

## **Evaluation of a Yoga Program for Back Pain**

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## Abstract

The objective of this study was to test the hypothesis that participants in a therapeutic yoga program for back pain would show improvements in back pain, and in back-related functionality, symptoms, mood, quality of life, and reduction in stress and the use of medication for back pain.

Participants were 25 adults with a complaint of chronic back pain who participated in a yoga program for back pain. The sample encompassed a variety of complaints including back pain, neck/shoulder problems, spondylolisthesis, sciatica/leg numbness, scoliosis, and herniated disc. The 12-week program consisted of weekly group yoga classes in the Krishnamacharya Healing Yoga Foundation (KHYF) tradition and included asana, pranayama, core strengthening, meditation, bhavana (visualization) and sound. Participants were also asked to practice regularly at home and maintain a journal. A battery of self-report questionnaires administered at baseline, 12 weeks and 24 weeks included two Likert scale (0-10) questions assessing back pain intensity and bothersomeness of back pain, the modified Roland-Morris Disability Scale (RMDS), Profile of Mood States (POMS), Perceived Stress Scale (PSS), SF36vHealth Survey and a qualitative exit questionnaire. Statistical significance was evaluated with one-sample *t*-tests on change scores.

Twenty-two subjects completed both baseline and end-program questionnaires and 19 completed follow-up questionnaires. Subjects showed statistically significant improvements from pre- to posttest on the following scales: disability, stress, physical health (physical functioning and bodily pain), mental health (vitality, social functioning, and psychological well-being), bothersomeness of symptoms, negative mood (depression/dejection, anger/hostility, fatigue, and confusion/bewilderment). These changes are considered clinically significant improvements on these scales. There was no significant change on use of medication. The end of program changes were sustained, and even strengthened at the three-month follow-up. Qualitatively, subjects reported strengthening of their back, more flexibility, reduced stress, better posture, reduced pain, and increased awareness.

The results demonstrated that KHYF yoga classes lead to significantly improved quality of life for adult sufferers of back pain, including decreased disability and pain, and improved physical functioning and mood (less anxiety, depressive feelings, anger, and fatigue). This study provided evidence that this yoga method ameliorates the negative effects of a very broad range of back pain disorders.

## **Introduction**

Although there have been some important contributions to the study of yoga for back pain, we have a great deal to learn about how this practice might mitigate a variety of back pain-inducing conditions. It is our intention that our work add to the body of scientific knowledge proving the hypothesis that yoga is an effective treatment tool for a wider range of musculoskeletal conditions than previously tested.

- 4/5 adults experience back pain
- Prior studies show that yoga improves back pain
- Little know about effectiveness of yoga for more severe back pain
- Objective: Test the hypothesis that participants would improve in back-related functionality, bothersomeness of symptoms, and related characteristics in a wider range of disorders

**Objective.** The objective of this study was to test the hypothesis that participants in a therapeutic yoga program for back pain would show improvements in back pain, and in back-related functionality, symptoms, mood, quality of life, and reduction in stress and the use of medication for back pain.

## **Methods**

### **Subjects**

Participants were adults with a complaint of chronic back pain who signed up to take a yoga program for back pain at a Boston teaching hospital. Participants had to be 18 or older, able to perform the yoga safely, and understand and carry out class instructions. There were no other entry criteria or exclusions.

Twenty-four adults completed participation in the program; 22 completed both baseline and end program questionnaires, 18 participants also completed the follow-up assessments 12 weeks after the end of the program. Twenty subjects were female, and 4 were male; their average age was 44.4. All subjects reported back pain. Other complaints at baseline included neck, shoulder, buttock and knee pain, muscle spasms, spondylolisthesis, leg numbness, postural misalignment, lack of flexibility and strength, scoliosis, and herniated disk.

### **Program**

The 12-week program consisted of weekly 90-minute group yoga classes in the Krishnamacharya Healing Yoga Foundation (KHYP) tradition. Classes included asana, pranayama, core strengthening, meditation, bhavana (visualization), and sound. Participants were given a handout of each sequence for home practice; they were asked to practice 5 times per week and to keep a journal in which they recorded practice times, questions and comments, and how they felt. Their questions and issues were discussed during a weekly intake circle, after which they handed their journal entries in. This helped us to identify problems early and address them promptly, usually during the same class. On average, participants attended approximately 10 classes and practiced at home 25-30 minutes 4 times per week.

Throughout the class series, posture sequences were adapted to meet individual needs. Neck & shoulder pain had been underreported initially, and after the first class, movements to stretch and strengthen the neck and shoulders were added to the breathing and centering at the beginning of class; back pain sequences were also modified to stretch, strengthen neck & shoulders. More subtle practices such as meditation, visualization, and affirmation were added to the classes as participants progressed, and the concept of Self from Patanjali's yoga sutras was explained and illustrated. In addition, the asana sequences were modified for three persons with spondylolisthesis, with flexion postures replacing extension postures. These subjects performed this different sequence side-by-side and concurrently with the other participants.

### **Measures**

A battery of self-report questionnaires were administered at baseline, 12 weeks and 24 weeks. These included two Likert scale (0-10) questions assessing back pain intensity and bothersomeness of back pain (“How painful was your back pain in the past week?” and “How bothersome was your back pain in the past week?”). Also included were the modified Roland-Morris Disability Scale (RMDS), and measures assessing health, mood, and stress. A qualitative exit questionnaire was administered only at the end of the program.

**Roland Morris Disability Scale (RMDS).** Participants’ self-reported disability for daily living activities, including work, was measured with the Roland Morris Disability Questionnaire (RMDQ), a health status measure to assess self-reported disability due to low back pain [20]. The RMDQ consists of 24 items. Each item is qualified with the phrase “because of my back pain.”

Patients were asked to check whether items applied to them during the past week. Examples include: “I walk more slowly than usual because of my back.” “I sleep less well because of my back.” Items rated “yes” were scored as 1; “no” was scored as 0. The RMDQ score was calculated by summing the items. The scores can range from 0, representing no disability, to 24, representing severe disability. Construct validity, internal consistency and reproducibility of the RMDQ are good [21, 22].

**SF-36v2 Health Survey.** The SF-36 was designed for use in clinical practice and research, health policy evaluations, and general population surveys. The SF-36v2® Health Survey is a multi-purpose, 36-item health survey yielding a profile of two health component summary measures and eight subscales representing domains of health-related quality of life [23, 24]. The SF-36 consists of one multi-item scale that assesses eight health concepts in eight subscales: 1) limitations in physical activities because of health problems [Physical Functioning]; 2) limitations in social activities because of physical or emotional problems [Social Functioning]; 3) limitations in usual role activities because of physical health problems [Role—physical]; 4) pain in the body [Bodily Pain]; 5) psychological distress or well-being [Mental Well-Being]; 6) limitations in usual role activities because of emotional problems [Role—emotional]; 7) energy and fatigue [Vitality]; and 8) perceptions of general health [General Health].

The two overall health consistent summary scores—Physical Health and Mental Health—were the average of four subscales each: the Physical Health was comprised of physical functioning, role—physical, bodily pain, and general health; Mental Health was comprised of social functioning, role—emotional, mental well-being, and vitality. All items were rated on 5-point scale, with 5 representing better health.<sup>1</sup> The internal reliability, construct validity and changes in disease-related symptoms over time of the SF-36 has been well documented [25, 26].

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<sup>1</sup> Physical functioning was a 3-point scale on the measure, but was converted to the 5-point equivalent in the analyses to make the means comparable.

**Mood Disturbance Scale (POMS).** The Profile of Mood States short form (POMS-SF) is a 30-item version of the POMS and is a well-validated, reliable and internally consistent self-report questionnaire consisting of 30 adjectives rated on a 5-point scale ranging from 0 (not at all) to 4 (extremely) designed to provide a total mood disturbance score as well as subscale scores for 6 mood states.<sup>27</sup> Five of the subscales represent negative mood states (tension/anxiety, depression/dejection, anger/hostility, fatigue, confusion/bewilderment), and one is a positive mood state (vigor/activity). The POMS has been validated on adult and college student populations.

**Perceived Stress Scale (PSS).** The 10-item Perceived Stress Scale (PSS) is the most widely used psychological instrument for measuring the perception of stress and has adequate internal reliability.<sup>28</sup> It is a measure of the degree to which situations in one's life are appraised as stressful. Items were designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale also includes a number of direct queries about current levels of experienced stress. Respondents are asked how often they felt a certain way over the past month on a scale of 0 (never) to 4 (very often). Higher stress scores indicate more stress.

## Results

Table 1 presents the means and standard deviations of study variables. Statistical significance of the change from the beginning to the end of the yoga program was evaluated with a one-sample *t*-test on the difference score computed by subtracting the posttest scores from the pretest scores. The one-sample *t*-tests were repeated on the difference between the follow-up and pretest scores to evaluate whether any changes found at the end of the yoga program were sustained three months later.

As shown in Table 2, subjects showed statistically significant improvements from pre- to posttest in the both physical and mental health. The mean decrease in physical health 0.5 points on a 5-point scale ( $p < .000$ ), including physical functioning, role—physical, and bodily pain; perceptions of general health did not improve. The mean decrease in mental health 0.3 points ( $p = .003$ ), including vitality, social functioning, and psychological distress and well-being, though not in usual roles because of emotional reactions to back pain. The health measure also included a question about perceptions of change in health status in the last year and that also indicated improvement (mean increase of 0.6 points ( $p = .015$ )).

A number of other measures also indicated improvement from pre- to posttest: disability (RMDQ mean decrease = 4.3 points,  $p < .000$ ); stress (mean decrease 0.3 points,  $p = .003$ ), bothersomeness of symptoms (mean decrease = 2.4,  $p < .000$ ), negative mood (mean decrease = 0.3,  $p = .004$ ), including, depression/dejection,

anger/hostility, fatigue, and confusion/bewilderment. These changes are considered clinically significant improvements on these scales. There was no significant change on use of medication.

These improvements in physical and mental health were not only maintained, but strengthened for most variables at the follow-up assessment, as shown in the baseline to follow-up data in Table 2. Several subscales that did not have significant change from pre- to posttest did show significant improvement from pretest to follow-up: the SF-36 subscale of perception of general health (mean increase of 0.20 point,  $p = .026$ ) and the mood disturbance subscales of tension/anxiety (mean decrease of .40,  $p = .010$ ) and vigor/activity anxiety (mean increase of .54,  $p = .019$ ).

Qualitatively, subjects reported the following improvements: strengthening of their back (9), flexibility (9), reduced stress (4), better posture (3), reduced pain (2), increased awareness (2), decreased medication (1), and better sleep (1). At the end of the program subjects responded to the question “In what ways, if at all, do you think yoga helped your back problem?” in an open-ended format. Most often, they attributed improvement to strengthened and increased flexibility. Also mentioned were reduced pain and stress, increased awareness, better posture, less use of medication, better sleep, relaxation, and sense of peace.

### **Discussion**

The results demonstrated that KHYF yoga classes lead to significantly improved quality of life for adult sufferers of back pain, including decreased disability and pain, and improved physical functioning and mood (less anxiety, depressive feelings, anger, and fatigue). This study provided evidence that this yoga method ameliorates the negative effects of a very broad range of back pain disorders.

#### Conclusions

- Yoga program reduced back pain and associated musculoskeletal symptoms, improved function, strength, flexibility, and mood.
- Improvements at end of program were sustained or even greater at 3-month follow-up

These robust effects three months after the end of the program suggest that participants continued the yoga after the end of the program.

The yoga program reduced back pain and associated musculoskeletal symptoms, improved function, strength, flexibility, and mood. Participants reported feeling more relaxed, peaceful, and balanced. Although not fully captured with the testing

instruments, from my personal perspective it was rewarding to see these people walk into class toward the end of the program looking less tired, more energetic, more calm and content. I would say that we witnessed the yoga of transformation in action (almost like the before & after on the core strengthening slide).

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Table 1. Means and Standard Deviations of Study Variables

	Mean <sup>1</sup> baseline	Mean posttest	Mean follow-up
Disability (RMDS)	6.13 (4.26)	2.05 (2.29)	1.89 (2.11)
Perceived stress (PSS)	1.40 (0.54)	1.12 (0.49)	1.17 (0.49)
<u>Health Scales (SF-36v2)</u>			
Physical health	3.70 (0.48)	4.14 (0.40)	4.23 (0.33)
Physical functioning	4.15 (0.59)	4.62 (0.34)	4.57 (0.41)
Role—physical	4.17 (0.72)	4.66 (0.60)	4.79 (0.40)
Bodily pain	2.52 (0.74)	1.82 (0.66)	1.63 (0.60)
General health	3.00 (0.41)	3.11 (0.34)	3.18 (0.36)
Mental health	3.60 (0.48)	3.84 (0.33)	3.90 (0.33)
Vitality	3.21 (0.65)	3.51 (0.65)	3.74 (0.51)
Social functioning	2.96 (0.29)	2.91 (0.20)	2.92 (0.30)
Role—emotional	4.39 (0.75)	4.73 (0.47)	4.68 (0.65)
Mental well-being	3.86 (0.64)	4.22 (0.46)	4.26 (0.41)
Change in health	2.87 (0.99)	3.45 (1.0)	3.58 (0.61)
Mood disturbance (POMS)	0.29 (0.56)	-0.01 (0.41)	-0.07 (0.42)
Tension/anxiety	0.92 (0.82)	0.69 (0.58)	0.59 (0.50)
Depression/dejection	0.64 (0.69)	0.27 (0.44)	0.31 (0.45)
Anger/hostility	0.84 (0.64)	0.43 (0.46)	0.49 (0.55)
Fatigue	1.24 (0.91)	0.89 (0.60)	0.68 (0.68)
Confusion/bewilder-	0.02 (0.66)	-0.29 (0.37)	-0.22 (0.37)
Vigor/activity	1.89 (0.87)	2.05 (0.75)	2.29 (0.53)
Bothersomeness	3.94 (2.68)	1.38 (1.28)	0.89 (1.33)
Use of medication	0.25 (0.44)	0.14 (0.35)	0.20 (0.41)

<sup>1</sup>Standard deviations are in parentheses after means.

Table 2. One-Sample *T*-test Results on Change Scores between Pretest and Posttest and between Pretest and Follow-up

	Baseline → Posttest			Baseline → Follow-up		
	Mean change	<i>t</i>	<i>p</i>	Mean Change	<i>t</i>	<i>p</i>
Disability (RMDS)	-4.26	-4.9	.000***	-5.53	-5.5	.000***
Perceived stress (PSS)	- 0.31	-3.4	.003**	- 0.34	-2.7	.016*
<u>Health Scales (SF-36v2)</u>						
Physical health	0.47	4.5	.000***	0.66	7.5	.000***
Physical functioning	0.52	4.5	.000***	0.27	4.8	.000***
Role—physical	0.56	3.4	.003**	0.83	5.8	.000***
Bodily pain	- 0.73	-4.6	.000***	-1.05	-6.1	.000***
General health	0.08	1.0	.341	0.20	2.4	.026*
Mental health	0.28	3.3	.003**	0.39	4.0	.001**
Vitality	0.35	2.4	.025*	0.62	-4.0	.001**
Social functioning	-0.02	-0.3	.747	0.00	0.0	1.000
Role—emotional	0.39	2.6	.017*	0.44	3.0	.007**
Mental well-being	0.39	3.1	.005**	0.52	-3.3	.004**
Change in health	0.55	2.7	.015*	0.68	2.5	.027*
Mood disturbance (POMS)	- 0.34	-3.2	.004**	- 0.46	-4.4	.000***
Tension/anxiety	- 0.28	-2.0	.064~	- 0.40	-2.9	.010**
Depression/dejection	- 0.39	-3.1	.006**	- 0.38	-3.3	.004**
Anger/hostility	- 0.42	-3.7	.001**	- 0.39	-3.1	.006**
Fatigue	- 0.42	-2.6	.016*	- 0.72	-3.5	.003**
Confusion/bewilder- Vigor/activity	- 0.32	-2.2	.042*	-2.78	-3.5	.002**
	0.20	0.8	.444	0.54	2.6	.019*
Bothersomeness	- 2.40	-4.7	.000***	-3.03	-6.0	.000***
Use of medication	-0.14	-1.4	.186	0.00	0.0	1.000

Statistical significance:  $\sim p < .10$ ;  $*p < .05$ ;  $**p < .01$ ;  $***p < .001$

Table 1. Means and Standard Deviations of Study Variables and One-Sample *T*-test Results on Change Scores

	Mean baseline	Mean posttest	Mean follow-up	Baseline → Posttest			Baseline → Follow-up		
				Mean change	<i>t</i>	<i>p</i>	Mean Change	<i>t</i>	<i>p</i>
Disability (RMDS)	6.13 (4.26)	2.05 (2.29)	1.89 (2.11)	-4.26	-4.9	.000***	-5.53	-5.5	.000***
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<u>Health Scales (SF-36v2)</u>									
Physical health	3.70 (0.48)	4.14 (0.40)	4.23 (0.33)	0.47	4.5	.000***	0.66	7.5	.000***
Physical functioning	4.15 (0.59)	4.62 (0.34)	4.57 (0.41)	0.52	4.5	.000***	0.27	4.8	.000***
Role—physical	4.17 (0.72)	4.66 (0.60)	4.79 (0.40)	0.56	3.4	.003**	0.83	5.8	.000***
Bodily pain	2.52 (0.74)	1.82 (0.66)	1.63 (0.60)	- 0.73	-4.6	.000***	-1.05	-6.1	.000***
General health	3.00 (0.41)	3.11 (0.34)	3.18 (0.36)	0.08	1.0	.341	0.20	2.4	.026*
Mental health	3.60 (0.48)	3.84 (0.33)	3.90 (0.33)	0.28	3.3	.003**	0.39	4.0	.001**
Vitality	3.21 (0.65)	3.51 (0.65)	3.74 (0.51)	0.35	2.4	.025*	0.62	-4.0	.001**
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Mental well-being	3.86 (0.64)	4.22 (0.46)	4.26 (0.41)	0.39	3.1	.005**	0.52	-3.3	.004**
Change in health	2.87 (0.99)	3.45 (1.0)	3.58 (0.61)	0.55	2.7	.015*	0.68	2.5	.027*
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Depression/dejection	0.64 (0.69)	0.27 (0.44)	0.31 (0.45)	- 0.39	-3.1	.006**	- 0.38	-3.3	.004**
Anger/hostility	0.84 (0.64)	0.43 (0.46)	0.49 (0.55)	- 0.42	-3.7	.001**	- 0.39	-3.1	.006**
Fatigue	1.24 (0.91)	0.89 (0.60)	0.68 (0.68)	- 0.42	-2.6	.016*	- 0.72	-3.5	.003**
Confusion/bewilder-	0.02 (0.66)	-0.29 (0.37)	-0.22 (0.37)	- 0.32	-2.2	.042*	-2.78	-3.5	.002**
Vigor/activity	1.89 (0.87)	2.05 (0.75)	2.29 (0.53)	0.20	0.8	.444	0.54	2.6	.019*
Bothersomeness	3.94 (2.68)	1.38 (1.28)	0.89 (1.33)	- 2.40	-4.7	.000***	-3.03	-6.0	.000***
Use of medication	0.25 (0.44)	0.14 (0.35)	0.20 (0.41)	-0.14	-1.4	.186	0.00	0.0	1.000 <sup>1</sup>

<sup>1</sup>There were only 14 subjects in this comparison, making it unreliable.

Statistical significance:  $\sim p < .10$ ;  $*p < .05$ ;  $**p < .01$ ;  $***p < .001$

Participants were also asked to practice regularly (5 times per week) at home and maintain a journal documenting their home practice and noting issues, questions, and observations.

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- 12-week program (12 1.5-hour classes)
- T. Krishnamacharya therapeutic yoga tradition
- Asana, pranayama, core strengthening, bhavana, meditation
- Weekly intake circle
- Asked to practice 5x/week
- Record practice details and turn in journal

The program consisted of 12 weekly 90-minute yoga classes, in the yoga tradition of T. Krishnamacharya. Classes included asana, pranayama, core strengthening techniques, bhavana<sup>2</sup>, and meditation.

Focused on Diaphragm, Pelvic Floor, Transversus Abdominus, Lumbar Multifidus

Included core strengthening in most postures thereafter

The focus of the practice was on the whole person, not simply strengthening this muscle and releasing that muscle. We did this initially through yogic breathing techniques, bhavana (attitude or mental image), and later, as the students begin to experience and report benefits, we introduced meditation, visualization, affirmation, and the concept of self based on Patanjali's yoga sutras. We proceeded with these more subtle techniques only after participants indicated, sometimes through their questions, that they were receptive to them.

Throughout the class series, asana sequences were adapted to meet individual needs. At the first class it was noted that many people who had initially complained only of back pain also had neck and shoulder pain. Thereafter, movements were included to stretch and strengthen the neck and shoulders with breathing and centering at the beginning of class, and whenever possible poses were modified in the back pain sequences to also address neck and shoulder conditions. Even though much of the emphasis may appear prescriptive (strengthening this muscle, releasing that muscle), the focus was on the whole person. Yogic breathing techniques and bhavana (attitude or mental image) were introduced first, and as the students began to experience and report benefits, meditation, visualization, affirmation, and the concept of self based on Patanjali's yoga sutras were presented. The instructor proceeded with these more subtle techniques only after participants indicated, sometimes through their questions, that they were receptive to them.

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<sup>2</sup> Bhavana is a visualization technique.

Adaptation was particularly important for three subjects with diagnosed spondylolisthesis, a forward movement or slippage of one spinal vertebra in relation to an adjacent vertebra. Extension postures are contraindicated for this condition, whereas flexion postures are generally helpful and can even encourage the slipped vertebra to slide back into place. Adaptation for this 3-person subgroup meant that we routinely had two very dissimilar group practices taking place concurrently. We devoted part of our circle time during our 5th class to teaching core-strengthening techniques.

From the fifth class on, participants incorporated core-strengthening principles in nearly every yoga posture. This slide shows the muscles we targeted for core strengthening: the diaphragm to enhance breathing capacity, the transversus abdominus, pelvic floor muscles, and lumbar multifidus to support the back--and a before and after example. ]

[

A battery of self-report questionnaires administered at baseline, end-program (12 weeks), and follow-up (24 weeks) included 2 questions assessing back pain intensity and bothersomeness of back pain on a scale of 0-10, the modified Roland-Morris Disability Scale (RMDS), and measures assessing health, mood, and stress. A qualitative exit questionnaire was administered only at the end of the program. We amended the pain intensity and bothersomeness questionnaire to apply to all types of back pain, not just low back pain. ]

The MOS 36-Item Short-Form Health Survey (SF-36): III. Tests of Data Quality, Scaling Assumptions, and Reliability Across Diverse Patient Groups



**Abstract**

Data from the Medical Outcomes Study (MOS) were used to evaluate data completeness and quality, test scaling assumptions, and estimate internal-consistency reliability for the eight scales constructed from the MOS SF-36 Health Survey. Analyses were conducted among 3,445 patients and were replicated across 24 subgroups differing in sociodemographic characteristics, diagnosis, and disease severity. Across patient groups, all scales passed tests for item-internal consistency (97% passed) and item-discriminant validity (92% passed). Reliability coefficients ranged from a low of 0.65 to a high of 0.94 across scales (median=0.85) and varied somewhat across patient subgroups.