Comparación del yoga, el ejercicio físico y los libros de autoayuda en la lumbalgia moderada crónica: ensayo aleatorio y con grupo-control

Karen J Sherman, Daniel C Cherkin, Janet Erro, Diana L Miglioretti, Richard A Deyo. **Annals of Internal Medicine**. Philadelphia: Dec 20, 2005.Vol.143, Iss. 12; pg. 849, 8 pgs

Datos de control del impacto:

Annals of Internal Medicine

Total de citas en 2003: 36590
Factor de Impacto: 12.427

Artículo completo

Background: Chronic low back pain is a common problem that has only modestly effective treatment options.

Objective: To determine whether yoga is more effective than conventional therapeutic exercise or a self-care book for patients with chronic low back pain.

Design: Randomized, controlled trial.

Setting: A nonprofit, integrated health care system.

Patients: 101 adults with chronic low back pain.

Intervention: 12-week sessions of yoga or conventional therapeutic exercise classes or a self-care book.

Measurements: Primary outcomes were back-related functional status (modified 24-point Roland Disability Scale) and "bothersomeness" of pain (11-point numerical scale). The primary time point was 12 weeks. Clinically significant change was considered to be 2.5 points on the functional status scale and 1.5 points on the bothersomeness scale. Secondary outcomes were days of restricted activity, general health status, and medication use.

Results: After adjustment for baseline values, back-related function in the yoga group was superior to the book and exercise groups at 12 weeks (yoga vs. book: mean difference, -3.4 [95% CI, -5.1 to -1.6] [$P < 0.001$]; yoga vs. exercise: mean difference, -1.8 [CI, -3.5 to - 0.1] [$P = 0.034$]). No significant differences in symptom bothersomeness were found between any 2 groups at 12 weeks; at 26 weeks, the yoga group was superior to the book group with respect to this measure (mean difference, -2.2 [CI, -3.2 to - 1.2]; $P < 0.001$). At 26 weeks, back-related function in the yoga group was superior to the book group (mean difference, -3.6 [CI, -5.4 to - 1.8]; $P < 0.001$).

Limitations: Participants in this study were followed for only 26 weeks after randomization. Only 1 instructor delivered each intervention.

Conclusions: Yoga was more effective than a self-care book for improving function and reducing chronic low back pain, and the benefits persisted for at least several months.

Ann Intern Med. 2005;143:849-856. www.annals.org

Most treatments for chronic low back pain have modest efficacy at best (1). Exercise is one of the few proven treatments for chronic low back pain; however, its effects are often small, and no form has been shown to be clearly better than another (2-5). Yoga, which often couples physical exercise with breathing, is a popular alternative form of "mind-body" therapy. An estimated 14 million Americans practiced yoga in 2002 (6), including more than 1 million who used it as a treatment for back pain (7, 8). Yoga may benefit patients with back pain simply because it involves exercise or because of its effects on mental focus. We found no published studies in western biomedical literature that evaluated yoga for chronic low back pain; therefore, we designed a clinical trial to evaluate its effectiveness and safety for this condition.

METHODS

Study Design and Setting

This randomized, controlled trial compared the effects of yoga classes with conventional exercise classes and with a self-care book in patients with low back pain that persisted for at least 12 weeks. The study was conducted at Group Health Cooperative, a nonprofit, integrated health care system with approximately 500 000 enrollees in Washington State and Idaho. The Group Health Cooperative institutional review board approved the study protocol, and all study participants gave oral informed consent before the eligibility screening and written consent before the baseline interview and randomization.

Patients

Patients from Group Health Cooperative were recruited for 12-week sessions of classes that were conducted between June and December 2003. We mailed letters describing the study to 6913 patients between 20 and 64 years of age who had visited a primary care provider for treatment of back pain 3 to 15 months before the study (according to electronic visit records). We also advertised the study in the health plan's consumer magazine. Patients were informed that we were comparing 3 approaches for the relief of back pain and that each was designed to help reduce the negative effects of low back pain on people's lives. A research assistant telephoned patients who returned statements of interest to assess their eligibility. After we received their signed informed consent forms, eligible patients were telephoned again for collection of baseline data and randomization to treatment.

We excluded individuals whose back pain was complicated (for example, sciatica, previous back surgery, or diagnosed spinal stenosis), potentially attributable to specific underlying diseases or conditions (for example, pregnancy, metastatic cancer, spondylolisthesis, fractured bones, or dislocated joints), or minimal (rating of less than 3 on a "bothersomeness" scale of 0 to 10). We also excluded individuals who were currently receiving other back pain treatments or had participated in yoga or exercise training for back pain in the past year, those with a possible disincentive to improve (such as patients receiving workers' compensation or those involved in litigation), and those with unstable medical or severe psychiatric conditions or dementia. Patients who had contraindications (for example, symptoms consistent with severe disk disease) or schedules that precluded class participation, those who were unwilling to practice at home, or those who could not speak or understand English were also excluded.

Randomization Protocol

Participants were randomly assigned to participate in yoga or exercise classes or to receive the self-care book. We randomly generated treatment assignments for each class series by using a computer program with block sizes of 6 or 9. A researcher who was not involved in patient recruitment or randomization placed the assignments in opaque, sequentially numbered envelopes, which were stored in a locked filing cabinet until needed for randomization.

Interventions

The yoga and exercise classes developed specifically for this study consisted of 12 weekly 75-minute classes designed to benefit people with chronic low back pain. In addition to attending classes held at Group Health facilities, participants were asked to practice daily at home. Participants received handouts that described home practices, and yoga participants received auditory compact discs to guide them through the sequence of postures with the appropriate mental focus (examples of postures are shown in the Appendix Figure, available at www.annals.org). Study participants retained access to all medical care provided by their insurance plan.

Yoga

We chose to use viniyoga, a therapeutically oriented style of yoga that emphasizes safety and is relatively easy to learn. Our class instructor and a senior teacher of viniyoga, who has +written a book about its therapeutic uses (9), designed the yoga intervention for patients with back pain who did not have previous yoga experience. Although all the sessions emphasized use of postures and breathing for managing low back symptoms, each had a specific focus: relaxation; strengthbuilding, flexibility, and large-muscle movement; asymmetric poses; strengthening the hip muscles; lateral bending; integration; and customizing a personal practice. The postures were selected from a core of 17 relatively simple postures, some with adaptations (Appendix Table, available at www.annals .org), and the sequence of the postures in each class was performed according to the rudiments of viniyoga (9). Each class included a question-and-answer period, an initial and final breathing exercise, 5 to 12 postures, and a guided deep relaxation. Most postures were not held but were repeated 3 or 6 times.

Exercise

Because we could not identify a clearly superior form of therapeutic exercise for low back pain from the literature, a physical therapist designed a 12-session class series that was 1) different from what most participants would have probably experienced in previous physical therapy sessions (to maximize adherence) and 2) similar to the yoga classes in number and length. We included a short educational talk that provided information on proper body mechanics, the benefits of exercise and realistic goal setting, and overcoming common barriers to developing an exercise routine (for example, fear). Each session began with the educational talk; feedback from the previous week; simple warm-ups to increase heart rate; and repetitions of a series of 7 aerobic exercises and 10 strengthening exercises that emphasized leg, hip, abdominal, and back muscles. Over the course of the 12-week series, the number of repetitions of each aerobic and strength exercise increased from 8 to 30 in increments of 2. The

strengthening exercises were followed by 12 stretches for the same muscle groups; each stretch was held for 30 seconds. Classes ended with a short, unguided period of deep, slow breathing.

Self-Care Book

Participants were mailed a copy of The Back Pain Helpbook (10), an evidence-based book that emphasized such self-care strategies as adoption of a comprehensive fitness and strength program, appropriate lifestyle modification, and guidelines for managing flare-ups. Although we did not provide any instructions for using the book, many of the chapters concluded with specific action items.

Outcome Measures

Interviewers who were masked to the treatment assignments conducted telephone interviews at baseline and at 6, 12, and 26 weeks after randomization. The baseline interview collected information regarding sociodemographic characteristics, back pain history, and the participant's level of knowledge about yoga and exercise. Participants were asked to describe their current pain and to rate their expectations for each intervention.

The primary outcomes were back-related dysfunction and symptoms, and the primary time point of interest was 12 weeks. We used the modified Roland Disability Scale (11) to measure patient dysfunction by totaling the number of positive responses to 23 questions about limitations of daily activities that might arise from back pain. This scale has been found to be valid, reliable, and sensitive to change (12-14); researchers estimate that the minimum clinically significant difference on the Roland scale ranges from 2 to 3 points (13, 15). Participants rated how "bothersome" their back pain had been during the previous week on an 11-point scale, in which 0 represented "not at all bothersome" and 10 represented "extremely bothersome"; a similar measure demonstrated substantial construct validity in earlier research (13). Estimates of the minimum clinically significant difference on the bothersomeness scale were approximately 1.5 points (16, 17).

Secondary outcome measures were general health status, which we assessed by conducting the Short Form-36 Health Survey (18); degree of restricted activity as determined by patient responses to 3 questions (19); and medication use. After all outcomes data were collected, we asked questions related to specific interventions (for example, "Did you practice at home?"). At the 12-week interview, we asked class participants about any pain or substantial discomfort they experienced as a result of the classes. We assessed adherence to the home practice recommendations by asking class participants to complete weekly home practice logs and by asking about home practice during the follow-up interviews at weeks 12 and 26.

Statistical Analysis

An intention-to-treat approach was used. We compared baseline characteristics across the randomization groups by using chi-square tests and analysis of variance; when comparing medians, we used the Mann-Whitney U test. To compare rates, we computed relative risks and 95% CIs. We used linear regression to assess differences among

randomization groups at each follow-up evaluation for our primary outcomes. All follow-up times, including the primary time point of interest (12 weeks), were analyzed for each outcome in a single model. The model included the main effects of follow-up time (treated as a categorical variable) and randomization group, along with the interactions between follow-up time and group to allow for differences in treatment effects over time. In addition, we adjusted for the baseline value of the outcome to increase precision. We fit regression models by using generalized estimating equations with an exchangeable correlation structure to adjust for possible correlation within patients over the 3 follow-up time points (20). Models were estimated with the PROC GENMOD statement in SAS statistical software, version 8.2 (SAS Institute, Inc., Cary, North Carolina). We used a 2-sided α level of 0.05 to determine statistical significance for all tests. To protect against multiple comparisons when comparing the 3 treatment groups at each follow-up time, we used the Fisher protected least significant difference test, which has been shown to be desirable for comparing 3 groups (21). We only made pairwise comparisons of the 3 treatment groups when the overall F test at that time point was significant. For the pairwise comparisons, there was 80% power to detect a difference of 2.7 on the Roland scale between groups of 30 individuals.

Role of the Funding Sources

The National Center for Complementary and Alternative Medicine and the National Institute for Arthritis and Musculoskeletal and Skin Diseases provided funding for this study, but neither agency had any role in its design, conduct, or interpretation or in the decision to submit the manuscript for publication.

RESULTS

Recruitment and Follow-up of Patients

We received responses from 563 of the patients who received invitation letters and from 90 patients responding to the advertisement. A total of 101 participants were enrolled: 96 from the mailings and 5 from the consumer magazine (Figure 1). Many nonrespondents were probably ineligible (for example, they may not have been presently experiencing low back pain or were unable to attend the classes) (22). All participants assigned to the yoga group attended at least 1 class, as did all but 2 individuals assigned to the exercise classes (Figure 1). Follow-up rates remained high, even at 26 weeks (95 of 101 participants completed telephone interviews).

Baseline Characteristics

The typical participant was a college-educated white woman between 40 and 50 years of age and gainfully employed (Table 1). Most had first experienced back pain more than 1 year before the study, and two thirds of participants reported that their pain had lasted for more than 1 year. Few reported work loss related to back pain or extensive activity restrictions, but more than half had taken medications in the week before the interview. Participants used nonsteroidal anti-inflammatory drugs most frequently; each of the other types of medications (for example, antidepressants, narcotics, and non-narcotic analgesics) were used by fewer than 12% of individuals in each treatment group. Pain radiating below the knee was more common at the baseline interview in the yoga and exercise groups. Most participants reported having exercised in the previous

week, averaging approximately 3 hours of exercise. They reported similar expectations of helpfulness from yoga or exercise but had lower expectations for the book.

Study Treatments

Class attendance was similar in the yoga (median classes attended, 9) and exercise (median classes attended, 8) groups (Figure 1). Most class attendees in both groups completed at least 9 weekly homework logs, and more than 75% of participants reported practicing for an average of 3 or more days per week. These data were consistent with the participants' reports of home practice during the interview at week 12 (median, 4 days of practice; median duration of each practice session was 30 minutes for the yoga group and 18 minutes for the exercise group). Even at 26 weeks, most participants in both groups reported that they practiced at home during the previous week (median, 3 days; median duration of each practice session was 20 minutes for the yoga group and 15 minutes for the exercise group). On a scale of 0 to 10, class attendees rated their feeling of connectedness to the yoga instructor at a median of 8 compared with a median rating of 7 for the exercise instructor ($P = 0.015$). Most participants in both classes reported that they were "very likely" to continue their yoga or exercise practice in the future, but twice as many yoga class participants said they would definitely recommend the class to others (relative risk, 2.1 [95% CI, 1.3 to 3.2]).

All participants in the group that received the self-care book reported reading at least part of the book; 9 (30%) participants reportedly read between one third and two thirds of the book, and 17 (57%) reportedly read more than two thirds of the book.

No serious adverse events were reported. One participant discontinued yoga classes because postures that required her to move her head below her heart precipitated her migraine headaches. One participant in the exercise class strained her back during class and sought care from a chiropractor.

Nonstudy Treatments

During the 12-week intervention, 11% of participants in the yoga group reported making visits to health care providers for low back pain compared with 23% in the exercise group (relative risk, 0.48 [CI, 0.15 to 1.5]) and 10% in the book group (relative risk, 1.1 [CI, 0.27 to 4.6]). By the end of the follow-up period, 4 of 34 (12%) participants in the yoga group reported back-related visits to a health care provider compared with 6 of 32 (19%) in the exercise group (relative risk, 0.63 [CI, 0.19 to 2.0]) and 9 of 29 (31%) in the book group (relative risk, 0.38 [CI, 0.13 to 1.1]). Primary care providers, chiropractors, and massage therapists were the most common types of providers visited. Among the 3 groups, there was no significant difference in time spent doing aerobic exercise or back-focused exercise at any of the follow-up interviews.

Functional Status and Symptoms

The Roland disability score decreased in all 3 groups over the course of the study (Figure 2); however, the mean Roland scores, adjusted for baseline scores, were significantly different among the 3 groups at all 3 follow-up time points (12 weeks: $P = 0.002$; 6 weeks: $P = 0.046$; 26 weeks: $P = 0.002$). Compared with the book group, the yoga group showed clinically important and statistically significant improvements in

functional status at all follow-up points; mean difference in Roland scores ranged from 2.6 to 3.6 points (Table 2). Although the yoga group had significantly greater improvement than the exercise group at 12 weeks, the differences were clinically unimportant. As expected, the difference between the exercise group and the book group was similar to what is found in the literature (4).

Bothersomeness of symptoms decreased in all treatment groups during the 12-week intervention period (Figure 3). However, between weeks 12 and 26, symptoms continued to improve only in the yoga group, whereas participants in the exercise and book groups experienced worsening symptoms. The omnibus F test did not reveal statistically significant differences among the treatment groups at the primary time point of 12 weeks (P = 0.135). At 6 and 26 weeks (Figure 3), the yoga group experienced clinically and statistically significant reductions in symptoms compared with the book group (1.6 and 2.2 points, respectively) (Table 2).

Although it was not part of our original analysis plan, we examined the robustness of our primary outcome measure by looking at improvement in the Roland Disability Scale at 12 weeks with respect to 2 other criteria: the proportion of participants in each group whose Roland score decreased by at least 2 points, and the proportion of participants whose Roland score decreased by at least 50%. In the yoga group, 78% of participants had reductions in their Roland score of at least 2 points compared with 63% in the exercise group (relative risk, 1.2 [CI, 0.89 to 1.7]) and 47% in the book group (relative risk, 1.7 [CI, 1.1 to 2.5]). Finally, 69% of participants in the yoga group had a reduction in their Roland score of at least 50% compared with 50% of participants in the exercise group (relative risk, 1.4 [CI, 0.91 to 2.1]) and 30% in the book group (relative risk, 2.3 [CI, 1.3 to 4.2]).

Other Outcomes

Medication use, which was similar among groups at baseline, decreased most sharply in the yoga group. Only 21% of participants in the yoga group reported medication use during the week before the 26-week interview compared with 50% in the exercise group (relative risk, 0.41 [CI, 0.20 to 0.87]) and 59% in the book group (relative risk, 0.35 [CI, 0.17 to 0.73]). Performance on the physical and mental health components of the Short Form-36 Health Survey and responses to questions regarding restricted activity were not significantly different between groups over time.

DISCUSSION

The results of this trial suggest that yoga is an effective treatment for chronic low back pain. The benefits persisted 14 weeks after the end of classes and did not appear to be caused by co-interventions or medications because use of such interventions was lower in this group. The benefits also do not appear to be attributable to baseline differences in prognostic factors because all prognostic measures except leg pain were similar at baseline. Our results were unchanged when we conducted an analysis that controlled for leg pain below the knee, which was more common in the yoga and exercise groups. The superior outcomes in the yoga group are particularly noteworthy given participants' high baseline levels of activity. The yoga group consistently reported superior outcomes compared with the exercise group, but none of these differences were both statistically and clinically significant.

There has been little research on the mechanisms by which yoga practice might relieve back pain. Although westerners often think of yoga as a form of exercise, the practice of yoga places as much emphasis on mental focus as on physical movement (23) and considers the breath, which links the mind and the body, as the key to achieving both physical and psychological benefits (24). Yoga may be beneficial for back pain because it involves physical movement, but it may also exert benefits through its effects on mental focus.

Our study was not designed to tease apart the relative contributions of physical movement and mental focus. From a physical perspective, popular lore posits that yoga increases flexibility and strength, tones muscles, and releases muscle tension (25-27), and several studies of patients with low back pain found that yoga increased hip flexion (28) and spinal and hamstring flexibility (29, 30). However, the mental focus induced by yoga could also help people to increase their awareness of how they had been moving and positioning their body in maladaptive ways, to relax tense muscles, and to relieve mental stress, as was anecdotally reported by our yoga participants.

We know of only 3 other trials examining yoga for low back pain (29, 31, 32), all of which were smaller than ours. One published trial (31) found significantly greater decreases in functional disability, pain levels, and medication use in an Iyengar-sryle yoga group (n = 20) compared with an educational group (n = 22) that persisted until the end of the 3-month post-treatment follow-up period. Another published trial (29) compared yoga with a waiting list control group (n = 11 participants per group). Although several physical measures improved more in the yoga group, no such benefits were found for yoga on the measure of functional disability. Pain was not measured.

Our study has notable strengths, including a rigorous randomization procedure, our use of recommended outcomes measures, good adherence and follow-up, use of masked assessors, and methodical development of yoga and exercise class protocols. The study also has limitations, including a follow-up period of only 14 weeks after the 12-week training period; modest sample sizes; reliance on class instructors who developed the interventions; and the inclusion of relatively well-educated, functional participants. Also, as with studies of other physical treatments, it was impossible to mask study participants to treatment group.

We do not know whether a different yoga regimen would have reaped similar benefits. Westerners practice various styles of yoga that differ in their approach to the practice of yoga postures and breathing exercises (for example, emphasis on strict alignment and methods of transition between poses). It is important to note that some styles, such as Bikram and vinyasa, may be too vigorous for patients with back pain who are unfamiliar with yoga whereas other styles (for example, Iyengar) may need modification from normal practice to be appropriate for patients with back pain. Dozens of classically identified yoga postures exist, and there are numerous variations in the way these postures can be practiced. We developed a series of classes that used simple poses from a therapeutically oriented style of yoga, viniyoga, and avoided the use of viniyoga poses that would be inappropriate for patients with back pain.

This study suggests that viniyoga is a safe and effective treatment for chronic back pain and provides physicians with a rationale for recommending it (and possibly other therapeutically oriented styles of yoga as well) to their patients. Physicians should

encourage their patients to choose instructors who have experience working with individuals who have back pain and who can help them manage the symptom flare-ups that may occur as a result of physical activity. Future research evaluating yoga for chronic back pain should investigate its mechanisms of action and whether similar results are seen in more diverse populations and in patients with more severe back pain.

[Sidebar]

Context

Yoga combines exercise with achieving a state of mental focus through breathing. In the United States, 1 million people practice yoga for low back pain.

Contribution

The authors recruited patients who had a recent primary care visit for low back pain and randomly assigned 101 to yoga or conventional exercise or a self-care book. Patients in the yoga and exercise groups reported good adherence at 26 weeks. Compared with self-care, symptoms were milder and function was better with yoga. The exercise group had intermediate outcomes. Symptoms improved between 12 and 26 weeks only with yoga.

Implications

Yoga was a more effective treatment for low back pain than a self-care book.

-The Editors

[Reference]

References

1. Bogduk N. Management of chronic low back pain. Med J Aust. 2004;180:79-83. [PMID: 14723591]

2. van Tulder M, Malmivaara A, Esmail R, Koes B. Exercise therapy for low back pain: a systematic review within the framework of the Cochrane Collaboration back review group. Spine. 2000;25:2784-96. [PMID: 11064524]

3. Liddle SD, Baxter GD, Gracey JH. Exercise and chronic low back pain: what works? Pain. 2004;107:176-90. [PMID: 14715404]

4. Hayden JA, van Tulder MW, Malmivaara AV, Koes BW. Meta-analysis: exercise therapy for nonspecific low back pain. Ann Intern Med. 2005;142:765-75. [PMID: 15867409]

5. Hayden JA, van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. Ann Intern Med. 2005;142:776-85. [PMID: 15867410]

6. Barnes PM, Powell-Griner E, McFann K, Nahin RL. Complementary and alternative medicine use among adults: United States, 2002. Adv Data. 2004:1-19. [PMID: 15188733]

7. Wolsko PM, Eisenberg DM, Davis RB, Kessler R, Phillips RS. Patterns and perceptions of care for treatment of back and neck pain: results of a national survey. Spine. 2003;28:292-7. [PMID: 12567035]

8. Saper RB, Eisenberg DM, Davis RB, Culpepper L, Phillips RS. Prevalence and patterns of adult yoga use in the United States: results of a national survey. Altern Ther Health Med. 2004;10:44-9. [PMID: 15055093]

9. Kraftsow G. Yoga for Wellness. New York: Arkana; 1999.

10. Moore J, Lorig K, Von Korff M, Gonzalez V, Laurent DD. The Back Pain Helpbook. Reading, MA: Perseus; 1999.

11. Roland M, Morris R. A study of the natural history of back pain. Part I: development of a reliable and sensitive measure of disability in low-back pain. Spine. 1983;8:141-4. [PMID: 6222486]
12. Deyo RA. Measuring the functional status of patients with low back pain. Arch Phys Med Rehabil. 1988;69:1044-53. [PMID: 2975164]
13. Patrick DL, Deyo RA, Adas SJ, Singer DE, Chapin A, Keller RB. Assessing health-related quality of life in patients with sciatica. Spine. 1995;20:1899-908. [PMID: 8560339]
14. Roland M, Fairbank J. The Roland-Morris Disability Questionnaire and the Oswestry Disability Questionnaire. Spine. 2000;25:3115-24. [PMID: 11124727]
15. Bombardier C, Hayden J, Beaton DE. Minimal clinically important difference. Low back pain: outcome measures. J Rheumatol. 2001;28:431-8. [PMID: 11246692]
16. Redelmeier DA, Guyatt GH, Goldstein RS. Assessing the minimal important difference in symptoms: a comparison of two techniques. J Clin Epidemiol. 1996;49:1215-9. [PMID: 8892486]
17. Farrar JT, Young JP Jr, LaMoreaux L, Werth JL, Poole RM. Clinical importance of changes in chronic pain intensity measured on an 11-point numerical pain rating scale. Pain. 2001;94:149-58. [PMID: 11690728]
18. Ware JE Jr. SF-36 health survey update. Spine. 2000;25:3130-9. [PMID: 11124729]
19. Riess P. Current Estimates from the National Health Interview Survey: United States, 1984. DHHS publication PHS 86-1584. Hyattsville, MD: National Center for Health Statistics; 1986.
20. Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes. Biometrics. 1986;42:121-30. [PMID: 3719049]
21. Levin J, Serlin R, Seaman MA. A controlled, powerful multiple-comparison strategy for several situations. Psychol Bull. 1994;115:153-9.
22. Cherkin DC, Deyo RA, Street JH, Barlow W. Predicting poor outcomes for back pain seen in primary care using patients' own criteria. Spine. 1996;21:2900-7. [PMID: 9112715]
23. Yoga. The ultimate mind-body workout. Harv Health Lett. 1998;24:4-5. [PMID: 9852792]
24. Sovik R. The science of breathing-the yogic view. Prog Brain Res. 2000;122:491-505. [PMID: 10737079]
25. Discovering yoga. Nursing. 2001;31:20. [PMID: 11272936]
26. Spilner M. Flex away back pain. Prevention. February 1999:53.
27. Globus S. What yoga can do for you. Current Health 2. September 2000:30.
28. Williams K, Steinberg L, Petronis J. Therapeutic application of Iyengar yoga for healing chronic low back pain. International Journal of Yoga Therapy. 2003;13:55-67.
29. Galantino ML, Bzdewka TM, Eissler-Russo JL, Holbrook ML, Mogck EP, Geigle P, et al. The impact of modified Hatha yoga on chronic low back pain: a pilot study. Altern Ther Health Med. 2004;10:56-9. [PMID: 15055095]
30. Baldwin MC. Psychological and physiologival influences of Hatha Yoga training on healthy, exercising adults. Dissertation Abstracts International. 1999;60:1031.
31. Williams KA, Petronis J, Smith D, Goodrich D, Wu J, Ravi N, et al. Effect of Iyengar yoga therapy for chronic low back pain. Pain. 2005;115:107-17. [PMID: 15836974]
32. Jacobs BP, Mehling W, Avins AL, Goldberg HA, Acree M, Lasater JH, et al. Feasibility of conducting a clinical trial on Hatha yoga for chronic low back pain:

methodological lessons. Altern Ther Health Med. 2004;10:80-3. [PMID: 15055099]

[Author Affiliation]
Karen J. Sherman, PhD, MPH; Daniel C. Gherkin, PhD; Janet Erro, RN, MN, PNP; Diana L. Miglioretti, PhD; and Richard A. Deyo, MD, MPH

[Author Affiliation]
From Group Health Cooperative and University of Washington, Seattle, Washington.

Acknowledgments: The authors thank Gary Kraftsow and Robin Rothenberg for developing the yoga intervention and Robin Rothenberg for teaching the yoga classes; John Maisano, PT, for developing the exercise intervention and for teaching those classes; and John Ewing, Christel Kratohvil, Rene Talenti, and Linda Wehnes for assistance in the conduct of the study and Kristin Delaney for analytical help.

Grant Support: By the National Center for Complementary and Alternative Medicine (grant R21AT 001215) and the National Institute for Arthritis and Musculoskeletal and Skin Diseases (grant P60AR48093).

Potential Financial Conflicts of Interest: None disclosed.

Requests for Single Reprints: Karen J. Sherman, PhD, MPH, Center for Health Studies, Group Health Cooperative, 1730 Minor Avenue, Suite 1600, Seattle, WA 98101; e-mail, Sherman.k@ghc.org

Current author addresses and author contributions are available at www.annals.org.

Figure 1. Participant flow diagram.

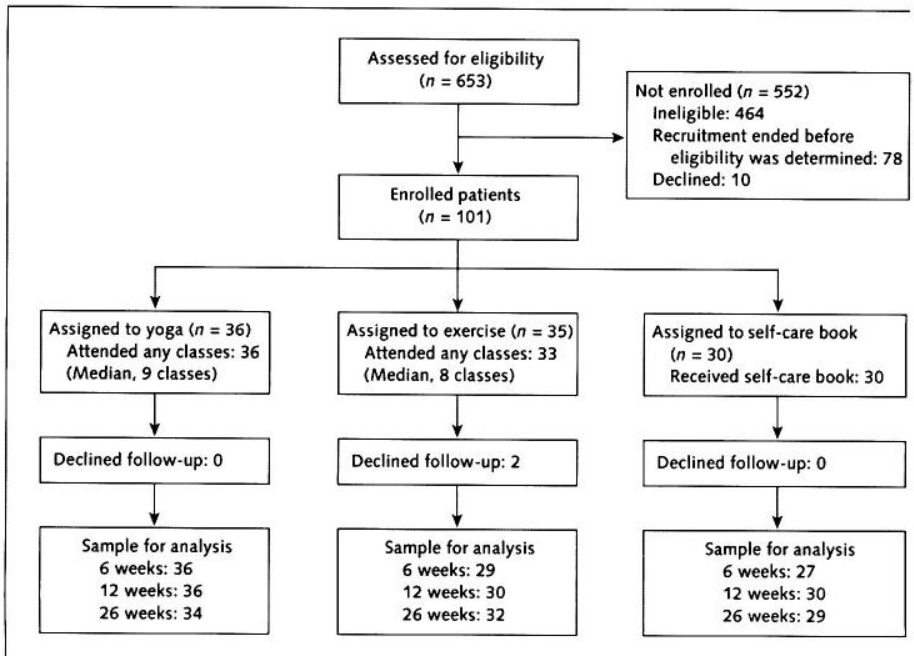
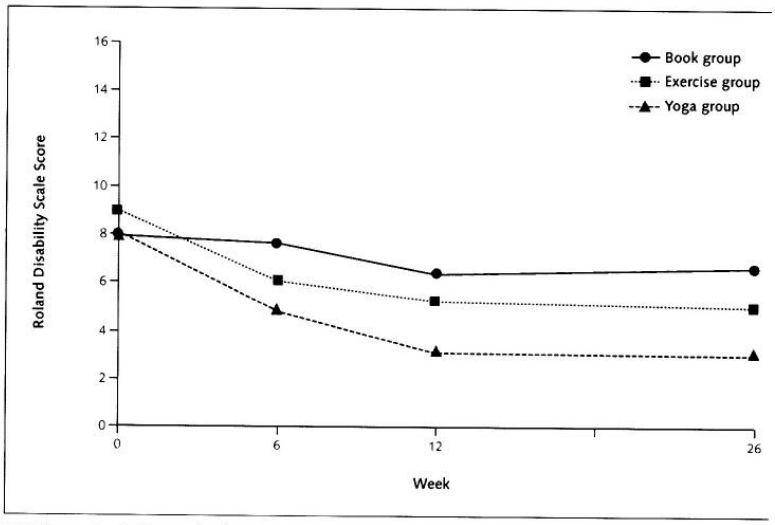


Figure 2. **Mean Roland Disability Scale scores at baseline, 6, 12, and 26 weeks by treatment group.**



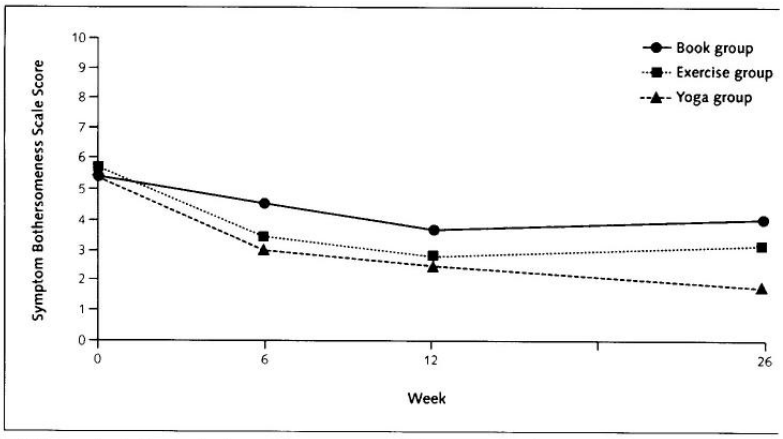
Classes ended at week 12. The x-axis signifies week after starting treatment. Higher scores signify greater disability. The *P* values for the omnibus *F* tests of any differences in mean Roland scores among the 3 treatment groups (derived from a linear regression model that was fitted to all follow-up time points, adjusting for baseline Roland score by using generalized estimating equations) are 0.046 at 6 weeks, 0.002 at 12 weeks, and 0.002 at 26 weeks.

Table 2. **Pairwise Score Comparisons of Roland Disability Scale and Symptom Bothersomeness Scale at 6, 12, and 26 Weeks, Controlling for Baseline Scores***

Comparison	6 Weeks		12 Weeks		26 Weeks	
	Mean Score Difference (95% CI)†	*P* Value	Mean Score Difference (95% CI)†	*P* Value	Mean Score Difference (95% CI)†	*P* Value
Roland disability score						
Yoga vs. book	−2.6 (−4.6 to −0.6)	0.0095	−3.4 (−5.1 to −1.6)	0.0002	−3.6 (−5.4 to −1.8)	<0.001
Exercise vs. book	−1.7 (−3.7 to 0.4)	0.11	−1.6 (−3.5 to 0.4)	0.12	−2.1 (−4.1 to −0.1)	0.035
Yoga vs. exercise	−1.0 (−2.4 to 0.6)	0.22	−1.8 (−3.5 to −0.1)	0.034	−1.5 (−3.2 to 0.2)	0.092
Symptom bothersomeness score						
Yoga vs. book	−1.6 (−2.6 to −0.5)	0.0025	ND‡	NA	−2.2 (−3.2 to −1.2)	<0.001
Exercise vs. book	−0.9 (−1.9 to −0.1)	0.0643	ND‡	NA	−0.8 (−2.1 to 0.5)	0.21
Yoga vs. exercise	−0.6 (−1.6 to −0.4)	0.22	ND‡	NA	−1.4 (−2.5 to −0.2)	0.018

* NA = not applicable; ND = not determined.
† Mean difference and 95% CI are from generalized estimating equation models described in the Statistical Analysis section.
‡ The *P* value for the omnibus *F* test was > 0.050 ($P = 0.135$); therefore, these comparisons were not examined.

Figure 3. **Mean symptom bothersomeness scale scores at baseline, 6, 12, and 26 weeks by treatment group.**



Classes ended at week 12. The x-axis signifies week after starting treatment. Higher scores signify greater symptom bothersomeness. The *P* values for the omnibus *F* tests of any differences in mean symptom bothersomeness scores among the 3 treatment groups (derived from a linear regression model fitted to all follow-up time points, adjusting for baseline symptom bothersomeness score by using generalized estimating equations) are 0.019 at 6 weeks, 0.135 at 12 weeks, and 0.001 at 26 weeks.