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Yoga as a treatment for low back pain a systematic review of randomized controlled trials

Alison Diaz
University of Central Florida



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YOGA AS A TREATMENT FOR LOW BACK PAIN:
A SYSTEMATIC REVIEW OF RANDOMIZED CONTROLLED TRIALS

by

ALISON DIAZ

A Thesis submitted in partial fulfillment of the requirements
for the Honors in the Major Program in Health Sciences – Pre Clinical
in the College of Health and Public Affairs
and in the Burnett Honors College
at the University of Central Florida
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Thesis Chair: Dr. William Hanney

ABSTRACT

Background: Low back pain is very common and has a tremendous economic impact. With the prevalence and incidence of low back pain on the rise, individuals are turning to alternative treatments. Yoga is the most widely used complementary and alternative medicine treatment for low back pain and it is not fully certain how effective this method is for resolving the symptoms.

Objectives: The purpose of this manuscript is to systematically review the current literature for randomized controlled trials that assess the outcomes of yoga intervention in individuals with low back pain.

Methods: An electronic database search was performed to analyze studies. To be included in the review, the studies were required to be a randomized controlled trial, published in English, present in a peer reviewed journal, identify yoga as the primary treatment focus for low back pain in at least one group, and included participants with at least a 12 week history of low back pain.

Results: A search of the databases revealed 177 articles, of which, 8 met the inclusion criteria.

Conclusions: Yoga intervention appears to be effective in alleviating symptoms brought on by low back pain. Yoga was either demonstrated to significantly improve quality of life and reduce disability, stress, depression, and medication usage associated with low back pain in 6 of the 8 analyzed trials. More research is necessary to account for the lack of between-group differences in two trials.

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INTRODUCTION

Low back pain (LBP) is experienced by approximately two-thirds of adults in their lifetime.¹ LBP is very costly and one of the main reasons individuals see their physician.² Risk factors for long term LBP include age, depression, history of back pain, pain below the knee, and dissatisfaction with job.³ With many common treatments for LBP found to be ineffective¹, many are turning to yoga as an alternative.^{1, 4-8}

Prevalence of LBP

The prevalence of chronic LBP (cLBP) is on the rise, with reported cases doubling in North Carolina from 3.9% to 10.2% within a 14 year interval.⁹ The age group most affected by LBP is between 30 and 50 years.¹ According to Andersson², there is a 15% to 30% point prevalence of LBP in adults with the prevalence increasing with age until 65 years. Men and women are affected equally and the cause can usually be traced to a work-related disability in adults under 45 years old.¹ The prevalence of LBP typically declines with increasing income and level of education.¹⁰ LBP had the lowest prevalence among Asian Americans and was highest in American Indians and Alaska Natives, according to the 2002 National Health Interview Survey.¹⁰ Data from the National Ambulatory Medical Care Survey suggest the proportion of physician visits for LBP, 2.3% in 2002, has not changed much from the early 1990s.¹⁰ Additionally, incidence of LBP is twice as high for individuals who have experienced LBP before in comparison to those whom have no history of LBP¹¹.

Economic impact of LBP

Along with the increase in prevalence of LBP, medical costs and workers' compensation lead to the most costly work-related disability.² It usually takes around two months for an individual to return back to work when they take a sick leave due to their LBP.¹¹ LBP leads to missed work, less productive workers, and rising healthcare costs in the billions of dollars.³

Classifications of LBP

Approximately 90% of individuals will experience non-specific LBP which may be classified as acute, sub-acute or chronic.¹¹ Each describe pain which has endured less than six weeks, six weeks to three months, and over three months, respectively.¹¹ It is believed there are fluctuations of recurrences of LBP especially in individuals with cLBP.¹¹ For this reason, the present manuscript has the inclusion criteria of at least a 12 week history of LBP.

CAM treatments for LBP

Complementary and alternative medicines (CAM) have long been used by individuals to help treat or manage illnesses. CAM treatments such as acupuncture, manual medicine, mind-body therapy and yoga have been used, in particular, to treat LBP.⁷ Acupuncture has been concluded to likely benefit patients with LBP and is prudently recommended along with manual medicine, such as chiropraxy and massage.⁷ Meditation has been used to relieve stress, affecting levels of cortisol, and improving mood and self-efficacy.⁵ Yoga has shown to be strong in improving these effects, leading to lessening of LBP symptoms.⁵ Yoga uses a holistic approach to manage LBP and is the most used CAM treatment for back pain.^{12, 13} Teets *et al.*⁷ state physicians should feel comfortable recommending Viniyoga as an effective treatment for cLBP.

Yoga Styles

There are eight parts of yoga which the majority of styles are based on: [Sanskrit name (English translation)] yamas (moral restraints), niyamas (moral observations), asana (posture), pranayama (controlled breathing), pratyahara (sensory withdrawal) dharana (concentration), dhyana (meditation) and samadhi (self-actualization).¹⁴ However, the majority of styles in Western culture simply incorporates asanas and pranayama.

Styles most practiced today and observed in studies include Hatha, Iyengar, Viniyoga, and Vinyasa. Hatha focuses on awareness and is used by Galatino *et al.*¹⁵ because it is accessible and not too intense for patients with LBP. Iyengar is the most widely practiced style in the United States and differs from other styles in its use of props to help participants attain the proper asana.⁴ Viniyoga is a therapeutic style of yoga that is used in some studies because of its ease for non-experienced yoga participants⁶. Vinyasa, meaning to flow, is where movements from one asana are linked with the breathing of the next asana¹⁶.

Solution for LBP

LBP affects many individuals directly and indirectly. According to van Tulder *et al.*¹¹, LBP is not just an isolated pain but rather a part of widespread pain.¹¹ More evidence describing the support of a holistic approach that yoga brings has become available, leading to a potentially stronger case as a treatment for patients who seek to manage and resolve their LBP. A recently published systematic review regarding yoga's effectiveness as a treatment for LBP concluded that a definitive claim about yoga's effect should be treated with caution, but, it has potential to alleviate LBP.¹⁷ Through analysis of the systematic review, it was discovered that not all randomized controlled trials were addressed. This led to the possibility of creating a stronger,

more valid claim concerning the treatment of LBP through yoga and is the aim of this present systematic review.

METHODS

Data Sources and Searches

A database search was performed on SPORTDiscus, Medline, CINAHL, AMED, and PEDro. The key words used in combination were yoga and low back pain. Eligible articles were determined by reviewing the title and abstract of articles. Cross-referencing of eligible articles was performed.

Study Selections

The studies included in the review were required to be a randomized controlled trial, published in English, present in a peer reviewed journal, identify yoga as the primary treatment focus for LBP, and included participants with at least a 12 week history of LBP. A valid outcome measure must have been utilized in the studies to be included. If the yoga style's main focus was not on LBP, or the study was not a randomized controlled trial, then it was excluded (Table 9).

Quality Assessment

The PEDro scale was used to assess the quality of the trials selected. de Morton¹⁸ found the PEDro scale to be a valid measure for assessing the methodological quality of clinical trials. The reliability of the total PEDro score is acceptable.¹⁹ The reliability of individual scaled items varied from 'fair' to substantial,' or from 'moderate' to 'substantial'.¹⁹

RESULTS

Study Selection

A total of 177 articles were retrieved from the electronic databases. Out of the 177 articles, based on the title, abstract, and inclusion criteria, 8 full text articles were included in the paper (Fig. 1).

Methodological Quality

The mean score of the PEDro scale, used to assess the methodological quality of the trials, was 6.625 with a range of 4-8. Subject and therapist blinding was not possible for any of the randomized controlled trials considering the yoga-based intervention. All of the studies used random allocation, between-group statistical comparisons, and point estimates and variability. Galantino *et al.*¹⁵ did not have baseline comparability, Galantino *et al.*¹⁵ and Saper *et al.*²⁰ did not have blind assessors, Williams *et al.*⁴ and Tekur *et al.*^{8,21} did not analyze outcome by intention to treat. Galantino *et al.*¹⁵, Williams *et al.*⁴, and Cox *et al.*²² did not have adequate follow-up. Where the PEDro scale requires more than 85% follow-up for point allocation, Galantino *et al.*¹⁵ reported a 72% follow-up at the 6-week point, Williams *et al.*⁴ reported a 70% follow-up at the 3-month point, and Cox *et al.*²² reported a 78% follow-up at the 12-week point. The levels of evidence for the clinical trials are listed in Table 9.

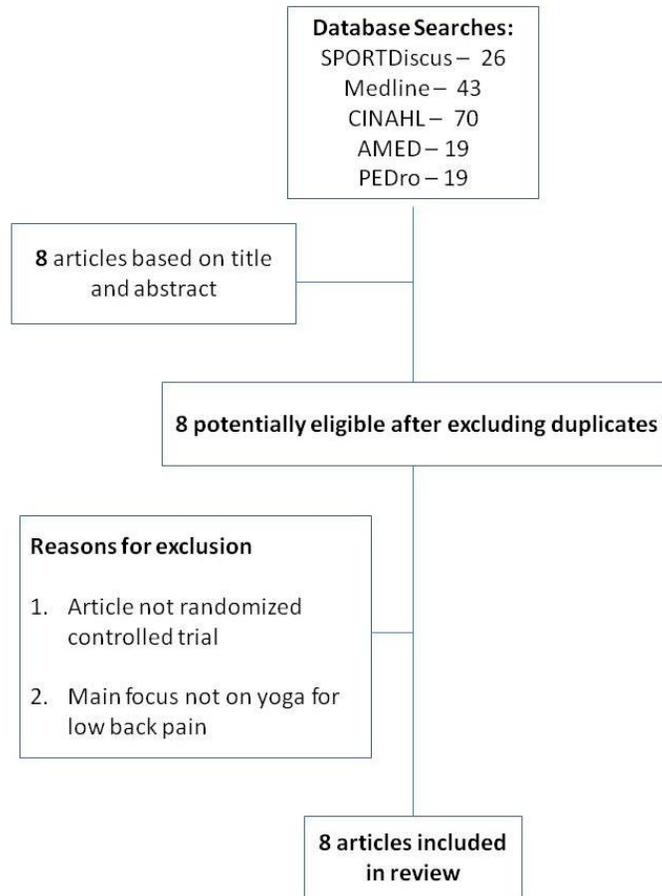


Figure 1 Search strategy for selected articles.

Study Characteristics

Yoga versus physical exercises

Tekur *et al.*^{8, 21} randomized 80 subjects with cLBP into an ‘integrated approach to yoga therapy (IAYT)’ group or a physical exercise group. Treatment was 1-week long consisting of a daily schedule, 8-hours in duration. The yoga group’s daily routine consisted of meditation, yoga-based special technique, yogic hymns, lectures on yogic lifestyle, pranayama, deep relaxation technique, cyclic meditation, counseling, and mind sound resonance technique. The

control group completed physical movements, nonyogic breathing exercises, and lectures on causes of back pain, stress and cLBP, and the benefits of exercise. There was a 100% compliance rate for both studies.

The primary outcome for Tekur *et al.*²¹ was the Oswestry Disability Index (ODI). There was a significant difference between groups ($P < 0.001$). There was no significant reduction in ODI scores in the control group ($P = 0.19$). Spinal mobility was also measured with an increase in flexion and extension in both groups with a significant difference between groups ($P = 0.008$ and $P = 0.001$, respectively). This study concluded that 1-week of residential intensive yoga-based lifestyle program reduced pain-related disability and improved spinal flexibility in patient with cLBP better than a physical exercise program (Table 1).

The primary outcome for Tekur *et al.*⁸ was the World Health Organization Quality of Life Assessment Bref (WHOQOL Bref). There was significant difference between groups on all domains ($P < 0.01$) and significantly better ($P < 0.01$) improvement in quality of life (QOL) in the yoga group than the exercise group. Stress was also measured through the perceived stress scale (PSS) and the researcher was able to show a negative correlation between PSS and all of the WHOQOL domains. Both studies demonstrate a positive effect from yoga intervention in patients with cLBP (Table 2).

Table 1 Interventions reported by Tekur *et al.*²¹

Yoga interventions	Physical exercise interventions	
<p>Performed a specific module of an integrated approach to yoga therapy consisting of asanas, pranayamas, meditation and didactics.</p> <ul style="list-style-type: none"> • Back-pain special techniques <ul style="list-style-type: none"> • Supine postures • Prone Postures • Quick relaxation technique • Sitting postures • Standing postures • Deep relaxation technique <p>Both groups were treated everyday for 1-week, 8 hours a day.</p>	<p>Performed sets of physical movements, nonyogic breathing exercise, and lectures about causes of back pain, stress and cLBP, and the benefits of exercise.</p> <ul style="list-style-type: none"> • Control group practices: <ul style="list-style-type: none"> • Standing hamstring stretch. Quadriceps leg raising. • Cat and camel. Trunk rotation. Press up. • Pelvic tilt. Double knee to chest. Curl ups. • Partial curl. Bridging. Lumbar rotation. • Piriformis stretch. Hook lying march. • Extension exercise. Single knee to chest. 	
<p>Oswestry Disability Index: mean (SD)</p>		P value
Baseline: 36.5 (14.22)	Baseline: 38.9 (13.27)	
1-week follow-up: 18.70 (11.55)	12-week follow-up: 35.75 (15.19)	<0.001

Table 2 Interventions reported by Tekur *et al.*⁸

Integrated yoga therapy	Physical therapy exercises	
<p>Performed a specific module of an integrated approach to yoga therapy consisting of asanas, pranayamas, meditation and didactics.</p> <ul style="list-style-type: none"> • Back-pain special techniques <ul style="list-style-type: none"> • Supine postures • Prone Postures • Quick relaxation technique • Sitting postures • Standing postures • Deep relaxation technique <p>Both groups were treated everyday for 1-week, 8 hours a day.</p>	<p>Performed sets of physical movements, nonyogic breathing exercise, and lectures about causes of back pain, stress and cLBP, and the benefits of exercise.</p> <ul style="list-style-type: none"> • Control group practices: <ul style="list-style-type: none"> • Standing hamstring stretch. Quadriceps leg raising. • Cat and camel. Trunk rotation. Press up. • Pelvic tilt. Double knee to chest. Curl ups. • Partial curl. Bridging. Lumbar rotation. • Piriformis stretch. Hook lying march. • Extension exercise. Single knee to chest. 	
<p>World Health Organization Quality of Life assessment Bref: mean (SD)</p>		P value
Physical health	Baseline: 11.87 (2.5)	Baseline: 12.49 (2.26)
	1-week follow-up: 15.14 (1.56)	1-week follow-up: 13.11 (2.17)
Psychological health	Baseline: 13.15 (2.34)	Baseline: 13.12 (2.42)
	1-week follow-up: 15.23 (1.34)	1-week follow-up: 13.35 (2.71)
Social health	Baseline: 13.43 (3.32)	Baseline: 13.50 (3.30)
	1-week follow-up: 14.80 (2.71)	1-week follow-up: 13.03 (3.16)
Environmental	Baseline: 13.45 (2.2)	Baseline: 13.44 (2.32)
	1-week follow-up: 14.63 (1.6)	1-week follow-up: 13.50 (2.16)

Iyengar yoga versus educational group

Williams *et al.*⁴ studied the effects of Iyengar yoga on patients with non-specific cLBP by comparing the results to an educational control group. The 60 subjects were randomized into one of the programs for 16-weeks, 30 to yoga intervention and 30 to control group. There was a follow-up of 20 out of the 30 subjects in the yoga group, and 22 out of 30 in the control group. Both groups received 16-weekly newsletters regarding back care written by physical therapy

students. Before beginning the program, both groups attended two 1-hour lectures of occupational/physical therapy education about cLBP. The yoga group attended a 1.5-hour class once a week and were encouraged to practice at home 5-days a week for half an hour. The primary outcome of the study was functional disability measured by the Pain Disability Index, with an adjusted P value of 0.009 between the groups at the 3 month follow-up. The study reports that yoga caused a significant reduction in self-reported disability and pain, reduced use of pain medication and that the results last longer than an educational intervention (Table 3)

Table 3 Interventions reported by Williams *et al*⁴.

Iyengar yoga	Education group	
Consisted of 29 postures that focused on correcting imbalances in muscles affecting spinal alignment and posture	The control group received educational newsletters and lectures.	
<ul style="list-style-type: none"> • Restorative poses were used to relieve pain and muscle tension • Standing poses were used to open hips and groins, and lengthen pelvic and spinal tissues • Twists were used to help back muscles realign vertebra and increases intervertebral disc space • Inversions were used to reverse compression from gravity on intervertebral disc space. 		
Both groups received 16-weekly newsletters regarding back care.		
Pain Disability Index: mean (SD)		P value
Baseline: 14.3 (13.6)	Baseline: 21.2 (20.5)	
16-week follow-up: 3.3 (5.1)	16-week follow-up: 12.8 (11.9)	0.834
3-month follow-up: 3.9 (5.3)	3-month follow-up: 12.7 (11.4)	0.009

Iyengar yoga versus self-directed standard medical care

To evaluate the effectiveness and efficacy of Iyengar yoga for cLBP, William *et al*.²³ randomized 90 subjects to either yoga or the control group of standard medical care. The yoga participants attended 24-weeks of yoga twice a week for 90 minutes. A significant reduction in functional disability, pain intensity, and medication usage were observed in the yoga group compared to the standard medical care group. Depression was significantly lower in the yoga group as well. There was 82% retention of participants in the yoga intervention. The study

concludes that their results suggest that yoga improves functional disability, pain intensity, and depression in adults with cLBP (Table 4).

Table 4 Interventions reported by Williams *et al.*²³

Iyengar yoga	Self-directed standard medical care	
Yoga classes were designed for cLBP. Classes consisted of 31 postures with different props. Yoga group performed 24 weeks of yoga, 2 times/week. Each class was 90 minutes in duration and patients were directed to practice 30 minutes of yoga at home on non-class days. No attempt was made to regulate treatment received in the control group.	Information about subject's medical care and pain medication was collected monthly.	
Oswestry Disability Index: mean (SEM)		P value
Baseline: 25.2 (1.08)	Baseline: 23.1 (1.58)	0.260
12-week follow-up: 22.2 (1.60)	12-week follow-up: 22.2 (1.59)	0.262
24-week follow-up: 17.9 (1.60)	24-week follow-up: 20.8 (1.50)	0.011
6-month follow-up: 19.3 (1.94)	6-month follow-up: 23.5 (1.80)	0.001

Yoga versus exercise versus self-care book

In the randomized control trial from Sherman *et al.*⁶, 101 adults with cLBP participated in 12 weeks of either a Viniyoga yoga class, exercise class, or a self-care book. Using a modified 24 point Roland Disability Scale and an 11 point number scale of how bothersome participants' pain was, the study concluded that yoga was more effective than a self-care book for improving function and reducing cLBP, and the benefits lasted for at least several months. The yoga group showed clinically important and statistically significant improvements in functional status at all of the follow-ups. Also, medication used to manage LBP after the 26 weeks decreased the most with yoga participants. Class attendance in the yoga group was similar to the exercise group, and over 75% reported in their homework logs that they practiced for an average of 3 or more days a week. It was reported that 69% of participants in the yoga group reduced their Roland score of at least 50% compared with the 50% from the exercise group and 30% from the self-care book group. To protect against multiple comparisons when comparing the three groups at the follow-ups, the researcher used the Fisher protected least significant difference test (Table 5).

Table 5 Interventions reported by Sherman *et al.*⁶

Yoga	Exercise	Self-care book	
Viniyoga intervention emphasized use of postures and breathing for managing low back symptoms.	12-session class series similar to yoga classes in number and length.	Subjects were mailed an evidence-based book titled <i>The Back Pain Helpbook</i> .	
<ul style="list-style-type: none"> • Specific focus: <ul style="list-style-type: none"> • Relaxation • Strength building • Flexibility • Large-muscle movement • Asymmetric poses • Strengthening hip muscles • Lateral bending • Integration and customizing 	<ul style="list-style-type: none"> • Sessions: <ul style="list-style-type: none"> • Educational talk about proper body mechanics, benefits of exercise, realistic goals, and overcoming barriers • Feedback from previous week • Warm-ups • Repetition of 7 aerobic and 10 strengthening exercises <ul style="list-style-type: none"> • Emphasized leg, hip, abdominal, and back muscles. • 12 stretches; held for 30 sec. • Short, unguided, deep, slow breathing. • Over time the number of strengthening repetitions increases by increments of 2. 	<ul style="list-style-type: none"> • Emphasized self-care strategies • Adopting a comprehensive fitness and strength program • Appropriate lifestyle modifications • Guidelines for managing flare-ups • Instructions for using the book were not given 	
Yoga and exercise class consisted of 12-weekly 75-minute classes. Participants received home practice handouts, and yoga group received auditory discs to guide them through postures at home.			
Roland Disability Scale: mean (SD)			P value
Baseline: 8.1 (4.5)	Baseline: 9.0 (4.1)	Baseline: 8.0 (4.0)	
Roland Disability Scale: mean score difference (95% CI)			
		• 6-week follow-up:	0.046
		Yoga vs. book: -2.6 (-4.6 to -0.6)	0.0095
		Exercise vs. book: -1.7 (-3.7 to 0.4)	0.11
		Yoga vs. exercise: -1.0 (-2.4 to 0.6)	0.22
		• 12-week follow-up:	0.002
		Yoga vs. book: -3.4 (-5.1 to -1.6)	0.0002
		Exercise vs. book: -1.6 (-3.5 to 0.4)	0.12
		Yoga vs. exercise: -1.8 (-3.5 to -0.1)	0.034
		• 26-week follow-up:	0.002
		Yoga vs. book: -3.6 (-5.4 to -1.8)	<0.001
		Exercise vs. book: -2.7 (-4.1 to -0.1)	0.035
		Yoga vs. exercise: -1.5 (-3.2 to 0.2)	0.092

Hatha yoga versus usual care with self-care book

Saper *et al.*²⁰ randomized 30 subjects with nonspecific cLBP, 15 were allocated to the yoga group and 15 to usual care. There were weekly hatha yoga classes lasting for 12-weeks, each session 75-minutes in length. The hatha yoga intervention was developed for subjects with little to no yoga experience. The internet, databases, books, videos, and periodicals on yoga for

LBP were collected and two yoga experts drafted the protocol. Each class was given a theme, such as ‘Listening to the Wisdom of the Body’, and each segment built upon the previous one. The protocol provided props in order to accommodate different abilities. Both groups continued to receive routine medical care and medication and a self-care book. For the groups, there was no statistically significant difference between them at baseline. Subject retention was 97% at 12 weeks and 77% at 26 weeks. There was one adverse event reported with a yoga participant whose LBP became worse and improved after discontinuing treatment. Roland-Morris Disability questionnaire was the primary outcome measure. The mean scores for the yoga group decrease 6.3 points (SD 6.9) from baseline to 12 weeks, where the usual care group decreased 3.7 points (SD 4.9, P=.28). Pain medicine usage by the yoga group decreased from 67% to 13%, and the control group did not change (Table 6).

Table 6 Interventions reported by Saper *et al.*²⁰

Hatha Yoga	Usual care	
Each class began with a relaxation exercise. Classes included postures and breathing techniques along with the use of props (such as a chair, block, or strap). The subjects were treated once per week for 12-weeks. Each session was 75-minutes in duration. Home practice for the yoga group for 30 minutes a day was strongly encouraged. Both groups received an educational book.	The usual care control group received an educational book that describes self-care management strategies for LBP.	
Roland-Morris Disability questionnaire: mean (SD)		P value
Baseline: 14.5 (5.0)	Baseline: 16.1 (4.0)	
6-week follow-up:	6-week follow-up:	0.29
12-week follow-up: 8.2 (6.9)	12-week follow-up: 12.4 (4.9)	0.26
26-week follow-up: 6.6 (2.6)	26-week follow-up: 8.3 (2.9)	

Hatha yoga versus no treatment

Galantino *et al.*¹⁵ performed the randomized pilot study in order to see the effect of a 6-week modified hatha yoga protocol on cLBP individuals. There were 22 randomized subjects, 11 in each group and retention of 72% of participants. Hatha yoga intervention consisted of postures that were able to be adapted to the subjects’ capabilities in order to prevent injury. Feedback was

given to the participants to assist them in maintaining positions with proper body mechanics and proper breathing techniques. There was no statistical significant differences between groups for the Oswestry Disability Index (P=0.170). Galantino *et al.* states this study was not intended for an efficacy analysis but rather to obtain an estimate of the effect size and variance to plan a definitive study. The study was not powered to reach statistical significance, but it did discovered functional changes and improvement in QOL from yoga intervention (Table 7).

Table 7 Interventions reported by Galantino *et al.*¹⁵

Hatha yoga	No intervention	P value
Postures were selected based on orthopedic biomechanics. Yoga class included a period of meditation and relaxation in the beginning and end. Postures were adapted to each individual to prevent injury. The yoga group meet twice a week for 6-weeks. Sessions were 1-hour long.		
Oswestry Disability Index: mean (SD)		
Baseline: 24.98 (10.28)	Baseline: 36.73 (18.91)	
6-week follow-up: 21.15 (10.18)	6-week follow-up: 38.91 (17.56)	0.17

Specialized yoga versus usual care and advice

Cox *et al.*²² performed a pilot study and randomized 20 participants into a yoga and usual care group. Learning yoga relaxation was an important part of the yoga intervention. The follow-up data received from the yoga group at baseline was 60%, 50% at 4-weeks, and 60% at 12-weeks; the usual care group at baseline was 90%, 80% at 4-weeks, and 90% at the 12-week follow-up. Since patients were screened prior to randomization, there is missing data at baseline. The primary outcome was functional limitations measured by the Roland and Morris disability questionnaire (P=0.43 at 4-weeks and P=0.72 at 12-weeks). At both follow-up points in the trial, there was no significant difference between groups. The study was not designed to have a statistical or clinical significance (Table 8).

Table 8 Interventions reported by Cox *et al.*²²

Specialized yoga and advice	Usual care and advice	
<p>The intervention was introduced slowly over the course.</p> <ul style="list-style-type: none"> • Class 1: Relaxation and pain-relieving postures. • Classes 2-6: Core practices (settling poses, standing poses to teach good posture, improved flexibility in the upper back and shoulders, and chair-seated posture-strengthening poses, supine and prone poses). • Classes 7-12: build upon core practices (introduce progressive practice sequence and more standing, abdominal, supine and prone poses, and breathing awareness). <p>The subjects were treated to 12-weekly 75-minute classes. Yoga subjects were given a yoga manual, weekly practice handouts, and encouraged to practice at home. Both groups were given advice.</p>	<ul style="list-style-type: none"> • Given written advice on management of LBP and continued with usual care. 	
Roland and Morris disability questionnaire: mean (SD)		P value
Baseline: 9.9 (4.5)	Baseline: 8.7 (4.0)	
4-week follow-up: 5.74	4-week follow-up: 6.42	0.43
12-week follow-up: 3.98	12-week follow-up: 3.48	0.72

Table 9 Studies involving yoga treatment for low back pain

Article	Patient characteristics, sample size, and duration of complaints	Interventions	Primary Outcome measures	Follow-up assessment points	PE德罗 score	Level of evidence
Tekur <i>et al.</i> ²¹	Patient characteristics: patients with chronic low back pain recruited by advertisements, newsletters, self-referrals, word-of-mouth, or referrals by medical practitioners. n=80, Age: 18-60 Duration of low back pain: > 3 months Main exclusion criteria: chronic low back pain due to spinal pathology, severe obesity, critical illness.	Group 1: Integrated approach to yoga therapy Group 2: physical exercise	Oswestry Disability Index	Base line 1 week	7/10	Level 1b
Tekur <i>et al.</i> ⁸	Patient characteristics: patients with chronic low back pain recruited from a holistic health home n=80, Age: 18-60 Duration of low back pain: > 3 months Main exclusion criteria: low back pain due to spinal pathology	Group 1: Integrated approach to yoga therapy Group 2: physical exercises	WHOQOL Bref	Base line 1 week	7/10	Level 1b
Williams <i>et al.</i> ⁴	Patient characteristics: patients with non-specific low back pain recruited through physician and self-referred from local advertisements n=60, Age: > 18 Duration of low back pain: > 3 months Main exclusion criteria: low back pain due to spinal pathology, presurgical spine candidates, body mass index > 35, experiencing major depression or substance abuse and were practiced yoga	Group 1: Iyengar yoga Group 2: educational control group	Pain Disability Index	Baseline 16 weeks 3 months	5/10	Level 2b
Williams <i>et al.</i> ²³	Patient characteristics: patients with chronic low back pain recruited through self-referral and health professional referrals n=90, Age: 18-70 Duration of low back pain: > 3 months Main exclusion criteria: low back pain due to spinal pathology and other conditions such as pregnancy, presurgical spine candidates.	Group 1: Iyengar yoga Group 2: self-directed standard medical care	Oswestry Disability Index	Baseline 12 weeks 24 weeks 6 months	8/10	Level 1b

Article	Patient characteristics, sample size, and duration of complaints	Interventions	Primary Outcome measures	Follow-up assessment points	PEDro score	Level of evidence
Sherman <i>et al.</i> ⁶	<p>Patient characteristics: patients who visited a primary care provider for back pain treatment 3 to 15 months before the study were recruited from Group Health Cooperative n=101, Age: 20-64 Duration of low back pain: > 3 months Main exclusion criteria: low back pain possibly from a specific condition or minimal bothersness, currently receiving treatment or participated in yoga within the past year</p>	<p>Group 1: Viniyoga yoga Group 2: exercise classes Group 3: self-care book</p>	Roland Disability Scale	<p>Baseline 6 weeks 12 weeks 26 weeks</p>	8/10	Level 1b
Saper <i>et al.</i> ²⁰	<p>Patient characteristics: patients with chronic low back pain recruited from community health centers n=30, Age: 18-64 Duration of low back pain: ≥ 12 weeks Main exclusion criteria: yoga use in the previous year, low back pain treatments, new pain medication use, back surgery in the last 3 years, nonmuscular pathology</p>	<p>Group 1: Hatha yoga Group 2: Usual care with self-care book</p>	Roland-Morris Disability questionnaire	<p>Baseline 6 weeks 12 weeks 26 weeks</p>	7/10	Level 1b
Galantino <i>et al.</i> ¹⁵	<p>Patient characteristics: patients with chronic low back pain recruited through local advertisement and health care practitioners n=22, Age: 30-65 Duration of low back pain: > 6 months Main exclusion criteria: previous yoga experience, current history of chronic systemic disease, and changes in medication</p>	<p>Group 1: Hatha yoga Group 2: no treatment</p>	Oswestry Disability Index	<p>Baseline 6 weeks</p>	4/10	Level 2b
Cox <i>et al.</i> ²²	<p>Patient characteristics: patients who visited general practitioner once or more in the last 18 months were recruited through mailed out packs of information n=20, Age: 18-65 Duration of low back pain: > 3 months Main exclusion criteria: pregnancy, psychosis or recent substance abuse, current participation in yoga, already in a trial for low back pain, previous spinal surgery</p>	<p>Group 1: Specialized Iyengar yoga plus written advice Group 2: usual care plus written advice</p>	Roland-Morris Disability questionnaire	<p>Baseline 4 weeks 12 weeks</p>	7/10	Level 2b

DISCUSSION

This systematic review resulted in a variety of evidence that suggests yoga's effect on LBP symptoms is positive and is superior compared to no treatment, usual care, a self-care book, and physical exercises. Yoga was demonstrated to significantly improve quality of life and reduce functional disability, pain intensity, stress, depression, and medication usage associated with LBP in six of the eight analyzed trials, with two showing no between-group differences.

With the many different styles of yoga available, the randomized controlled trials differed in their choice for treatment of LBP. This inconsistency in yoga intervention may have confounding variables. However, each style of yoga focused mainly on postures, breathing, and meditation. Each study also involved participants with nonspecific cLBP, with the duration of low back pain was at least 12 weeks. The specific inclusion criteria was important for the studies concerning the natural course that LBP takes, where 90% of nonspecific LBP conditions resolve within two weeks and 40% are affected with recurrences within 6 months.¹

The average PEDro score for the trials analyzed was 6.625 with a range of 4-8; where many were with limitations. There was a possibility of skewed results when the principle investigator was either the yoga instructor or on the expert panel, as in the studies of Williams *et al.*^{4,23}, Saper *et al.*²⁰, and Galantino *et al.*¹⁵ Other inconsistencies throughout the studies included the specific set up of the programs. Also, the trials from Galantino *et al.*¹⁵ and Cox *et al.*²² lacked between-group differences, as both were not designed to reach statistical significance.

However, in the two trials by Tekur *et al.*,^{8, 21} there were significant differences between the groups, and the author found yoga to improve QOL and reduce disability according to the ODI. Williams *et al.*^{4, 23} reported yoga improved functional disability and reduced pain intensity and pain medication usage. Sherman *et al.*⁶ studied the effects of self-care book, yoga, and exercise on cLBP and found yoga to be more effective than the book in reducing cLBP and improving function. Saper *et al.*²⁰ found yoga to be more effective in reducing pain and medicine use than usual care, in the short term.

In a related study by Evans *et al.*⁵, 53 adults participated in a 6 week long treatment for cLBP. Through the use of modified integral yoga class and physical therapy, the researchers strongly correlated the outcome of cLBP treatment with self-efficacy. The study concluded that individuals with high pain self-efficacy fared better with less pain, improved health, and less disability compared to individuals with low pain self-efficacy. However, Evans *et al.* discussed how the social factor in yoga, as in all of the randomized controlled trials analyzed, may have presented subjects with a positive influence through social interaction that the control group did not have. This study is also filled with the possibility of bias considering it is a nonrandomized longitudinal study where participants were allowed to choose between yoga and physical therapy as their treatment for cLBP.

In most cases, exercise is suggested for managing cLBP²⁴, however, in a 10 year period, a survey showed the amount of physician visits for LBP barely changed. This suggests that the current treatments for LBP is are not effective or provide long-term solutions. As an alternative, the American College of Physicians and the American Pain Society have recommend yoga for

managing patients cLBP²⁵ and evidence has arisen that practicing yoga strengthens the core muscles, producing stability around the lumbar spine.²⁶

In the previously published systematic review by Posadzki and Ernst¹⁷, it was concluded that yoga alleviates cLBP through the positive outcomes from the majority of analyzed studies. Yet, with the limitations present, including two trials with no between-group differences, a firm claim is not possible. However, the systematic review did not include the randomized controlled trial by Tekur *et al.*⁸ In this randomized controlled trial, yoga is reported to lead to a higher QOL for patients with LBP. This is an important factor, as Lamé *et al.*²⁷ states the number one predictor for a person's QOL is pain catastrophizing, where an individual's personal belief about their pain is strongly correlated with their QOL, more so than the actual pain. Also, Mason *et al.*²⁸ found an important role in QOL is the present pain level and whether or not the pain is acceptable for individuals with cLBP. These studies show how LBP affects individuals on a multitude of levels and seem to indicate why the holistic approach of yoga has had positive results as a treatment for LBP.

CONCLUSION

With common LBP treatments found to be ineffective, research supports yoga as an effective alternative for LBP. With the complexities involved in formulating an effective treatment for LBP, yoga and its holistic approach is a viable option. Research demonstrated that yoga reduces functional disability, has positive effect on QOL, and a negative effect on stress, depression and pain intensity. It cannot be determined that yoga is the most effective treatment for LBP or which style is most effective, however, its overall effect on the subjects in the trials was positive.

KEY POINTS:

- It is supported that yoga is an effective treatment for LBP.
- Yoga as a holistic approach has potential to resolve cLBP
- Yoga was shown to be more effective than no treatment, usual care, a self-care book, and physical exercises.

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