Original Article

Yoga for Persistent Fatigue in Breast Cancer Survivors

A Randomized Controlled Trial

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BACKGROUND: Cancer-related fatigue afflicts up to 33% of breast cancer survivors, yet there are no empirically validated treatments for this symptom. **METHODS:** The authors conducted a 2-group randomized controlled trial to determine the feasibility and efficacy of an Iyengar yoga intervention for breast cancer survivors with persistent post-treatment fatigue. Participants were breast cancer survivors who had completed cancer treatments (other than endocrine therapy) at least 6 months before enrollment, reported significant cancer-related fatigue, and had no other medical conditions that would account for fatigue symptoms or interfere with yoga practice. Block randomization was used to assign participants to a 12-week, Iyengar-based yoga intervention or to 12 weeks of health education (control). The primary outcome was change in fatigue measured at baseline, immediately post-treatment, and 3 months after treatment completion. Additional outcomes included changes in vigor, depressive symptoms, sleep, perceived stress, and physical performance. Intent-to-treat analyses were conducted with all randomized participants using linear mixed models. **RESULTS:** Thirty-one women were randomly assigned to yoga (n = 16) or health education (n = 15). Fatigue severity declined significantly from baseline to post-treatment and over a 3-month follow-up in the yoga group relative to controls ($P = .032$). In addition, the yoga group had significant increases in vigor relative to controls ($P = .011$). Both groups had positive changes in depressive symptoms and perceived stress ($P < .05$). No significant changes in sleep or physical performance were observed. **CONCLUSIONS:** A targeted yoga intervention led to significant improvements in fatigue and vigor among breast cancer survivors with persistent fatigue symptoms. *Cancer* 2012;118:3766-75. © *2011 American Cancer Society.*

KEYWORDS: yoga, fatigue, breast cancer, randomized controlled trial, survivor.

INTRODUCTION

Approximately 33% of cancer survivors experience persistent fatigue of unknown origin, causing significant impairment in quality of life.[1,2] Despite the prevalence and impact of this symptom, currently, there are no empirically validated treatments for persistent cancer-related fatigue. To date, only 2 published behavioral intervention trials have specifically targeted cancer survivors with persistent fatigue.[3,4] Other psychological (eg, stress reduction) and activity-based (eg, exercise) interventions have reduced fatigue in cancer populations[5-7]; however, because these trials have not targeted fatigued patients, the feasibility and efficacy of these approaches for treating postcancer fatigue is unclear. Indeed, fatigue is a significant barrier to participation in exercise programs for cancer survivors.[8]

Mind-body interventions like yoga are promising approaches for treating cancer-related fatigue. Yoga involves physical postures (*asanas*) that develop strength and flexibility and promote relaxation. Yoga is also a meditative practice, because the practitioner focuses on the body and breath in each pose.[9] A growing body of research indicates that yoga has beneficial effects on physical and behavioral outcomes in cancer patients and survivors,[10-12] including improvements in quality of life, mood, and fatigue.[13-18] However, as with the behavioral interventions, none of the published yoga trials

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have targeted patients with fatigue. Moreover, very few of these trials have included an active control group to control for attention, group support, and other nonspecific components of the treatment.

The primary objective of this randomized controlled trial (RCT) was to examine the feasibility and efficacy of an Iyengar yoga intervention for breast cancer survivors with persistent post-treatment fatigue relative to health education control. On the basis of promising results from a small, uncontrolled trial conducted by our group,[19] we hypothesized that this intervention would lead to significant improvements in fatigue and vigor. Effects on secondary outcomes, including depressive symptoms, sleep disturbance, stress, and physical performance, also were assessed.

MATERIALS AND METHODS

Design

The study was a single-center, 2-armed RCT. The University of California-Los Angeles (UCLA) Institutional Review Board approved the study procedures, and written informed consent was obtained from all participants.

Participants

Breast cancer survivors with persistent post-treatment fatigue were recruited through multiple mechanisms, including tumor registry mailings, newspaper advertisements, and flyers distributed at cancer-related and community locations. Inclusion criteria were: 1) originally diagnosed with stage 0 to II breast cancer, 2) completed local and/or adjuvant cancer therapy (with the exception of hormone therapy) at least 6 months previously, 3) ages 40 to 65 years, 4) postmenopausal, 5) no other cancer in last 5 years, and 6) experiencing persistent cancer-related fatigue. We focused on women with early stage breast cancer to reduce heterogeneity in disease-related and treatment-related factors impacting fatigue and its biologic and psychological correlates. We focused on women at least 6 months post-treatment completion to ensure that participants had persistent post-treatment fatigue and to reduce confounding residual effects of cancer treatment on biologic parameters. The presence of cancer-related fatigue was indicated by scores $\leq$50 on the Medical Outcomes Study 36-item short-form health survey (SF-36) vitality scale, a reliable and valid measure of energy/fatigue in the past month,[20] and self-report that fatigue was a consequence of cancer or cancer therapy. In our previous research, breast cancer survivors who scored $\leq$50 on the SF-36 vitality scale had behavioral, immune, and neuroendocrine alterations relative to women who scored $>$50, supporting this classification.[1,21-26] Exclusion criteria were: 1) chronic medical conditions or regular use of medications associated with fatigue (eg, untreated hypothyroidism, diabetes, autoimmune disease, anemia [defined as a hematocrit $<$24], chronic fatigue syndrome), 2) evidence that fatigue was driven primarily by a medical or psychiatric disorder other than cancer (eg, current major depression, insomnia, sleep apnea), 3) evidence that fatigue was driven primarily by other noncancer-related factors (eg, shift work, recent change in activity or schedule), 4) physical problems or conditions that could make yoga unsafe (eg, serious neck injuries, unstable joints), and 5) a body mass index (BMI) $>$31 kg/m^2. Potential participants were first screened by telephone and then, if they met preliminary eligibility criteria, completed an in-person screening visit at which they completed questionnaires and interviews about their medical history and were asked to perform simple movements (eg, standing with feet touching for 30 seconds, lifting arms over head, moving from standing position to seated position on floor) to verify safety for yoga practice.

Randomization and Blinding

Given class scheduling considerations, participants were randomized in blocks. Once a sufficient number of participants to comprise the yoga and health education groups had been screened as eligible (8-14 women), participants were randomized (1:1) to the 2 treatments after completing baseline assessments. The allocation sequence was generated independently by the study statistician (R.O.) and was concealed in opaque envelopes. Our recruitment documents, screening materials, and informed consent indicated that the purpose of this study was to compare 2 different treatments for postcancer fatigue: yoga classes and a wellness seminar series. Thus, although participants were aware of the condition to which they were assigned, they did not know the study hypotheses. Outcomes assessors for the performance tasks were blinded to group assignment, and all were trained in standardized testing procedures.

Interventions

Iyengar yoga classes were conducted for 90 minutes twice a week for 12 weeks in groups of 4 to 6 women. Classes were taught by a certified Junior Intermediate Iyengar yoga instructor and an assistant under the guidance of a senior teacher. Iyengar yoga, a traditional form of Hatha

Table 1. List of Yoga Postures for Persistent Cancer-Related Fatigue

Study Postures[a]
Supta Baddhakonasana with bolster, strap, and blankets
Supta Svatstikasana with bolster and blanket
Setubandha Sarvangasana with bolster, strap, and blankets
Setubandha Sarvangasana on a wooden bench with a box and bolster
Purvottanasana with 2 chairs, bolsters, and blankets
Viparita Dandasana on 2 chairs with the head supported
Salamba Sarvangasana with a chair, bolster, sticky mat, and blanket
Salamba Sirsasana on ropes
Supta Konasana with legs apart on 2 chairs
Viparita Karani with 2 blocks, a wall, a bolster, and blankets
Bharadvajasana on chair
Adhomukha Svanasana on ropes with chair
Urdhva Mukha Svanasana with chair
Urdhva Hastasana
Urdhva Baddhanguliyasana
Ropes 1
Savasana with bolster and blanket

[a] A full description of each pose, including pictures, and a detailed intervention manual including class sequences is available from the first author.

yoga, prescribes specific therapeutic yoga practices for individuals with specific medical problems and conditions.[27] This trial emphasized postures and breathing techniques believed to be effective for reducing fatigue among women with a history of breast cancer, with a focus on passive inversions (ie, supported upside-down postures in which the head is lower than the heart) and passive backbends (ie, supported spinal extensions). In supportive postures, the shape of the pose is supported by props (eg, blocks, bolsters, blankets, wall ropes, belts) rather than being held by the strength of the body, so that participants can perform and maintain the postures without stress and tension. The postures were introduced using a standard progression from simpler to more challenging over the course of the intervention and were adapted to suit individual needs. A complete list of study postures and the props used to support each is provided in Table 1. Not all of these postures were included in each class. A typical sequence of postures included in a midintervention class and the duration of each posture is as follows: 1) Supta Baddhakonasana (10 minutes), 2) Setubandha Sarvangasana on bolsters (5 minutes), 3) Adhomukha Svanasana (5 minutes), 4) Salamba Sirsasana (5 minutes), 5) Viparita Dandasana (5 minutes), 6) Setubandha Sarvangasana on a wooden bench (5 minutes), 7) Viparita Karani (10 minutes), and 8) Supported Savasana (10 minutes).

Health education classes were conducted for 120 minutes once a week for 12 weeks in groups of 4 to 7 women. Classes were led by a PhD-level psychologist with clinical experience in the treatment of breast cancer survivors. The classes were didactic in nature and consisted of lectures about topics of interest to breast cancer survivors followed by questions and discussion. The topics included 1) cancer-related fatigue; 2) introduction to cancer survivorship; 3) psychosocial issues in cancer survivorship; 4) weight and chronic disease management; 5) cancer genetic predisposition testing and counseling for breast/ovarian cancer syndromes; 6) stress and cancer; 7) diet, nutrition, and cancer survivorship; 8) sleep hygiene; 9) cognitive problems after cancer treatment; 10) osteoporosis and cancer survivorship; 11) body image and sexuality; and 12) finding meaning and achieving goals. Our previous experience with this patient population suggested that women would be unlikely to travel to the study site twice a week for health education classes. Thus, we elected to have the health education group meet only once per week (vs twice per week for yoga) for a longer duration (120 minutes per session vs 90 minutes per session for yoga). Consequently, the total number of class hours for yoga (36 hours) was greater than that for health education (24 hours). Neither group was instructed to do home practice or reading.

Outcome Measures

Questionnaires and functional assessments were obtained at baseline, within 2 weeks postintervention, and 3 months after the intervention was completed. The primary outcome of interest was subjective fatigue severity, which was assessed with the Fatigue Symptom Inventory (FSI), a reliable and valid measure of fatigue that was designed for use with cancer patients.[28,29] A related outcome, vigor, was assessed using the vigor subscale of the Multidimensional Fatigue Symptom Inventory.[30] Several secondary outcomes also were assessed. To determine whether intervention effects might extend to behavioral symptoms correlated with fatigue,[1,31] we assessed depressive symptoms using the Beck Depression Inventory-II,[32] and we assessed subjective sleep quality using the Pittsburgh Sleep Quality Index.[33] In addition, to examine more generalized intervention effects on feelings of stress, we administered the Perceived Stress Scale.[34] Physical performance tasks were administered to provide an objective measure of functional status. Timed chair stands were used to assess lower extremity strength and endurance,[35] and the functional reach test was used to assess strength, flexibility, and balance.[36]

Self-reported demographic and disease-related variables were assessed at baseline, and expectations and beliefs about treatment efficacy were assessed at baseline and postintervention. Self-efficacy for managing fatigue, a

potentially important component of intervention effects,[37] was assessed with the fatigue subscale of the Human Immunodeficiency Virus Self-Efficacy Questionnaire[38] adapted for breast cancer. Fatigue interference with activities, mood, and enjoyment of life was assessed with the interference subscale of the FSI.[28,29] Finally, blood and saliva samples were collected for assessment of biologic functioning; the results from these assays still are pending and will be reported separately.

Statistical Analyses

On the basis of the large effect on subjective fatigue severity observed in our single-arm pilot study of this yoga intervention (d = 2.2 at postintervention, d = 1.2 at 3-month follow-up),[19] a sample of 30 participants would provide ≥90% power to detect a between-group difference on the FSI. To account for the possibility of a smaller intervention effect than that observed in our single-arm pilot, our original enrollment target was 72 participants and assumed 20% loss to follow-up. Because of our stringent eligibility criteria, enrollment was lower than planned (n = 31) but was still adequate to detect a large intervention effect. All statistical analyses were performed on an intent-to-treat basis. Outcome measures were tested first for baseline equivalence using *t* tests or chi-square tests, as appropriate. Primary analyses used mixed-model analyses of variance to account for any incomplete data (ie, loss to follow-up). Treatments (yoga or health education) by time (baseline, post-treatment, 3-month post-treatment follow-up) were the independent factors, and time factor covariances were estimated individually (ie, unstructured). Separate analyses were conducted for each of the outcome measures. We did not adjust for multiple testing. Exact *P* values are presented.

RESULTS

The study took place at the UCLA Medical Center, Westwood, California between March 2007 and July 2010. We screened 255 women for eligibility; 188 (75%) were not eligible, and 36 (14%) were not interested in participating. The primary reasons for ineligibility were cancer-related, including diagnosis with stage III or IV breast cancer (n = 23), no previous breast cancer diagnosis (n = 19), <6 months post-treatment completion (n = 11), and other cancer in the last 5 years (n = 3). Medical exclusions were BMI >31 kg/m^2 (n = 23), medical conditions that could interfere with safe yoga practice (n = 17), chronic medical conditions or medications that could impact fatigue (n = 11), and age-related and menopause-related reasons (n = 39). Fatigue-related exclusions were not fatigued (n = 30) and fatigue not related to cancer (n = 11). We randomized 31 women to either a 12-week Iyengar yoga intervention (n = 16) or a 12-week health education program (n = 15). Twenty-eight women received the allocated intervention, which we defined as attending more than 1 class, and follow-up data were obtained on 29 participants (94%). A Consolidated Standards of Reporting Trials (CONSORT) flow diagram is provided in Figure 1.

Groups were balanced on demographic and disease-related characteristics at baseline, and both reported high levels of fatigue (Table 2). In the yoga group, the mean number of classes attended was 18.9 of 24 classes (78%), and the median was 22 of 24 classes (92%). In the education group, the mean number of classes attended was 9.2 of 12 classes (77%), and the median was 11 of 12 classes (92%). At the-3 month follow-up, 9 of 14 women who attended the yoga classes (64%) were continuing to use the techniques learned in class.

Intervention Effects on Fatigue and Vigor

Yoga led to statistically significant improvements in fatigue severity (*P* for group-by-time interaction = .032; effect size for predicted change from baseline to 3-month follow-up in the yoga vs health education group, d = 1.5). Participants in the yoga group reported steady declines in fatigue severity from baseline to post-treatment and over the 3-month follow-up, whereas women assigned to health education reported no change over this period (Fig. 2). Similar effects were observed for vigor: The yoga group had a statistically significant increase in vigor over the assessment period compared with controls (*P* for group-by-time interaction = .011; effect size for predicted change from baseline to 3-month follow-up in yoga vs health education, d = 1.20). We also explored intervention effects on fatigue interference and observed a significant effect of time ($P < .0001$) and a marginally significant group-by-time interaction ($P = .08$). Both groups reported decreases in fatigue interference over time with a marginally larger decrease in the yoga group (mean change from baseline to 3-month follow-up = 15.8) than in the health education group (mean change from baseline to 3-month follow-up = 7.9). Yoga group participants also were significantly more confident about their ability to manage fatigue and its impact on their lives than control group participants post-treatment (yoga group mean, 7.9; education group mean, 6.1; $t(28) = -2.6$; $P = .017$).

To determine the clinical significance of these effects, we calculated the change in SF-36 vitality scale

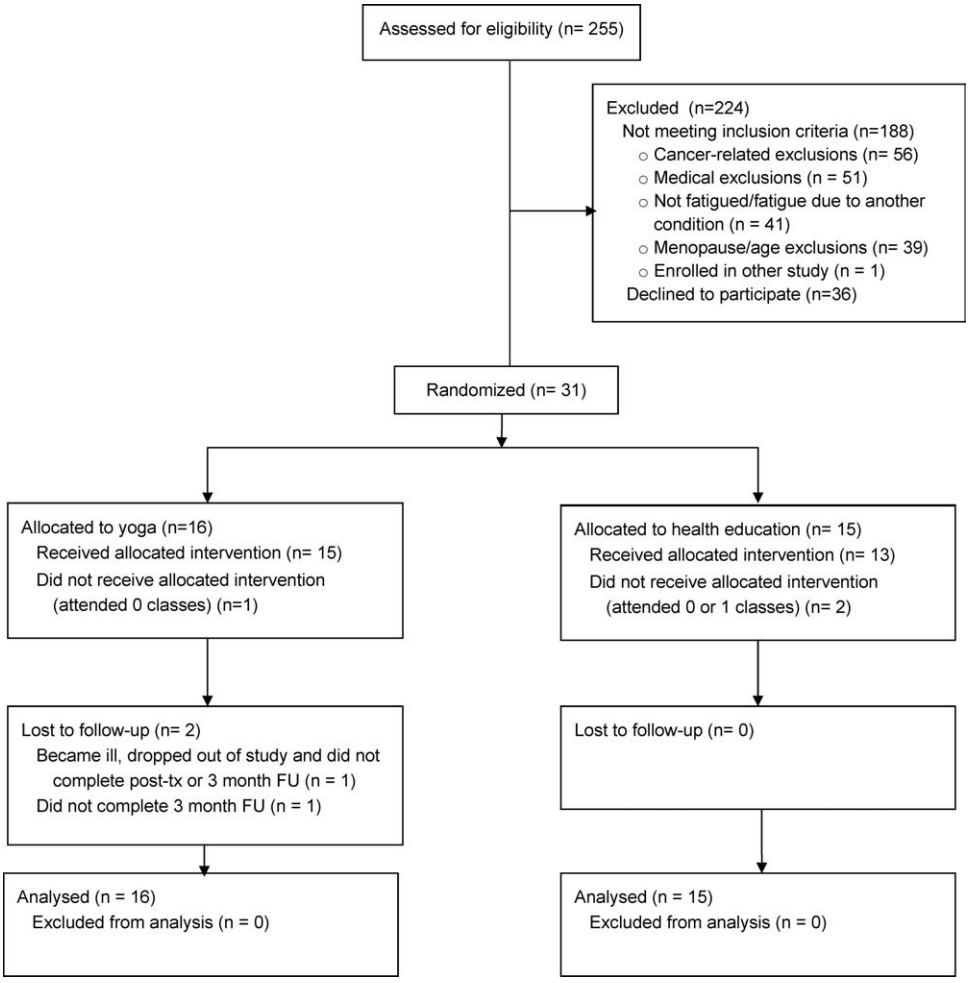

Figure 1. This is a Consolidated Standards of Reporting Trials (CONSORT) diagram of the current study. FU indicates follow-up; post-tx, post-treatment.

scores from baseline to 3-month follow-up in each group. Although this was not a primary outcome for the trial, there are published norms for the determination of clinically significant changes on this measure.[39] For women randomized to yoga, there was a mean increase in SF-36 vitality scores of 23.9 points, which exceeds the reliable change index of 22.7 for this scale and indicates a clinically significant improvement in fatigue. For women randomized to health education, the mean increase in SF-36 vitality scores was 7.7 points.

Intervention Effects on Depressive Symptoms, Stress, Sleep, and Physical Performance

For depressive symptoms, there was a significant effect of time ($P < .0001$) and a significant group-by-time interaction ($P = .026$). Both groups reported reductions in depressive symptoms from baseline to post-treatment, although there was a greater decline in symptoms among women in the yoga group at this time point. By the 3-month follow-up, the yoga group had rebounded, and the groups reported similar symptom levels. There also was a significant time effect for perceived stress ($P = .015$); feelings of stress decreased over the assessment period in both groups. There were no significant effects for subjective sleep quality. For the physical performance tasks, there was a significant time effect for chair stands ($P < .0001$) as both groups improved over time, but no group-by-time interaction was observed for either task ($P > .60$). Table 3 presents mean scores for the primary and secondary outcomes at baseline, post-treatment, and 3-month follow-up as well as group differences in change scores.

Table 2. Demographic and Treatment-Related Characteristics of Study Participants: Mean +/- SD for Continuous Variables and Numbers (%) for Categorical Variables[a]

Characteristic	Yoga Group, n = 16	Health Education Group, n = 15
Age, y	54.4±5.7	53.3±4.9
BMI, kg/m^2	24.0±2.5	25.3±3.4
SF-36 vitality score	37.8±16.0	34.0±16.3
Married/in committed relationship	12 (75)	11 (73)
Race/ethnicity		
White	15 (94)	12 (80)
Hispanic	0 (0)	2 (13)
Black	1 (6)	0 (0)
Other	0 (0)	1 (7)
Education status		
High school graduate/AA degree	6 (37.5)	7 (46)
College graduate	6 (37.5)	4 (27)
Graduate degree	4 (25)	4 (27)
Annual family income		
<$45,000	3 (19)	1 (7)
$45,000-$75,000	5 (31)	4 (27)
$75,000-$100,000	4 (25)	3 (20)
>$100,000	3 (19)	7 (46)
Not reported	1 (6)	0 (0)
Treatment received		
Radiation	11 (69)	13 (87)
Chemotherapy	8 (50)	9 (60)
Tamoxifen/aromatase inhibitor	12 (75)	10 (67)
Time since treatment completion		
Median [range], y	1.7 [0.7- 4.1]	1.7 [0.7-18.3]

Abbreviations: BMI, body mass index; SF-36, the Medical Outcome Study 36-item short-form health survey; SD, standard deviation.
[a] No differences were significant at $P < .20$.

Expectations and Beliefs About Treatment

We assessed expectations and beliefs about treatment efficacy to determine whether these may account for beneficial effects of yoga. After random assignment, participants in both groups believed that the intervention to which they had been assigned would be effective in improving their fatigue symptoms: On a 7-point Likert scale ranging from 0 (not at all effective) to 6 (very effective), the mean score was 3.86 for the yoga group and 3.2 for the health education group ($P = .33$). At the post-treatment assessment, participants in both groups reported that they had experienced "quite a bit" of benefit from attending the classes: On a 7-point Likert scale ranging from 0 (no benefit) to 6 (very much benefit), the mean score was 4.43 for the yoga group and 4.87 for the health education group ($P = .53$). Moreover, both groups reported positive changes in fatigue postintervention: On a 13-point Likert scale ranging from −6 (very much worse) to 6 (very much better), the mean score was 1.93 for the yoga group and 1.87 for the education group ($P = .94$). These findings suggest that the 2 groups had similar expectations and beliefs about treatment efficacy.

Safety

There was 1 adverse event related to the protocol: A participant who had a history of back problems experienced a back spasm in yoga class. After evaluation by her physician, she was able to return to class and complete the intervention.

DISCUSSION

Results from this RCT indicate that a yoga intervention targeted at improving fatigue may be a feasible and effective treatment for breast cancer survivors who have persistent cancer-related fatigue. Participants in the yoga group experienced significant reductions in fatigue and increases in vigor from baseline to post-treatment that persisted over a 3-month follow-up, consistent with results from our single-arm pilot study,[19] whereas no changes in these

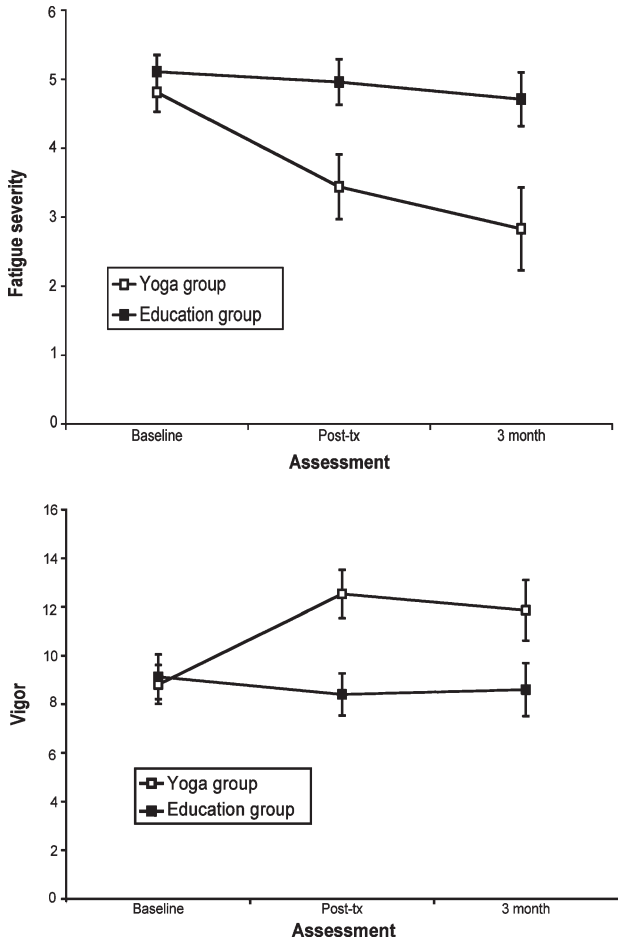

Figure 2. Changes in (*Top*) fatigue severity and (*Bottom*) vigor are illustrated in the yoga and health education groups. The yoga group had significant declines in fatigue severity and significant improvements in vigor from baseline to post-treatment (post-tx) and over the 3-month post-treatment follow-up relative to health education controls.

outcomes were observed in the control group participants. Measures of effect size indicated that this was a large effect ($d = 1.5$ for fatigue severity) and was considerably larger than the small-to-moderate effect sizes observed in previous behavioral interventions for cancer-related fatigue.[5,7] This change also appeared to be clinically significant. By the 3-month post-treatment follow-up, scores on the FSI fell below the cutoff for clinically meaningful fatigue among women in the yoga group,[40] and this group also had a clinically significant improvement in scores on the SF-36 vitality scale.[39]

Despite high levels of fatigue at study onset, adherence to the yoga intervention was excellent, with over 80% of participants attending at least 20 of the 24 yoga classes offered. This is noteworthy, because fatigue is typically a barrier to participation in behavioral interventions for cancer patients, including yoga programs not specifically designed to treat fatigue.[18] We suspect that the careful selection of yoga poses for fatigued individuals and the use of props that enabled these poses to be performed without effort or strain played an important role in maintaining trial adherence.

Participants in the yoga and health education interventions reported comparable declines in depressive symptoms and perceived stress by the 3-month follow-up. For the education group, these improvements may have resulted from the provision of information about breast cancer survivorship as well as nonspecific aspects of the intervention, including attention and group support. Very few behavioral or mind-body intervention trials for cancer-related fatigue have included active control groups, relying instead on usual care or wait-list controls.[5-7] Consistent with our findings, Irwin et al observed beneficial effects of health education on depressive symptoms in a study comparing Tai Chi with health education for insomnia.[41] These results strongly support the inclusion of active control groups in mind-body and other behavioral intervention trials.

Our study had several limitations. First, we enrolled a relatively small number of participants, reflecting the challenges of recruiting fatigued breast cancer survivors with no comorbid fatigue-related medical conditions or physical limitations who were willing to participate in a demanding intervention study. It will be important to replicate these findings in a larger trial and to determine whether effects are generalizable to a broader group of breast cancer survivors. We also restricted our sample to women who had been diagnosed with early stage disease, had completed cancer treatment, and had a BMI <31 kg/m^2. Thus, effects may not be generalizable to breast cancer survivors with more advanced disease, those who are undergoing treatment, and/or those who are obese; and the yoga intervention may require adaptation to meet the specific needs of these groups. In addition, although the majority of study participants (94%) were within 5 years postdiagnosis, we did enroll a few women who had been living with cancer-related fatigue for greater than 10 years. Future studies should examine whether the length of time since cancer treatment influences intervention efficacy and possibly target either shorter term or longer term survivors. Next, it is not feasible to use a double-blind study design with this type of intervention; participants unavoidably are aware of the treatment that they receive. We attempted to minimize the impact of pre-existing

Table 3. Group Means and Group Differences in Mean Change Scores for All Outcomes

Outcome	Mean±SD			Mean [95% CI]	
	Baseline	Post-Treatment	3-Month Follow-Up	Group Difference in Change From Baseline to Post-Treatment	Group Difference in Change From Baseline to 3-Month Follow-Up
Primary outcomes					
FSI fatigue severity (0-11; higher is worse)					
Iyengar yoga	4.8±1.1	3.4±1.8	2.8±2.3	−1.24 [−0.04 to −2.45][a]	−1.62 [−0.37 to −2.88][a]
Health education	5.1±0.95	4.9±1.3	4.7±1.5		
MFSI vigor (0-24; higher is better)					
Iyengar yoga	8.8±3.2	12.5±3.8	11.9±4.7	4.80 [1.86 to 7.74][a]	4.25 [0.99 to 7.50][a]
Health education	9.1±3.6	8.4±3.4	8.6±4.2		
Secondary outcomes					
BDI-II depressive symptoms (0-63; higher is worse)					
Iyengar yoga	15.5±7.5	7.7±5.8	9.9±8.0	−5.80 [−1.74 to −9.86][a]	−3.06 [0.37 to −6.49]
Health education	14.3±7.5	11.6±7.1	10.5±7.9		
PSQI sleep disturbance (0-21; higher is worse)					
Iyengar yoga	9.2±3.3	8.1±2.5	7.6±2.7	0.20 [2.78 to −2.38]	−2.14 [1.06 to −5.39]
Health education	9.1±3.5	7.7±2.6	9.1±3.3		
Perceived stress scale (0-40; higher is worse)					
Iyengar yoga	26.6±7.3	23.5±7.3	23.6±6.7	−1.77 [1.71 to −5.26]	−1.51 [2.38 to −5.39]
Health education	26.8±5.9	25.4±5.9	24.2±4.7		
Chair stand time, s (higher is worse)					
Iyengar yoga	13.4±2.3	12.3±2.0	11.1±1.9	1.31 [−5.00 to 2.38]	−0.74 [−3.74 to 2.26]
Health education	13.5±2.6	12.6±3.2	12.2±2.8		
Functional reach, cm (higher is better)					
Iyengar yoga	31.1±5.7	29.6±6.2	29.5±5.1	−2.00 [5.76 to −9.73]	−2.21 [5.56 to −9.98]
Health education	29.5±6.7	28.5±7.2	28.8±8.0		

Abbreviations: BDI-II, Beck Depression Inventory, second edition; CI, confidence interval; FSI, Fatigue Symptom Inventory; FU, follow-up; MFSI, Multidimensional Fatigue Symptom Inventory; PSQI, Pittsburgh Sleep Quality Index; SD, standard deviation.
[a] $P < .05$.

beliefs and expectations on study outcomes by informing participants that we were testing 2 different treatments for cancer-related fatigue, each of which presumably was effective. This presentation appeared to have been successful, because both groups had similar, positive expectations about the efficacy of the treatment to which they had been assigned. Finally, the yoga and health education conditions were not matched for class frequency or duration, and it is possible that the benefits observed in the yoga group may be attributable in part to the higher number of intervention hours received. Future studies should match class frequency and duration across conditions. It also will be useful to compare yoga with a more physically oriented control condition (eg, stretching) or with relaxation to probe the active components of this intervention.

These preliminary findings indicate that a specialized yoga intervention may have beneficial effects on cancer-related fatigue, even among survivors who have experienced fatigue for years after treatment. Future investigation into this promising approach is warranted, including an examination of the mechanisms and duration of treatment effects. Yoga may have effects on the immune and neuroendocrine systems,[42-46] which have been linked to post-treatment fatigue in previous research[21,23,24,26,47-49] and are currently under investigation in this sample.

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CONFLICT OF INTEREST DISCLOSURES

The authors made no disclosures.

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