visits to primary care providers, and with up to 70% it is the most common disorder diagnosed by gastroenterologists.<sup>4,5</sup> The current diagnosis of IBS is based on Rome-III criteria,<sup>1,2</sup> which states the following

criteria that have to be met: recurrent abdominal pain or discomfort associated with 2 or more of the following:

- Improvement of discomfort with defecation
- Onset associated with a change in frequency of stool
- Onset associated with a change in form (appearance) of stool
- Change in passage (sensation of incomplete defecation or need of pushing)

**Abbreviations used in this paper:** GI, gastrointestinal; IBS, irritable bowel syndrome; MBSR, mindfulness-based stress reduction; NRS, Numeric Rating Scale; RCT, randomized controlled trial.

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- e) Appearance of mucus in stool, often accompanied by bloating

Symptoms have to be present for the last 3 months on at least 3 days/month with a symptom onset of at least 6 months before diagnosis. Furthermore, other diseases that might result in such symptoms must be excluded: chronic inflammatory diseases, neoplasia, or infectious diseases. Such organic diseases are often associated by signs of other diseases than IBS including sudden weight loss, blood in stool, and fever.

Yoga is a part of the ancient Indian philosophy, which dates back more than 5000 years.<sup>6</sup> Yoga has evolved with a focus on physical practice with a strong connection to the traditional Indian medicine system, called Ayurveda (“the science of life”).<sup>6</sup> Yoga has been adapted as a method in complementary medicine and is practiced especially in terms of prevention and therapy of diseases.<sup>7</sup> Yoga traditionally consists of body postures (Sanskrit: asanas), breathing exercises (pranayama), and meditation (dyana). The goal of practicing yoga asanas focuses on strengthening of muscle tissues and nervous system, while reaching a balance of body and mind.<sup>8</sup>

Different theories have been developed to explain the origin of IBS, such as visceral hypersensitivity and psychosocial factors (eg, disturbed stress regulation),<sup>3,9</sup> and autonomic nervous system dysfunction seems to be involved in the pathophysiology of IBS.<sup>10</sup> Psychiatric comorbidities are common as well and need particular consideration.<sup>11</sup> One explanation, as demonstrated by an increasing quantity of preclinical literature, is the finding of bidirectional signaling between the brain and the gut, which has led to the suggestion that both play an equivalent role in the pathophysiology of psychiatric disorders or in chronic abdominal pain syndromes, such as IBS.<sup>12-16</sup> It is hypothesized that Yoga practice corrects underactivity of the parasympathetic nervous system induced by stress<sup>17</sup> and it has been proven to be effective in the reduction of stress and psychological disorders in different patient populations.<sup>18-23</sup> These factors play an important role in the onset and persistence of IBS, suggesting that yoga may be efficacious in improving IBS symptoms. The purpose of this review is to examine the efficacy and safety of yoga as a treatment for patients with IBS.

## Methods

PRISMA guidelines for systematic reviews<sup>24</sup> and the recommendations of the Cochrane Collaboration<sup>25</sup> were followed.

### Eligibility Criteria

**Types of studies.** Randomized controlled trials (RCTs) and randomized crossover studies were eligible, only if they were published as full paper.

**Types of participants.** Adults and adolescents with IBS were eligible if they were diagnosed by Rome

criteria<sup>1,2</sup> or any other clinician-based diagnosis criterion. Studies involving participants with comorbid physical or mental disorders were eligible for inclusion.

### Types of Interventions

**Experimental.** Yoga interventions including at least 1 of the following were eligible: physical activity, breath control, meditation, and/or lifestyle advice (based on yoga theory and/or traditional yoga practices). No restrictions were made regarding yoga tradition, length, frequency, or duration of the program. Studies on multimodal interventions, such as mindfulness-based stress reduction (MBSR) and mindfulness-based cognitive therapy (that include yoga among others),<sup>26</sup> were excluded. Cointerventions were allowed if all groups received comparable cointerventions.

**Control.** This consisted of usual care or standard care, pharmacologic interventions, and exercise or other active nonpharmacologic interventions.

### Types of Outcome Measures

To be eligible, RCTs had to assess at least 1 of the following primary outcomes: (1) improvement in the severity of symptoms of IBS, measured by patient-rated scales, such as the Irritable Bowel Syndrome–Severity Scoring System,<sup>27</sup> or any other validated scale; (2) pain or disability measured through means, such as a Numeric Rating Scale (NRS); or (3) improvement in quality of life or well-being measured by any validated scale, such as the Health-Related Quality of Life–Short Form-36,<sup>28</sup> the Irritable Bowel Syndrome Quality of Life questionnaire,<sup>29</sup> or Functional Disability Index.<sup>30</sup>

Secondary outcomes included (1) stress, measured by any validated scale, such as the Cohen Perceived Stress Scale<sup>31</sup>; (2) anxiety, depression, or fatigue measured by any validated scale, such as Hospital Anxiety and Depression Scale or Fatigue Impact Scale<sup>32,33</sup>; and (3) safety of the intervention assessed as number of patients with adverse events or side effects.

### Search Methods

MEDLINE/Pubmed, Scopus, the Cochrane Library, CAM-QUEST, CAMbase, and IndMED were searched from their inception through November 2, 2015. The literature search was constructed around search terms for “yoga,” “pranayama,” “asana,” and search terms for “irritable bowel syndrome.” For PubMed, the following search strategy was used: (“Yoga”Mesh OR “Yoga”Title/Abstract OR “Yogic”Title/Abstract) OR “Pranayam\*”Title/Abstract) OR “Asana\*”Title/Abstract) AND (“irritable bowel syndrome”Mesh OR “irritable bowel”Title/Abstract OR “IBS”Title/Abstract). The search strategy was adapted for each database as necessary.

Additionally, reference lists of identified original articles or reviews and the tables of contents of the

*International Journal of Yoga Therapy*, the *Journal of Yoga & Physical Therapy*, and the *International Scientific Yoga Journal SENSE* were searched manually. Abstracts identified during literature search were screened by 2 review authors independently. Potentially eligible articles were read in full by 2 review authors to determine whether they met 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 (eg, age, diagnosis), methods (eg, randomization, allocation concealment), interventions (eg, yoga type, frequency, and duration), control interventions (eg, type, frequency, duration), cointerventions, outcomes (eg, outcome measures, assessment time points), and results were extracted independently by 2 authors 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

Two authors independently assessed risk of bias using the risk of bias tool proposed by the Cochrane Collaboration.<sup>25</sup> This tool assesses risk of bias on the following domains: selection bias, performance bias, attrition bias, reporting bias, detection bias, and other bias. Risk of bias was assessed for each criterion as (1) low risk of bias, (2) unclear, and (3) high risk of bias. Discrepancies were discussed with a third review author until consensus was reached.

## Results

### Literature Search

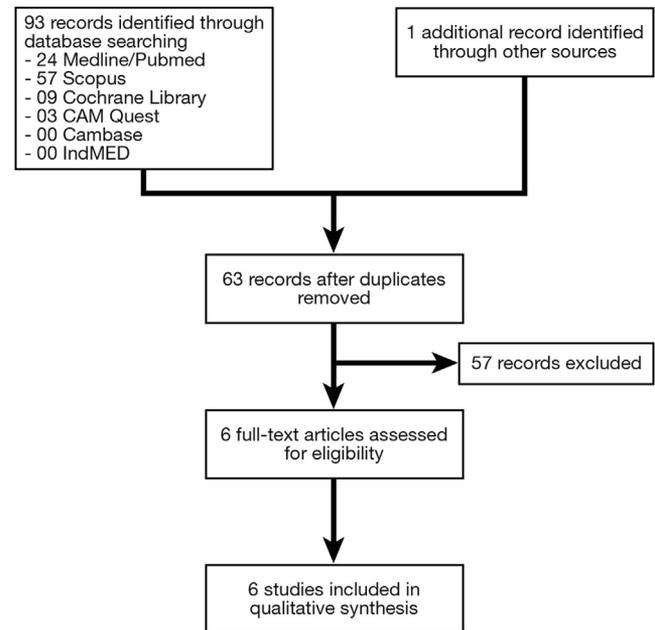
The literature search retrieved 93 records; 1 additional record was retrieved through other sources. Sixty-three nonduplicate records were screened and 57 records were excluded because they did not fulfill RCT design and/or yoga was not an intervention (Figure 1). Six full-text articles (RCTs) with a total of 273 patients were included in qualitative analysis.<sup>34–39</sup>

### Study Characteristics

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

### Setting and Participant Characteristics

Of the 6 RCTs that were included, 2 originated from India<sup>37</sup> and 4 from North America (3 from United



**Figure 1.** Flowchart of the results obtained from literature search.

States<sup>34,35,38</sup> and 1 from Canada<sup>36</sup>). Patients were recruited from gastroenterology clinics<sup>34–36,39</sup>; psychiatry offices<sup>35</sup>; and/or Internet announcements, flyers, and primary care physicians.<sup>34,36,38</sup> Patients in 1 RCT were diagnosed with IBS according to Rome-I criteria,<sup>36</sup> in 1 RCT according to Rome-II criteria,<sup>39</sup> and patients in 3 RCTs were diagnosed according to Rome-III criteria<sup>34,35,38</sup> (1 of those RCT further included patients with a diagnosis of having recurrent abdominal pain).<sup>34</sup> The remaining RCT relied on clinical and laboratory diagnosis only.<sup>37</sup> Symptoms had to be present for more than 3 months in 1 RCT<sup>39</sup> and for more than 6 months in the others. Patients in all RCTs were allowed to continue symptomatic medical treatment. Patients' mean age ranged from 14.2 years to 44.1 years with a median age of 32.5 years. Between 0.0% and 89.0% (median, 71.4%) of patients in each study were female.

### Intervention Characteristics

Yoga was based on the yoga module developed by research associates of Vivekananda Yoga Research Foundation in 1 RCT<sup>35</sup>; on the principles of the Hatha Yoga Pradipika in 1 RCT<sup>37</sup>; and 1 RCT did not follow a certain school, but instead selected the yoga exercises based on a review of different yogic literature.<sup>39</sup> In 1 RCT Hatha and Iyengar yoga tradition were merged. The remaining 2 RCTs based their yoga intervention on Iyengar yoga.<sup>34,38</sup> All yoga programs included yoga postures. Breath control was instructed in 3 RCTs,<sup>35,36,39</sup> and meditation was an additional part of 1 RCT.<sup>35</sup> Program length and intensity varied (Table 1), and asanas were taught by certified yoga teachers in 4 of the

Table 1. Characteristics of the Included Studies

Reference	Country of origin	Sample Sample size; mean age; gender; ethnicity; diagnostic criteria	Intervention Intervention; program length; frequency; duration; components	Control group Intervention; program length; frequency; duration	Follow-up Outcome assessment: postintervention and longest follow-up	Outcome measures	Results Yoga compared with control group
						<ol style="list-style-type: none"> <li>1. Gastrointestinal symptoms</li> <li>2. Pain</li> <li>3. Life quality</li> <li>4. Anxiety</li> <li>5. Mood (stress, depression, fatigue)</li> <li>6. Safety</li> </ol>	
Evans et al, 2014	United States	Sample size: n = 76 (yoga n = 39; control n = 37) Mean age: adolescents, age 14–17 and young adults, age 18–26; yoga 19.00 ± 3.70; control 19.00 ± 4.20 Gender: 60 f, 16 m Ethnicity: NR Diagnostic criteria: recurrent abdominal pain or IBS Rome-III pediatric criteria for adolescents and Rome-III adult criteria for young adults	Yoga (Iyengar) 6 weeks 2 × per week 90 min each  Asanas Certified Iyengar teacher	Usual care	6 weeks 14 weeks	<ol style="list-style-type: none"> <li>1. CSI subscale, GIS, weekly NRS</li> <li>2. Abdominal pain, NRS</li> <li>3. SF-36, FDI</li> <li>4. NA</li> <li>5. BSI-18; FACIT</li> <li>6. Adverse events</li> </ol>	Significant group differences reported by young adults in IBS symptoms, psychological distress, and fatigue and for adolescents in physical functioning in favor of yoga; no statistically significant differences on abdominal pain or physical functioning; 1 yoga-related adverse event occurred.
Kavuri et al, 2015	United States	Sample size: n = 97 (yoga n = 33; combination group n = 33; control n = 31) Mean age: yoga 44.17 ± 13.51, control 45.08 ± 13.28 Gender: 84 f, 13 m Ethnicity: NR Diagnostic criteria: Rome-III	Yoga (Hatha) 12 weeks 3 × per week 60 min  Asanas, Pranayama, Dhyana, relaxation; certified yoga instructor	<ol style="list-style-type: none"> <li>1. Usual care</li> <li>2. Yoga intervention: 2 groups: a) medi- cation allowed as needed, b) reduced medica- tion &lt;3 × per week</li> </ol>	12 weeks	<ol style="list-style-type: none"> <li>1. IBS-SSS, IBS-GAI</li> <li>2. NA</li> <li>3. IBS-QOL</li> <li>4. HADS-A</li> <li>5. HADS-D</li> <li>6. Adverse events</li> </ol>	Significant improvements in IBS-SSS and IBS-QOL scores in yoga and combination groups when compared with wait-list control group. Also, HADS, ASS, IBS-GAI, physical flexibility, and autonomic functions were significantly improved. Adverse events were assessed but not reported accordingly.

Table 1. Continued

Reference	Country of origin	Sample Sample size; mean age; gender; ethnicity; diagnostic criteria	Intervention Intervention; program length; frequency; duration; components	Control group Intervention; program length; frequency; duration	Follow-up Outcome assessment: postintervention and longest follow-up	Outcome measures	Results Yoga compared with control group
						1. Gastrointestinal symptoms 2. Pain 3. Life quality 4. Anxiety 5. Mood (stress, depression, fatigue) 6. Safety	
Kuttner et al, 2006	Canada	Sample size: n = 28 (yoga n = 14; control n = 11) Mean age: adolescents age 11–18; yoga 14.36 ± 2.10; control 13.83 ± 1 .89 Gender: 20 f, 8 m Ethnicity: white 23, First Nations 1, Asian 1, Indo-Canadian 1 Diagnostic criteria: Rome-I	Yoga (Iyengar/Hatha) 4 weeks 1 h instructional session once Home practice from a 10-min yoga video 1 × per day  Asanas, Pranayama, Certified Hatha and Iyengar teacher	Usual care	4 weeks	1. Blanchard and Scharff checklist 2. NRS, pain scoping questionnaire 3. FDI 4. Revised Child Manifest Anxiety Scale 5. Children's- Depression- Inventory Short Form 6. NR	No significant differences between groups. Only after the wait list control group participated in the yoga intervention and the data of the 2 yoga groups were combined, adolescents had significantly lower scores for gastrointestinal symptoms and emotion- focused avoidance following the yoga intervention. Reporting of adverse events was lacking.
Madhu et al, 1988	India	Sample size: n = 15 (yoga n = 5; medical treatment n = 5; placebo n = 5) Mean age: 18–50 years Gender: 15 m Ethnicity: NR Diagnostic criteria: GI symptoms, hemogram, urine analysis, stool examination, sigmoidoscopy, rectal biopsy, barium enema, fecal fat estimation, plain radiographs of chest and abdomen	Yoga (Hatha) 3 months 1 × per day 30 min each  Asanas, Teacher NR	1. Medical treatment (propranolol, 15 mg 3 × per day; diazepam, 5 mg 2 × per day; psyllium husk, 2–3 tsp/day) 2. Placebo, 3 capsules with glucose, 100 mg/day	3 months	1. Scoring system; myoelectrical activity; Motility Index (MI) 2. NA 3. NA 4. NA 5. NA 6. NA	Two-thirds of the patients showed considerable clinical improvement in symptoms with no statistical difference among medical control, placebo, and yoga group. Adverse events were not assessed.

Shahabi et al, 2015	United States	Sample size: n = 35 (yoga n = 23; control n = 13) Mean age: 36.30 ± 12.80 years (yoga 34.7 ± 11.7; control 39.0 ± 15.0) Gender: 3 m, 25 f Yoga 11.8% m, 88.2% f; control 10% m, 90% f Ethnicity: NR Diagnostic criteria: Rome-III	Yoga (Iyengar) 8 weeks 2 × per week 60 min each  Asanas, Certified Iyengar teacher	Walking program 8 weeks 2 × per week 60 min each	8 weeks 6 months	1. NRS, VSI, PHQ-15 2. NRS 3. NA 4. STAI (PANAS-X); VSI 5. Negative affect 6. NR	No significant effect on IBS severity (overall GI and abdominal pain severity on NRS). Within-group analysis showed significant decreases in IBS severity for yoga. Walking showed significant decreases in overall GI symptoms and state anxiety. At 6-month follow-up, overall GI symptoms for walking continued to significantly decline, whereas for yoga, GI symptoms rebounded toward baseline levels. A report of adverse events was missing.
Taneja et al, 2004	India	Sample size: n = 22 (yoga n = 9; control n = 13) Mean age: 30.90 ± 6.79 years Gender: 22 m Ethnicity: NR Diagnostic criteria: Rome-II, IBS-D	Yoga (asanas based on a review of yogic literature) 8 weeks 2 × per day Duration NR  Asanas, Pranayama, Teacher NR	Loperamide (2–6 mg/ day)	2 months	1. Autonomic symptom score; Talley's Bowel Disease Questionnaire/ Bowel Habit Score; EGG, ECG, respiration 2. NA 3. NA 4. STAI 5. Parasympathetic reactivity 6. NR	Both conventional and yoga intervention showed a significant decrease of bowel symptoms and state anxiety, indicating a beneficial effect of yoga intervention over conventional treatment in diarrhea-predominant IBS. Reporting of adverse events was lacking.

BSI-18, Brief Symptom Inventory 18; CSI, Child Somatization Inventory; ECG, electrocardiography; EGG, surface electrogastrography; FACIT, Functional Assessment of Chronic Illness Therapy Fatigue Subscale; FDI, Functional Disability Index; GIS, Global Improvement Scale; HADS-A, Hospital Anxiety and Depression Scale (anxiety related); HADS-D, Hospital Anxiety and Depression Scale (depression related); IBS-D, diarrhea predominant IBS; IBS-GAI, IBS Global Assessment of Improvement; IBS-QOL, Irritable Bowel Syndrome Quality of Life questionnaire; IBS-SSS, IBS Symptom Severity Scale; NA, not assessed; NR, not reported; PANAS-X, Positive And Negative Affect Schedule; PHQ-15, Patient Health Questionnaire-15; PSQI, Pittsburgh Sleep Quality Index; SF-36, Health-Related Quality of Life Short Form-36; STAI, state and trait anxiety inventory; VSI, Visceral Sensitivity Index; WMF, Weekly Monitoring Form.

studies,<sup>34–36,38</sup> whereas the other 2 gave no further information about the instructors.<sup>37,39</sup> Three RCTs compared yoga with no treatment.<sup>34–36</sup> Two of those further divided the yoga intervention group. Kavuri et al<sup>35</sup> allowed patients in 1 part of the yoga intervention group to continue with their medication as needed (combined group) and the other group was advised to restrict medication to at most three times a week (yoga group). Kuttner et al<sup>36</sup> divided the yoga intervention group according to age specified as adolescents (14–17 years) and young adults (18–26 years). One study compared yoga with pharmacologic intervention.<sup>39</sup> One 3-arm RCT compared yoga with pharmacologic care and placebo,<sup>37</sup> whereas 1 RCT examined yoga versus a walking program.<sup>38</sup> The exercise intervention was matched to the yoga intervention in terms of frequency, length, and duration and was led by physical trainers.

Methods for assessing outcome measures symptoms of IBS are shown in Table 1. For GI symptoms a checklist by Blanchard and Scharff,<sup>36</sup> Child Somatization Inventory, Global Improvement Scale and Bowel Symptom Score developed by Talley,<sup>39</sup> NRS,<sup>34,38</sup> Scoring system,<sup>37</sup> Irritable Bowel Syndrome–Severity Scoring System,<sup>35</sup> and Global Assessment Of Improvement<sup>35</sup> were used. Shahabi et al<sup>38</sup> further checked physical symptoms through the Patient Health Questionnaire-15. Quality of life was assessed in 2 studies using the Health-Related Quality of Life–Short Form-36<sup>34</sup> and the Irritable Bowel Syndrome Quality of Life questionnaire.<sup>35</sup> Pain was measured by 3 RCTs using NRS.<sup>34,36,38</sup> Anxiety was assessed in 5 RCTs using the Revised Child Manifest Anxiety Scale,<sup>36</sup> State and Trait Anxiety Inventory,<sup>38,39</sup> or Hospital Anxiety and Depression Scale.<sup>35</sup> Depression was assessed through Children’s Depression Inventory Short Form,<sup>36</sup> positive and negative affect schedule-X,<sup>38</sup> or a subscale of Hospital Anxiety and Depression Scale.<sup>35</sup> Evans et al<sup>34</sup> measured depression and stress with the Brief Symptom Inventory-18, and fatigue through the Functional Assessment of Chronic Illness Therapy Fatigue Subscale. Although all RCTs reported short-term to medium-term effects (up to 6 months postintervention), no RCT reported long-term effects.

### *Risk of Bias in Individual Studies*

Risk of bias in individual studies is shown in Figure 2. Three studies reported adequate random sequence generation<sup>34–36</sup>; none of the studies, however, reported adequate allocation concealment or blinding of participants and personnel. Blinding of outcome assessment was sufficient in 1 study.<sup>35</sup> Four RCTs were free of suspected selective reporting,<sup>35–39</sup> but 1 RCT was of high risk.<sup>34</sup> High risk also had to be considered concerning performance bias,<sup>34,38</sup> incomplete outcome data,<sup>34,38</sup> and for other bias<sup>35,38</sup> for 2 studies, respectively. Three other RCTs, however, received a low-risk rating regarding attrition bias.<sup>36,37,39</sup>

## Outcomes

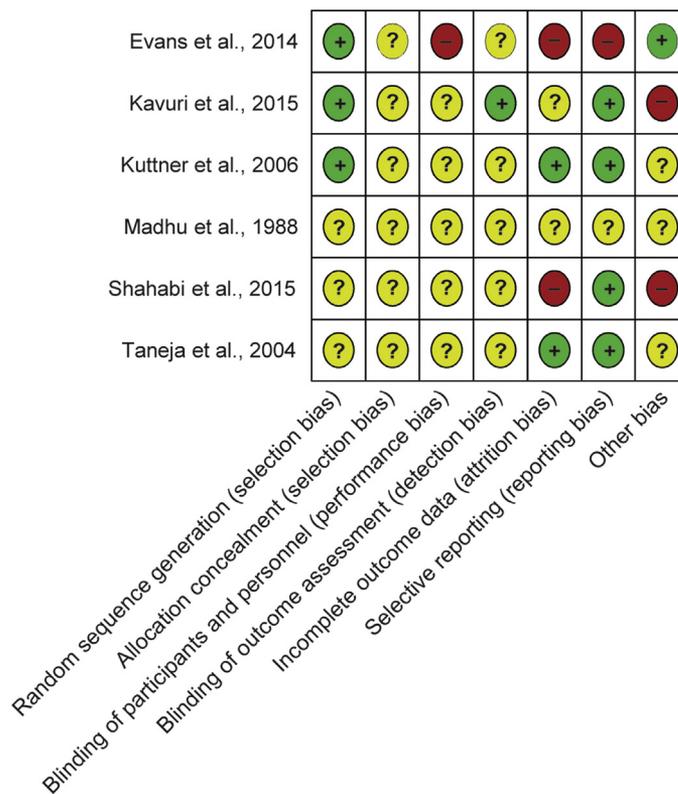
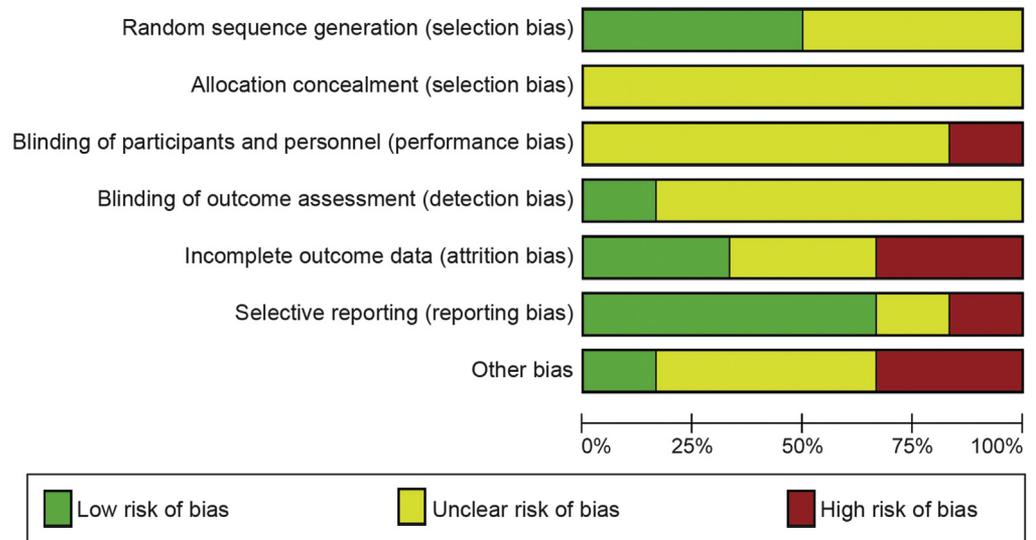
### *Yoga Versus No Treatment*

Kavuri et al<sup>35</sup> reported significant improvements in IBS symptom severity and IBS-related quality of life in yoga and combination groups when compared with wait-list control group. Furthermore, improvement in anxiety and depression scores, IBS Global Assessment of Improvement, and autonomic functions were observed, which correlated with a reduction in the amount of medicine and supplement use (psyllium, fiber drinks, herbal teas, and probiotics) in the yoga and combination groups.

According to Kuttner et al,<sup>36</sup> adolescents who received the yoga intervention tended to report lower levels of functional disability and anxiety than adolescents in the control group. There were no group differences in depression or overall GI symptoms. Pain was assessed but postintervention results were not displayed because of group differences in baseline levels between control and yoga. Evans et al<sup>34</sup> reported adolescents assigned to yoga stated significantly improved physical functioning relative to control subjects, whereas young adults assigned to yoga reported significantly improved IBS symptoms, global improvement, disability, psychological distress, sleep quality, and fatigue. For young adults, global improvement, worst pain, constipation, and nausea were significantly improved postyoga, but only global improvement, worst pain, and nausea maintained at the 2-month follow-up. According to IMMPACT guidelines, approximately one-third of participants in the yoga group reported clinically significant improvement in IBS symptoms. Evans et al<sup>34</sup> found no significant group differences in pain on the NRS. They reported that 44% of adolescents experienced a reduction of at least 1 point on the NRS, and 46% of young adults experienced a reduction of at least 1.74 points on the NRS for abdominal pain, which is a minimally clinically significant difference, but no group differences were calculated for minimally clinically significant difference. No evidence was found for short-term effects of yoga compared with no treatment on anxiety. Evans et al<sup>34</sup> also found no significant evidence for short-term effects on fatigue.

### *Yoga Versus Exercise*

Shahabi et al<sup>38</sup> compared a walking program with a yoga intervention. There were no significant group differences between yoga and walking groups. Exploratory analysis of within-group treatment effects showed significant differences in abdominal pain, overall GI symptoms, visceral sensitivity, and severity of somatic symptoms for yoga. Significant differences in overall GI symptoms, negative affect, and state anxiety were observed in the walking group. When comparing yoga with exercise, there was a significant group by time interaction for intermediate-term effects. Specifically, mean of overall GI



**Figure 2.** Risk of bias for each criterion for each included study (top) and risk of bias for each criterion presented as percentages across all included studies (bottom).

symptoms for yoga rose from posttreatment to 6-month follow-up, whereas for walking, mean of overall GI symptoms continued to drop from posttreatment to 6 months.

### Yoga Versus Medication

Two RCTs compared yoga with pharmacologic intervention.<sup>37,39</sup> Overall, Taneja et al<sup>39</sup> found no significant difference between control group (loperamide, 2–6 mg/day) and yoga group with respect to bowel symptom scores, state anxiety scores, and gastric motility. Similarly, no group differences emerged for other measures of autonomic reactivity. In a 3-arm study Madhu et al<sup>37</sup> also

found no difference between groups comparing yoga with medical treatment including 2–3 tablespoons psyllium husk, 1 tablet propantheline (15 mg) 3 times a day, and 1 tablet diazepam (5 mg) twice a day. After 3 months of treatment 3 of 5 patients on medical therapy and 3 of 5 on yoga showed >50% improvement in their symptoms.

### Yoga Versus Placebo

Madhu et al<sup>37</sup> also compared yoga with placebo treatment, but found no differences between groups; a 3 of 5 on yoga and 4 of 5 on placebo showed >50% improvement in their symptoms.

## Safety

Two studies reported adverse events.<sup>34,35</sup> Evans et al<sup>34</sup> reported a participant slipping while in headstand and hitting his knee, but the event was self-limited and did not stop the participant from practicing yoga. Kavuri et al<sup>35</sup> recorded 3 patients in the yoga group with temporarily aggravated lower back pain. A further incident of a cardiac arrest resulted in death of 1 participant in the control group. Apparently other self-limited adverse events were mentioned; however, group allocation was not mentioned for these participants.<sup>35</sup>

## Discussion

### *Summary of Evidence and Implications for Clinical Practice*

In this systematic review of 6 randomized trials on yoga for IBS, evidence for beneficial effects of yoga on GI symptoms, quality of life, and anxiety was found when compared with no treatment. Individual studies reported considerable effects on IBS-related symptoms in favor of yoga compared with control group; and yoga also seems to be equally effective as a walking program in improving patient-reported outcomes. Nevertheless some limitations need to be taken into account. Applicability seems to be an important factor concerning regular home practice. In the case of Iyengar yoga, the help of props is often required and the emphasis lies on correct alignment, which usually requires supervision. Furthermore, less focus is put on relaxation during classes. In contrast to yoga, mean of overall GI symptoms in the walking group continued to drop from posttreatment to 6 months, which can be related to the fact that the percentage of participants who reported regular home practice at 6 months was significantly greater for those in walking (75%) than in yoga (25%). It should be considered that yoga has occasionally been associated with serious adverse events in case studies.<sup>40</sup> However, no serious adverse events were observed during yoga practice in this review, which is in line with previous cross-sectional studies<sup>20,41</sup> and systematic reviews of yoga interventions in other patient populations that found no evidence for serious yoga-associated adverse events.<sup>18,19,21</sup> Thus, yoga seems to be a promising and safe treatment for people with IBS supporting recent evidence in multiple studies, suggesting that exercise has a positive effect on IBS-associated symptoms.<sup>42,43</sup> Nevertheless, no recommendations can be made to practice yoga for the relief of IBS symptoms based on this review because of the wide methodological heterogeneity of the studies and mostly unclear risk of bias of the included studies. However, its practice need not be discouraged in this patient population, especially when they believe that it benefits their health, quality of life, or IBS-related comorbidities.

## *Agreements With Prior Systematic Reviews*

To best of our knowledge this is the first systematic review specifically investigating yoga practice in IBS. One descriptive review on yoga for IBS was available, which concluded that the essential components of a yoga module for IBS should include postures, breathing, and meditation and should be designed to be easily practiced by most patients, with least complications.<sup>44</sup> This review included 2 RCTs that were also included in our review<sup>36,39</sup> and a trial that observed that any moderate physical activity 3 times a week ranging from 20 to 60 minutes improved symptom severity of IBS when compared with nonactive control subjects.<sup>43</sup> A long-term follow-up also showed improvement in disease-specific quality of life, fatigue, depression, and anxiety.<sup>42</sup> Another systematic review of 8 studies on the effectiveness of yoga for the treatment of anxiety and anxiety disorders reported positive results.<sup>45</sup> Nevertheless, because of the many methodological inadequacies, diversity of conditions treated, and poor quality of most of the studies, no conclusion could be drawn for yoga to be effective in treating anxiety or anxiety disorders in general.<sup>45</sup> One multimodality approach that also comprises yoga elements, meditation techniques, and breathing exercises is MBSR. A systematic review investigating whether MBSR is effective in improving physical health outcomes for long-term physical conditions included 15 studies, finding some preliminary evidence that MBSR might be effective in improving IBS.<sup>26</sup> Similarly, a systematic review on relaxation therapy for patients with IBS showed that IBS symptoms decreased significantly, whereas symptom severity and anxiety decreased because of relaxation therapies without being statistically significant. However, these results need to be interpreted with caution because of the small number of studies examined and associated methodological problems.<sup>41</sup>

## *External and Internal Validity*

Mainly patients from Asia and people of mixed ethnicities from North America were included. Given that there is no convincing evidence of a difference between western and developing countries in the cause of IBS,<sup>46</sup> these findings might not be limited to geographic regions. Because female patients represented most participants, the results might not be fully applicable to male patients. It has to be added, however, that eastern and western countries show a female predominance or no gender difference in the prevalence of IBS.<sup>46</sup> Two studies did not or only partially use Rome criteria as a standard for eligibility.<sup>34,37</sup> This further limits applicability of the results.

Overall, risk of bias of the included studies was unclear. Only 1 study reported adequate blinding of outcome assessment.<sup>35</sup> High risk was found in 1 study

for performance bias<sup>38</sup> and for reporting bias,<sup>34</sup> in 2 studies for attrition bias<sup>34,38</sup> and other bias,<sup>35,38</sup> respectively. It is noted that the blinding of participants and personnel form an inevitable issue in RCTs investigating yoga interventions. Nevertheless, the observed studies lacked sufficient description of methods, such as adequate random sequence generation and allocation concealment. Moreover selective reporting and high dropout rates represented an issue.

### *Strengths and Weaknesses*

Strengths of this review include the comprehensive literature search and the assessment of applicability of the results.<sup>47</sup> The primary limitation of this review is the deficiency of eligible studies, resulting in a relatively limited overall sample size. The applicability of the findings was limited. Because only 1 study reported longer term effects,<sup>38</sup> no conclusions can be drawn on the long-term effects. Publication bias could not be assessed because of the low number of included studies. No unpublished studies or studies published in “grey literature” were included because the usefulness of including unpublished trials is still under debate as unpublished studies tend to lack peer review; also, investigators are often unwilling to provide unfavorable results.<sup>25</sup>

### *Modes of Action*

Psychological factors seem to play an important role in the cause of IBS, because a strong association of psychiatric disorders in 94% of patients with IBS can be found.<sup>48</sup> Headache, fibromyalgia, fatigue, and depression were commonly found in individuals with IBS.<sup>49</sup> Evidence supports the role of stress in patients with IBS, particularly in altering brain-gut interactions.<sup>50</sup> It was hypothesized that yoga addresses the brain-gut axis in the management of IBS with fewer side effects than conventional treatment.<sup>44</sup>

### *Implications for Further Research*

Given that the main drawbacks of the included studies concern study methodology, authors of prospective research should not only ensure rigorous methodology but also improve the reporting of yoga trials and follow commonly accepted reporting guidelines (eg, CONSORT).<sup>51,52</sup> The choice of outcome measures, future studies should be planned according to methodological recommendations for high-quality clinical trials for IBS based on consensus. The adequate relief question should be a measure of choice when assessing global symptomatology as an outcome in IBS studies.<sup>53</sup> For a more detailed IBS symptom assessment, the IBS Severity Scoring System is preferable and the IBS Quality of Life measurement scale can be used to establish changes in

health-related quality of life.<sup>53</sup> Abdominal pain was believed to be the hallmark feature of IBS, although newer research suggests that bloating is the predominant complaint of patients.<sup>54,55</sup> Among the pain dimensions, intensity, frequency, constancy, and predictability were strongly and independently associated with illness severity, whereas duration, speed of onset, and relationship to bowel movements had weaker associations. Thus IBS trials should measure pain dimensions, including intensity, constancy, frequency, and predictability to improve on the customary use of measuring pain as a unidimensional symptom in IBS. Further considerations implied the use of the IBS Global Assessment of Improvement scale and GI symptom rating scale.<sup>54</sup>

Furthermore, insufficient power of studies has to be regarded as a limiting factor, comprising small sample sizes, different patient populations, and limited external validity. Most importantly, safety of the intervention was insufficiently reported. Specifically, only 2 studies explicitly assessed adverse events, although 1 of them described so-called side effects (ie, those events with a plausible causality to the intervention) and labelled them adverse events. Future studies should ensure rigorous reporting of adverse events, and the correct use of terminology. Because stress and IBS symptoms seem to be improved by meditation, breathing exercises, and yoga,<sup>56-58</sup> a holistic approach including breathing practices, relaxation modules, and meditation should be considered in designing further studies for patients suffering from an increased GI response to stress. At this point, more research is needed to draw definite conclusions. So far, the recent global guidelines of the World Gastroenterology Organization on IBS consider sufficient physical activity and relaxation techniques to be appropriate nonpharmacologic approaches.<sup>59</sup>

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