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CASE BASED REVIEW

Yoga for low back pain: a systematic review of randomized clinical trials

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Abstract It has been suggested that yoga has a positive effect on low back pain and function. The objective of this systematic review was to assess the effectiveness of yoga as a treatment option for low back pain. Seven databases were searched from their inception to March 2011. Randomized clinical trials were considered if they investigated yoga in patients with low back pain and if they assessed pain as an outcome measure. The selection of studies, data extraction and validation were performed independently by two reviewers. Seven randomized controlled clinical trials (RCTs) met the inclusion criteria. Their methodological quality ranged between 2 and 4 on the Jadad scale. Five RCTs suggested that yoga leads to a significantly greater reduction in low back pain than usual care, education or conventional therapeutic exercises. Two RCTs showed no between-group differences. It is concluded that yoga has the potential to alleviate low back pain. However, any definitive claims should be treated with caution.

Keywords Complementary and alternative medicine · Effectiveness · Low back pain · Systematic review

Introduction

Yoga is regarded as a form of mind–body medicine or part of complementary and alternative medicine [1]. It has been suggested that yoga creates inner, physical and emotional balance through the use of postures (Hatha yoga), called asanas, that are combined with breathing techniques or pranayama that are based mainly on isometric muscle contractions [2]. Yoga has diverse clinical and nonclinical applications. This is mainly attributed to the degree of complexity and multidimensionality of influences that are apparent in yoga exercises [3]. Some authors claimed that when performed correctly, yoga exercises have no adverse effects [4], but global and detailed indications and contra-indications of different yoga exercises must be respected carefully [5].

Low back pain (LBP) is one of the most common musculoskeletal problems in modern society [6], causing huge health care costs [7]. LBP is defined as pain localised between the 12th rib and the inferior gluteal folds, with or without leg pain and in 90% of cases nonspecific [8]. Other authors defined it as a lumbar, sacral or lumbosacral spinal pain that is continuous or essentially continuous but low level punctuated by exacerbations of pain, each of which is characterized as "acute" [7]. The aetiology of LBP is complex and not fully understood. However, physical and (partially) psychosocial occupational factors seem to play an important etiological role [9]. Patients who experience LBP are limited in their activities of daily living and may experience inappropriate neuromuscular adaptations to maintain and/or preserve functions such as walking, running or other activities [10].

Yoga might reduce LBP, but the mechanisms by which this is affected remain hypothetical. They include an increase in tissue flexibility and oxidation combined with a relaxation effect within the lower back and the release of enkefalins or endorphins. To the best of our knowledge, the literature on yogic techniques in the management of pain has not yet been critically evaluated.

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The aim of this paper was to systematically review the evidence for or against the effectiveness of yoga as a treatment option for LBP in adults.

Method

Literature searches were performed to identify all controlled clinical trials of yoga for low back pain. The following databases were used: the Cochrane Central Register of Controlled Trials, the Clinical Trial Registry of the Indian Council of Medical Research, MEDLINE, EMBASE, CINAHL, AMED, PsycINFO. The search terms were constructed over two concepts—yoga and low back pain—to identify all relevant published articles on the subject. Experts were also contacted and asked for any unpublished data. The reference lists of all located articles were scanned for further relevant literature. Additionally, the bibliographies of relevant book chapters were hand-searched for further articles. No language barriers were imposed. Hard copies of all included articles were read in full. The mean change of pain in any pain-related questionnaire compared with baseline was defined as the primary outcome measure and was used to assess the differences between the intervention and control groups.

All retrieved data including uncontrolled trials, case studies, preclinical and observational studies were reviewed for safety information. Only RCTs testing yoga in adults of age 18 and above, any sex with any pain of any duration and intensity were included. Trials were excluded if low back pain is not a central symptom of the patients.

Two authors extracted data independently. For each study, the trial design, randomization, blinding, dropout rate, inclusion and exclusion criteria, details of the treatment method and control groups, main outcome measures and main results were extracted. The quality of the studies was assessed using the five-point Jadad scale [11]. Clinical trials with three or more points were considered high quality. The mean change of pain as measured by the visual analogue scale (VAS) or any pain-related questionnaire compared with baseline was defined as the primary outcome measure. It was used to assess the differences between the intervention and control groups. Two independent reviewers validated the data using a predefined standardized form. Any differences were resolved through discussion.

The protocol stipulated that a quantitative meta-analysis would be carried out if the number and degree of trial heterogeneity allowed. However, if heterogeneity between studies prevented a meaningful meta-analysis, the data would be narratively synthesized.

Results

The search strategy generated a total of 201 references, of which 145 were considered to be potentially relevant. We did not locate any unpublished trials nor any relevant papers published in languages other than English. A total of 17 clinical trials were retrieved for further evaluation, of which seven, involving 404 patients (N=403), were eligible for inclusion [2, 12–17] (Fig. 1). The seven studies originated from the USA [2, 12, 14–17] and India [13]. Patient populations were relatively homogeneous in terms of clinical condition, namely chronic LBP (see Table 1). Control interventions were heterogeneous and received standard or usual care [2, 12, 17], physical exercises [13, 14], education [15] or no treatment [16]. Primary and secondary outcome measures included pain score [12], pain intensity, pain medication usage and pain-related attitudes/behaviours [15], VAS [2], 11-point NRS [14], Oswestry Disability Index (ODI) [13, 16], Roland–Morris Disability Questionnaire (RMDQ) [12, 17], as well as the Beck Depression Inventory [2, 14, 16].

Tekur et al. [13] aimed to compare the effect of a short-term intensive residential yoga programme with physical exercise on pain and spinal flexibility in subjects with chronic LBP. They reported that 7 days of a residential intensive yoga-based lifestyle programme reduced pain-related disability and improved spinal flexibility in patients with chronic LBP better than a physical exercise regimen. This was high-quality RCT; however, a lack of intention-to-

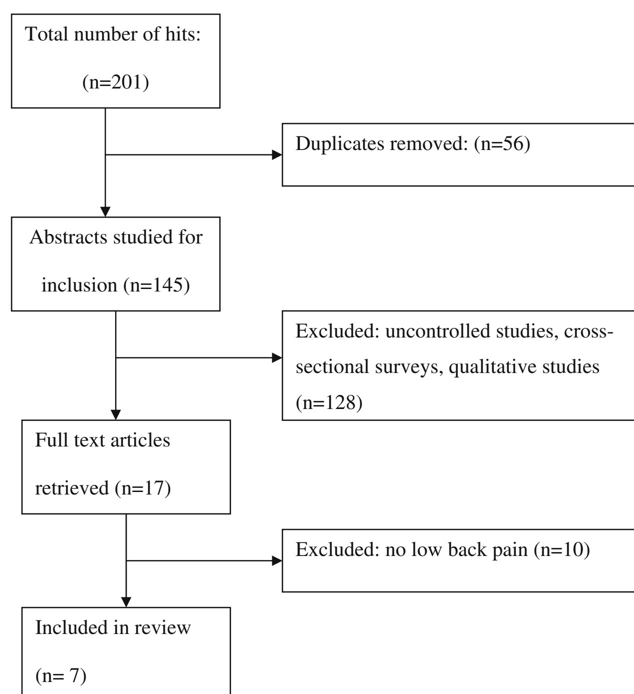

Fig. 1 Flowchart of eligibility assessment and inclusion

Table 1 Controlled studies of yoga for the treatment of low back pain

First author, year [reference]	Study design	Characteristics of participants (n)	Experimental intervention	Control intervention	Primary outcome measures	Main result
Saper (2009) [12]	RCT with 2 parallel groups	30 patients with moderate-to-severe CLBP	Standardized series of weekly Hatha yoga classes for 12 weeks, 75-min classes	Usual care	Pain score, Roland–Morris, Disability Questionnaire	Decreased pain scores (from 6.7 to 4.4) (p=0.02) and RMDQ scores (from 14.5 to 8.2) (p=0.28) in favour of yoga
Williams (2009) [2]	RCT with 2 parallel groups	90 patients with CLBP	Iyengar yoga for 24 weeks, 90-min classes	Usual care	Oswestry Disability Questionnaire, Visual Analogue Scale, Beck Depression Inventory, pain medication usage	Significantly greater reductions in functional disability and pain intensity were observed in the yoga group
Tekur (2008) [13]	Single blind RCT with 2 parallel groups	80 CLBP subjects	Yoga asanas, pranayamas, meditation, and didactics for 1 week, 8 h per day	Physical exercises	Oswestry Disability Index, spinal flexibility (goniometer)	A significant reduction in ODI scores in the yoga group compared to the control group (p=0.01; effect size, 1.264).
Sherman (2005) [14]	RCT with 3 parallel groups	101 CLBP adults	Viniyoga for 12 weeks, 75-min classes	Conventional therapeutic exercise classes or a self-care book	24-point Roland Disability Scale, 11-point numerical scale of pain, Beck Depression Inventory, medication usage	The yoga group was superior to the self-care book group with respect to pain (mean difference, −2.2 [CI, −3.2 to −1.2]; p<0.001) and back-related function (mean difference, −3.4 [95% CI, −5.1 to −1.6] [p<0.001]; and yoga vs. exercise: mean difference, −1.8 [CI, −3.5 to −0.1] [p=0.034]).
Williams (2005) [15]	RCT with 3 parallel groups	60 nonspecific CLBP subjects	Iyengar yoga+usual care for 16 weeks, 90-min classes	Educational control group+usual care	Functional disability, present pain intensity, pain medication usage, pain-related attitudes and behaviours, spinal range of motion	Significant reductions in pain intensity (64%), functional disability (77%), and pain medication usage (88%) in the yoga group
Galantino (2004) [16]	RCT with 2 parallel groups	22 CLBP patients	Iyengar yoga for 6 weeks, 2 times per week	No treatment	Forward reach test, sit and reach test, Oswestry Disability Index, Beck Depression Inventory	No significant differences between Iyengar yoga and standard exercise
Cox (2010) [17]	Pragmatic RCT with 2 parallel groups	20 CLBP patients	Yoga for 12 weeks, 75-min classes+written advice	Usual care+written advice	Roland–Morris Disability Questionnaire	No significant difference in RMDQ and significant less pain in yoga group

treat analysis and insufficiently described exclusion and inclusion criteria may increase the risk of bias.

Sherman et al. [14] aimed to determine whether yoga is more effective than conventional therapeutic exercise or a self-care book for patients with chronic LBP and suggested that yoga was more effective than a self-care book for improving function and reducing chronic LBP. This study was of high quality. Lack of allocation concealment and partial blinding may, however, increase the source of bias.

Cox et al. [17] aimed at assessing the efficacy of yoga for the treatment of chronic LBP. They reported no significant differences between groups in RMDQ. This study was of low quality. It lacks blinding and power calculation and the sample was very small.

Williams et al. [2] aimed to evaluate Iyengar yoga therapy on chronic LBP and reported that yoga improves functional disability, pain intensity, and depression and reduces medication usage in adults with chronic LBP. This RCT was of low quality; claims regarding blinding were unjustified as only data collectors were masked.

Williams et al. [15] aimed to determine the efficacy of Iyengar yoga therapy on pain-related outcomes in persons with chronic LBP. They revealed significant reductions in pain intensity, functional disability and pain medication usage in the yoga group at the post and 3-month follow-up assessments. This study was of low quality. It lacked blinding procedures and clearly described the exclusion criteria; however, the dropout rate, power calculations and intention-to-treat analysis may compensate for the possible biases.

Saper et al. [12] aimed to assess the feasibility of studying yoga in a predominantly minority population with chronic LBP and concluded that yoga may be more effective than the usual care for reducing pain and pain medication use. This was a low-quality RCT. An intention-to-treat analysis and well-described exclusion criteria may offset for possible biases.

Galantino et al. [16] aimed to evaluate a protocol to study the effects of Hatha yoga on participants with chronic LBP. They reported that their pilot study was not powered to detect any between group differences; however, a modified yoga-based intervention may benefit individuals with chronic LBP. This was low-quality RCT with several limitations. It lacked blinding, allocation concealment, and clearly defined exclusion and inclusion criteria.

Discussion

A recent review of yoga for LBP concluded that "yoga has a positive effect on low back pain and function" [18]; however, it is burdened with a high risk of bias for several reasons. Firstly, in this review, low-quality studies such as case series and reports were included, and three high-quality RCTs were missing. Secondly, it lacked a critical assessment of the methodology and validity of the included primary studies.

The purpose of the present review was to critically evaluate the totality of the evidence from the RCTs that were for or against the effectiveness of yoga as a treatment for chronic LBP. Five trials that met our eligibility criteria suggested that yoga is effective for chronic LBP [2, 12–15]. Two trials showed no effect [16, 17]. The evidence from RCTs of yoga for treating chronic LBP pain is thus encouraging but, for several reasons, inconclusive. Firstly, the definition of onset and/or duration of chronic LBP varied from 12 weeks or more, [2, 12–15] more than 6 months [16], to one or more episodes within the past 18 months [17]. The control groups received standard or usual care [2, 12, 17], physical exercises [13, 14], education [15] or no treatment [16]. Secondly, some yoga schools may differ from one Iyengar to another in both the studies of Williams et al. [2, 15], yoga-based intervention [16], Hatha Yoga [12, 13] to yoga+written advice [17], and this may reflect the homogeneity of the data presented. The primary and secondary outcome measures were also heterogeneous and included pain score [12], pain intensity, pain medication usage, and pain-related attitudes/ behaviours [15], VAS [2], 11-point NRS [14], ODI [13,

Table 2 Quality assessment of the included studies (Jadad score)

Domain	Random sequence generation	Appropriate randomization	Blinding of participants or personnel	Blinding of outcome assessors	Withdrawals and dropouts	Sum (Jadad score)
Study						
Saper [12]	1	1	0	0	0	2
Williams [2]	1	1	0	0	1	3
Tekur [13]	1	1	0	1	1	4
Sherman [14]	1	1	0	0	1	3
Williams [15]	1	0	0	0	1	2
Galantino [16]	1	0	0	0	0	1
Cox [17]	1	1	0	0	1	3

16], RMDQ [12, 17] or the Beck Depression Inventory [2, 14, 16].

The duration and length of yoga practice ranged from a 1-week intensive programme (8 h per day for 7 days) in the study of Tekur et al. [13], 6 weeks two times per week in the study of Galantino et al. [16], 12-week 75-min classes in the other studies [12, 14, 17], 16 weeks of 90-min classes in the study of Williams et al. [15] to 24 weeks twice weekly 90-min classes [2]. Yoga interventions in themselves varied from one another ranging from Hatha Yoga postures/regime (diaphragmatic breathing, stretching postures and sun salutation) [12, 16] to Viniyoga [14] to Iyengar yoga classes [15, 17]. Given such variability in terms of length, intensity, and frequency of yoga-based intervention and the type of yoga classes themselves, it is difficult to draw any definite conclusions. Also, the fact that yoga interventions cannot control for placebo effects limits its generalizability.

The methodological quality of the trials varied, with one RCT scoring 4, three RCTs scoring 3, and two scoring 2 out of 5 possible points for methodological quality (Table 2). Other possible sources of bias included lack of blinding and allocation concealment [2, 12, 14–17]. Three trials have sample sizes that were small [12, 16, 17]. Three of the four trials that were of high quality (Jadad score of 3 or more) suggested effectiveness [2, 14, 15]. One of the three trials that were of low quality (Jadad score of 2 or less) suggested no effect [16]. Two of the three trials that were of poor quality suggested effectiveness [12, 15].

Adverse events (AEs) were not reported in several trials [2, 16, 17]. Two studies reported no AEs [13, 14]. In the study of Saper et al. [12], one participant discontinued trial due to worsening of pain, and in the study of Sherman et al. [14], one discontinued due to preexisting health problems and one in Williams et al. [15] with symptomatic osteoarthritis who was diagnosed with a herniated disc during the study. Therefore, more research is required to more extensively explore the safety of these interventions. None of the studies included a cost effectiveness analysis of yoga classes compared with other commonly used interventions for chronic LBP. Also, long-term effectiveness (e.g. return to work, recurrence) was not assessed in any of these trials and therefore remains to be determined.

There is a potential conflict of interest in the study of Saper et al. [12] as the principal investigators (PI) and an expert panel constituted the same individuals. In the other studies, PI and yoga teachers were the same persons [2, 15, 16]. None of the included studies reported conflicts of interest [2, 12–17]. It is therefore imperative that trials of these yoga interventions be repeated by other research groups and in different settings.

Although the specific yoga techniques varied across programmes, some elements are common to all of them and include specific stretching, breathing, relaxation exercises and specific attention to alignment of body structures [19]. The mechanisms that may be involved in yoga are hypothetical. They include an increase in the lumbar spine flexibility combined with a relaxation effect within the spine musculature, and the release of enkephalins or endorphins may be part of it [20].

Our review has several limitations. Firstly, the potential incompleteness of the reviewed evidence may have limited the validity of the results. Secondly, publication and location biases that are well-known phenomena may also influence the results of this systematic review. Thirdly, the total number of trials included in our review and analysis and the total sample size are too small to allow definitive judgments. Fourthly, although seven of these studies were considered to have homogenous LBP populations, statistical pooling was not possible due to a lack of reporting of sufficient raw data. However, this review has several strengths also, including the comprehensive search strategy, the inclusion of only the highest quality trial design and the use of suggested methods for systematic reviews of interventions for low back pain.

Future studies of yoga should be in line with accepted standards of trial design and reporting (CONSORT). In particular, studies should be of adequate sample size based on power calculations, use validated outcome measures, control for nonspecific effects, and minimize other threats to internal and external validity. Reporting of these studies should be such that results can be independently replicated.

In conclusion, the evidence that yoga alleviates chronic LBP in the majority of studies is positive. Several caveats, however, prevent a firm conclusion.

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