Journal of Yoga & Physical Therapy
ISSN: 2157-7595

Schultz et al. J Yoga Phys Therapy 2011, 1:2
DOI: 10.4172/2157-7595.1000e103

Editorial Open Access

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 a variety of back pain conditions would show improvements in back pain, back-related functionality, symptoms, mood, quality of life, and reduction in stress and the use of medication for back pain.

Participants were 24 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 based on the methodology of the Krishnamacharya Healing Yoga Foundation (KHYF). This method includes asana, pranayama, core strengthening, meditation, bhavana (visualization) and mantra. Participants also practiced regularly at home and maintained a journal. A battery of self-report questionnaires were administered at baseline, 12 weeks, and 24 weeks. 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 baseline to end-program 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). There was no significant change on use of medication. The end-program changes were sustained, and even strengthened, at the 24-week 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 depressive feelings, anger, fatigue, and confusion). This study provided evidence that this yoga method ameliorates the negative effects of a very broad range of back pain disorders.

Keywords: Yoga; Chronic back pain

Introduction

Back pain is a widespread [1] and costly [2,3] public health issue. The incidence of back pain is exacerbated by our modern sedentary and stress-filled lifestyle, which contributes to the upsurge in many of the causes of back pain. These causes include obesity, hypokinetic (sedentary) activity—which makes muscles weak and unable to support normal structural weight—and stress, which produces tense and shortened muscles with restricted movements [4].

Chronic back pain continues to be challenging to treat. Conventional medical therapies are limited to analgesics, patient education on proper posture, physical therapy, and exercise [5,6], and seem largely ineffective [7]. This leads many to seek complementary or alternative treatments, such as massage, chiropractic, and mind-body techniques [8,9]. Yoga is among the most commonly used of these alternative therapies [10].

Research on the effectiveness of yoga in treating back pain has employed varying levels of control (including randomized control trials), a variety of types of control groups, and various methods of yoga, including Iyengar, viniyoga, and other types of Hatha yoga [10]. Studies have found yoga to be effective in the reduction of low back pain-related disability [6,11-13], pain and use of pain medication [6,11,12,14], and depression [14-15], as well as in improvements in spinal flexibility (flexion, extension, lateral flexion, functional sit and reach) [13,15]. Although researchers have generally studied majority populations [16], a recent study has specifically looked at the positive effects of Yoga on minorities with chronic low back pain [17].

Studies of yoga and back pain have focused almost exclusively on chronic, nonspecific *low* back pain, and therefore little is known about the efficacy of yoga in treating a wider range of musculoskeletal conditions of the back (e.g., pain in other areas of the back). One exception is a recent small-scale (n = 11) German study in which participants with back pain anywhere along the spine were guided through eight one-on-one intensive sessions of T. Krishnamacharya yoga tailored to their individual needs [18]. The objective of the current study is to test the hypothesis that participants in a therapeutic yoga program in the T. Krishnamacharya tradition for back pain not restricted to the low back would show improvements in back pain, back-related functionality, symptoms, mood, quality of life, and reductions in stress and the use of medication for back pain.

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Received July 19, 2011; **Accepted** July 19, 2011; **Published** July 21, 2011

Citation: Schultz LH, Uyterhoeven S, Khalsa SBS (2011) Evaluation of a Yoga Program for Back Pain. J Yoga Phys Therapy 1:e103. doi:10.4172/2157-7595.1000e103

Methods

Subjects

Participants were adults with a complaint of chronic back pain recruited at a Boston teaching hospital through a newsletter emailed to all employees and notices posted at a medical office building. 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.

Program

The 12-week program consisted of weekly 90-minute group yoga classes using the Krishnamacharya Healing Yoga Foundation (KHYF) methodology [19-21]. Classes included asana, pranayama, core strengthening, meditation, bhavana (visualization), and mantra. Participants were given a handout of each sequence for home practice and asked to practice a weekly sequence of poses five times per week. They recorded practice times (averaging about 30 minutes a day), questions and comments, and how they felt in a journal. Their questions and issues were discussed during a weekly intake circle, after which they handed in their journal entries. This helped us to identify problems early and address them promptly, usually during the same class.

Throughout the class series, posture sequences were adapted to meet individual needs. Neck and shoulder pain had been underreported at intake, 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 and 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 [22,23] was explained and illustrated. In addition, the asana sequences were modified for three people 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?"). Use of medication was evaluated with the "yes/no" question, "Have you used medication for your back during the past week?" Also included were the modified Roland-Morris Disability Scale (RMDS), and measures assessing health, mood, and stress. A qualitative exit questionnaire consisted of write-in questions about the main reason for participating in the class series, the results experienced, whether class instructions were clear, which aspects of the work the participants would continue using, the most useful aspects of the classes, recommendations for improving the program, and whether they would recommend the program to others with similar problems.

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 [24]. The RMDQ consists of 24 items, each qualified with the phrase "because of my back."

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 [25,26].

SF-36v2 health survey (SF-36)

The SF-36 was designed for use in clinical practice and research, health policy evaluations, and general population surveys. The SF-36 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 [27,28]. 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 Heath scale 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.[1] The internal reliability, construct validity and changes in disease-related symptoms over time of the SF-36 have been well documented [29,30].

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. It consists 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 [31]. Five subscales represent negative mood states (tension/anxiety, depression/dejection, anger/hostility, fatigue/inertia, 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 [32]. 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

[1]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.

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.

Analyses

Statistical significance of the change from baseline to end-program was evaluated with a one-sample *t*-test on the difference score computed by subtracting the end-program scores from the baseline scores. The one-sample t-tests were repeated on the difference between the follow-up and baseline scores to evaluate whether any changes found at end-program were sustained at follow-up 24 weeks later. Cohen's *d* effect sizes were calculated as the difference between the means divided by the (common)[2] standard deviation [33].

Results

Twenty-four adults completed participation in the program; 22 participants completed both baseline and end-program questionnaires, and 18 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 and sciatica, postural misalignment, lack of flexibility and strength, scoliosis, and herniated disk. On average, participants attended approximately 10 classes and practiced at home 25-30 minutes 4 times per week.

Table 1 presents the means and standard deviations of study variables, and Table 2 presents the statistical significance testing and effect sizes (ES). As shown in Table 2, subjects showed statistically significant improvements from baseline to end-program in both physical and mental health. The mean increase in physical health was 0.5 points on a 5-point scale (ES = 1.00, p < .000), including physical functioning, role-physical, and bodily pain; perceptions of general health did not improve. The mean increase in mental health was 0.3 points (ES = 0.59, p = .003), including vitality, social functioning, and psychological distress and well-being. There was no significant change in role-emotional (an individual's usual behavior 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, ES = 0.58, p = .015).

A number of other measures also showed improvement in participants from baseline to end-program: disability (RMDQ mean decrease = 4.3 points, ES = 1.25, p < .000); stress (mean decrease 0.3 points, ES = 0.54, p =.003), bothersomeness of symptoms (mean decrease = 2.4 , ES = 1.29, p < .000), negative mood (mean decrease = 0.3, ES = 0.61, p = .004), including, depression/dejection, anger/hostility, fatigue, and confusion/bewilderment. There was no significant change on use of medication.

	Baseline mean[1]	End-program mean	Follow-up mean
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)
Health Scales (SF-36)			
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)

[1]Standard deviations are in parentheses after means.

Table 1: Means and Standard Deviations of Study Variables.

[2]An assumption of the *t*-test is that the two means have equal standard deviations; in these calculations, the average of the two standard deviations was used as the denominator.

	Baseline → End-program				Baseline → Follow-up			
	Mean change	*t*	*p*	Effect size	Mean change	*t*	p	Effect size
Disability (RMDS)	-4.26	-4.9	.000***	1.25	-5.53	-5.5	.000***	1.33
Perceived stress (PSS)	-0.31	-3.4	.003**	0.54	- 0.34	-2.7	.016*	0.44
Health Scales (SF-36)								
Physical health	0.47	4.5	.000***	1.00	0.66	7.5	.000***	1.29
Physical functioning	0.52	4.5	.000***	1.00	0.27	4.8	.000***	0.84
Role—physical	0.56	3.4	.003**	0.79	0.83	5.8	.000***	1.11
Bodily pain	- 0.73	-4.6	.000***	1.00	-1.05	-6.1	.000***	1.33
General health	0.08	1.0	.341	0.29	0.20	2.4	.026*	0.46
Mental health	0.28	3.3	.003**	0.59	0.39	4.0	.001**	0.73
Vitality	0.35	2.4	.025*	0.46	0.62	-4.0	.001**	0.91
Social functioning	-0.02	-0.3	.747	0.20	0.00	0.0	1.000	0.13
Role—emotional	0.39	2.6	.017*	0.46	0.44	3.0	.007**	0.41
Mental well-being	0.39	3.1	.005**	0.65	0.52	-3.3	.004**	0.75
Change in health	0.55	2.7	.015*	0.58	0.68	2.5	.027*	0.89
Mood disturbance (POMS)	- 0.34	-3.2	.004**	0.61	- 0.46	-4.4	.000***	0.73
Tension/anxiety	- 0.28	-2.0	.064~	0.35	- 0.40	-2.9	.010**	0.50
Depression/dejection	- 0.39	-3.1	.006**	0.65	- 0.38	-3.3	.004**	0.58
Anger/hostility	- 0.42	-3.7	.001**	0.75	- 0.39	-3.1	.006**	0.58
Fatigue	- 0.42	-2.6	.016*	0.46	- 0.72	-3.5	.003**	0.70
Confusion/bewilder-	- 0.32	-2.2	.042*	0.60	-2.78	-3.5	.002**	0.46
Vigor/activity	0.20	0.8	.444	0.20	0.54	2.6	.019*	0.57
Bothersomeness	- 2.40	-4.7	.000***	1.29	-3.03	-6.0	.000***	1.53
Use of medication	-0.14	-1.4	.186	0.28	0.00	0.0	1.000	0.12

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

Table 2: One-Sample *T*-test Results on Change Scores between Baseline and End-program and between Baseline and Follow-up.

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 baseline to end-program did show significant improvement from baseline to follow-up: the SF-36 subscale of perception of general health and the mood disturbance subscales of tension/anxiety and vigor/activity.

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. Many attributed improvement to strengthening of their back and increased flexibility (9 participants each). 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 suggest 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 depressive feelings, anger, fatigue, and confusion). This study provides evidence that this yoga method ameliorates the negative effects of a very broad range of back pain disorders. The robust effects three months after the end of the program suggest that participants either continued yoga practice after the end of the program or had incorporated better postural patterns and movement into everyday life, and thus that back pain sufferers may be able to maintain the gains from this intervention over time. The yoga of T. Krishnamacharya used in this study shares the same origins as Viniyoga, which was employed in an earlier controlled, randomized trial demonstrating its effectiveness in reducing low back pain and improving back-related functionality [6]. Both emphasize dynamic movement, coordination of movement with breath, adaptation, sequencing, and function over form.

A number of rationales have been put forward for yoga's utility as a therapy for chronic back pain. Yoga improves strength, range of motion, balance and agility, and mobilizes the spine and hip joints to reduce pain [5]; yoga increases flexibility, tones muscles, and releases muscle tension [34–36] specifically increasing hip flexion [37] and spinal and hamstring flexibility [38,39]. Yet yoga's benefits reach beyond the physical realm into the psychological and even spiritual, making it uniquely suited to treating pain. Pain affects every system of our physical body as well as our mental experience, including thoughts, emotions, behavior, and relationships [16]. Yoga couples physical exercise with breathing, which links the mind and the body, and thus offers physical movement with a mental focus [6].

Research on meditation as an effective intervention for chronic low back pain highlights the constructive role of cognitive components in people's ability to manage their pain. Mindfulness meditation helps reduce pain, improve physical function, and increase quality

of life [40,41], in part because people learn to bear witness to their own experiences without judgment, leading to acceptance of their pain-filled condition [42]. Meditation and pranayama have both been found helpful in pain management [43,44], and the meditation and pranayama techniques included in the intervention in this study increased the mindfulness of the yoga.

The mental focus cultivated by yoga helps people increase their awareness of maladaptive ways of moving and positioning their body, to relax tense muscles, and to relieve mental stress [6,45]. Moreover, yoga therapy promotes healing by resting the area of pain and teaching the proper alignment of bones, muscles, and connective tissue in movements that change the underlying root cause of the discomfort, thus minimizing and ultimately correcting underlying physical malfunctions [11]. Yoga reduces stress and improves mood and overall well-being [5,46]. The yoga practiced in the current study followed the principle of the "panca maya" model, in which the five "mayas" or dimensions of body, breath/energy, mind, personality, and relationship are all elements of healing and growth. As a T. Krishnamacharya disciple commented, "Yoga takes into account the present state of all areas of one's being and seeks to affect them all in whatever manner is most personally appropriate" [47].

The present study had a number of limitations related to its preliminary and exploratory nature. The sample size was small and there was no control group. The self-selected subjects joined the study with an expectation of positive benefits. Despite such limitations, the large effect sizes found in this pilot study suggest that yoga may have the power to help manage and heal a wide range of back pain conditions. This study lays the groundwork for larger, controlled and randomized trials that can provide more substantial evidence for the effectiveness of yoga to ameliorate and heal back pain problems—anywhere along the spine—that cause millions to suffer chronic pain.

Acknowledgements

Lisa Whittemore served as Research Assistant and assisted the yoga teacher in this study.

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