Restorative Yoga for Women with Ovarian or Breast Cancer: Findings from a Pilot Study

Suzanne C. Danhauer, PhD, Janet A. Tooze, PhD, Deborah F. Farmer, PhD, Cassie R. Campbell, MA, Richard P. McQuellon, PhD, Rolland Barrett, MD, Brigitte E. Miller, MD

Yoga has demonstrated benefit in healthy individuals and those with various health conditions. There are, however, few systematic studies to support the development of yoga interventions for cancer patients. Restorative yoga (RY) is a gentle type of yoga that has been described as ''active relaxation.'' The specific aims of this pilot study were to determine the feasibility of implementing an RY intervention as a supportive therapy for women diagnosed with ovarian or breast cancer and to measure changes in self-reported fatigue, psychological distress and well-being, and quality of life. Fifty-one women with ovarian ($n = 37$) or breast cancer ($n = 14$) with a mean age of 58.9 years enrolled in this study; the majority (61%) were actively undergoing cancer treatment at the time of enrollment. All study participants participated in 10 weekly 75-minute RY classes that combined physical postures, breathing, and deep relaxation. Study participants completed questionnaires at baseline, immediately postintervention, and 2 months postintervention. Significant improvements were seen for depression, negative affect, state anxiety, mental health, and overall quality of life. Fatigue decreased between baseline and postintervention follow-up. Health-related quality of life improved between baseline and the 2-month follow-up. Qualitative feedback from participants was predominantly positive; relaxation and shared group experience were two common themes.

Key words: *anxiety, cancer, depression, mind-body medicine, stress, yoga*

A comparison of two national surveys of US adults revealed that more than one in three had used some form of complementary and alternative medicine (CAM) in the past year, with the largest relative increases seen for herbal medicine and yoga.[1] According to the surveys, over 10 million adults were practicing yoga during 2002.[1] Among cancer patients, use of CAM therapies is also widespread.[2–5] Mind-body therapies are defined by the National Center for Complementary and Alternative Medicine as ''interventions designed to facilitate the mind's capacity to affect bodily functions and symptoms''

Suzanne C. Danhauer, Janet A. Tooze, Cassie R. Campbell, Richard P. McQuellon, *and* Brigitte E. Miller: *Wake Forest University School of Medicine, Winston-Salem, NC;* Deborah F. Farmer: *Winston-Salem State University, Winston-Salem, NC; and* Rolland Barrett: *Derrick L. Davis Forsyth Regional Cancer Center, Winston-Salem, NC.*

(see< http://nccam.nih.gov/health/whatiscam/>); these include meditation, relaxation, guided imagery, yoga, and hypnosis. It is estimated that nearly 20% of US adults use mind-body therapies, with meditation, imagery, and yoga being the most common.[6,7] There is clinical evidence of the efficacy of mind-body therapies for ameliorating anxiety, nausea and vomiting, pain, and sleep disturbances in cancer patients.[8] An extensive review concluded that there is strong evidence for the use of mind-body interventions with cancer patients and recommended that such therapies be strongly considered as adjunctive therapy for cancer patients to improve mood, quality of life, and coping with disease and treatment-related side effects.[9]

Yoga interventions have been used in previous research with both healthy individuals and those with a variety of health conditions.[10] The therapeutic benefits of yoga practice include increased muscular strength, increased flexibility, increased range of motion, increased energy, decreased pain, improved sleep quality, and improved control over physiologic parameters (including blood pressure, heart rate, respiratory function, body temperature, and cardiopulmonary endurance).[11–14] Recent studies have also shown an association between yoga and decreased serum cortisol (stress hormone) levels, as well as

enhanced immune function, in healthy individuals.[15,16] Yoga practice also reduced stress, promoted feelings of relaxation, and enhanced subjective well-being in two previous reports.[14,17]

Clinical and anecdotal reports of yoga for patients with cancer suggest physical (ie, increased energy, fewer chemotherapy side effects) and psychological benefits, plus an increased sense of active participation in the treatment and recovery process.[18–20] Evaluation of a cancer supportive care program revealed that restorative yoga (RY) was the most popular class offering; 96% of respondents felt that it reduced stress, 94% reported an increased sense of well-being, 74% reported increased energy, 65% reported more restful sleep, and 51% reported reduced pain.[21]

However, there are few data from systematic studies of yoga interventions for cancer patients. The results from a study of 39 lymphoma patients randomized to a Tibetan yoga class or waitlist control group found that those in the yoga group reported significantly lower sleep disturbance scores (better subjective sleep quality, faster sleep latency, longer sleep duration, and less use of sleep medications).[22] Another study of 38 women post-treatment for breast cancer revealed that those randomized to a yoga therapy intervention (modified and gentle hatha yoga) versus a waitlist control group showed less mood disturbance, tension, depression, and confusion and better global quality of life and emotional function than the control group.[23] Further, a recent pilot study of breast and prostate cancer patients who participated in mindfulness-based stress reduction (relaxation, meditation, gentle yoga) demonstrated improvements in overall quality of life, symptoms of stress, and sleep quality.[24] With the increased availability of yoga programs for cancer patients and the paucity of research data in this area, research on the benefits of yoga practice as an adjunct to medical treatment for cancer is warranted.

RY, which as been described as "active relaxation," is a particularly gentle form of yoga that may be useful for individuals with cancer. It consists of a series of gentle poses supported by props, with an emphasis on breathing and relaxation.[25] Restorative poses are useful when an individual feels weak, fatigued, or highly stressed and can be practiced when a patient is ill or recovering from illness or surgery.[20,25] Props are used to provide a completely supportive environment for total relaxation with minimal physical effort.

The specific aims of this pilot study were to determine the feasibility of implementing an RY intervention as a supportive therapy for women diagnosed with ovarian or breast cancer (all stages) and to measure changes in fatigue, psychological distress (anxiety, depression, negative affect), psychological well-being (positive affect), and quality of life. It was hypothesized that participation in the RY intervention would result in (1) decreased fatigue; (2) decreased anxiety, depressive symptoms, and negative emotions; (3) increased positive emotions; and (4) improved overall quality of life.

Methods

Study Design

This was a pilot/feasibility intervention study with pre, post, and 2-month follow-up measures completed by a convenience sample of women with breast or ovarian cancer. All study participants participated in the intervention (described below). This study was approved by the Institutional Review Boards at Wake Forest University Health Sciences and Forsyth Medical Center. All study participants signed a written informed consent form meeting institutional, state, and federal guidelines.

Eligibility Criteria

Initial data collection targeted women with ovarian cancer; however, recruitment of enough ovarian cancer patients was difficult, owing in large part to long travel distances from home to the local medical centers, making participation in a weekly class impossible. Consequently, participation was opened up to breast cancer patients after the study had begun. Women were eligible for the study if they were (1) ≥18 years of age; (2) diagnosed with ovarian or breast cancer (any stage); (3) 2 to 24 months post–primary treatment (surgery) following the initial diagnosis and/or had a recurrence of ovarian or breast cancer within the past 24 months (irrespective of current treatment status); (4) physically able to attend the RY classes; (5) able to understand written and spoken English; and (6) free of medical contraindications reported by their physician. The window of eligibility was intentionally broad to determine when women with cancer would be most likely to participate in a yoga intervention.

Procedure

Recruitment

Study participants were identified by physicians from the Wake Forest University Comprehensive Cancer Center and the Derrick L. Davis Forsyth Regional Cancer Center.

Participants were recruited by sending out recruitment letters signed by each patient's oncologist or surgeon, along with detailed study information and a consent form. The study was also advertised in newsletters through local agencies that serve women with ovarian or breast cancer. Women who were self-referred were asked to discuss their study participation with their attending physician. A follow-up recruitment telephone call was made by a research assistant to determine interest and eligibility, using a standardized script.

Data Collection

Questionnaires were mailed to participants to complete and return by mail in a postage-paid, preaddressed envelope. If needed, the research assistant followed up with participants by telephone to clarify questions and obtain responses to missing items. All baseline questionnaires were completed prior to starting the intervention. Follow-up questionnaires (excluding demographic information) were administered in the same manner within 1 week of completing the intervention (at 10 weeks) and again 2 months after completing the intervention (at 18 weeks). An incentive ($20 bookstore gift card) was offered to study participants who completed all study questionnaires. Clinical data were obtained from chart reviews conducted by research nurses to describe the study sample.

Intervention

The intervention consisted of 10 weekly 75-minute RY classes[25] taught by a yoga instructor certified by the National Yoga Alliance who has also had cancer-specific yoga training. The yoga instructor is a cancer survivor; this information was disclosed in the recruitment packet. Yoga classes were offered at a local yoga studio (near the medical centers where women were treated for their cancer) on Mondays at 4:30 pm. Classes were conducted in a closed-group format. The average number of women in each yoga group was 7.3 (range 5–12 women per group). No home yoga practice was required, and no home practice information was provided. Once women completed the 10-class session, they were free to take yoga classes on their own but no longer participated in the RY intervention classes.

The 10 class sessions combined physical postures (asanas), breathing (pranayama), and deep relaxation (savasana). One guiding principle in yoga practice, "ahimsa" (nonviolence), was emphasized to study participants; this principle reinforces the notion of being gentle to oneself, and it was made clear that participants should not practice any pose that caused or exacerbated discomfort. Yoga postures were modified based on participant needs. The following poses were practiced in all classes: (1) centering and meditation (conscious, deep breathing, mental inventory of body, energy, thoughts, and emotions); (2) neck and shoulder series (move neck through range of motion, turning head side to side and dropping ear to shoulder and chin to chest and moving eyes toward ceiling, roll shoulders forward and back, then squeeze shoulders to ears, and release); (3) leg stretch (Janu Sirsasana variation) using a strap and circling ankles slowly in both directions; (4) side bend (seated Parighasana); (5) seated twist (Ardha Matsyandrasana variation); (6) simple supported backbend; (7) transition (resting pose to shift into another posture); (8) legs up the wall (Viparita Karani or variation); and (9) supported bound-angle pose (Supta Badha Konasana variation). The first five poses were done from a chair or floor mat (depending on the student's ability), and the remaining poses were done on a floor mat. The following poses were sometimes used as time or mobility allowed: (1) mountain pose; (2) arm and shoulder stretch; (3) supported seated angle pose; (4) seated sun salutation (Surya Namaskar variation); and (5) reclining twist with a bolster. In all poses, the teacher helped the student adjust the props until the pose became comfortable. Throughout the practice, participants were reminded to notice the breath and to breathe slowly and deeply.

Measures

Demographic and Clinical Information

The following demographic information was collected at baseline on all study participants: age, race/ethnicity, marital/partner status, educational history, and income. The following clinical information was obtained from the patient's medical record: diagnosis, date of diagnosis, stage of disease, previous cancer history, and prescribed treatment regimen (surgery, chemotherapy, radiation).

SF-12 Health Survey

The SF-12 Health Survey (SF-12) is an abbreviated measure of physical health status developed from the Medical Outcomes Study.[26] It is a 12-item self-report measure of perceived health and functioning that yields summary measures of physical (physical component score [PCS]) and mental health (mental component score

[MCS]). There are general population norms for this measure.

Functional Assessment of Cancer Therapy

The Functional Assessment of Cancer Therapy (FACT-G) is a 28-item self-report measure of quality of life in cancer patients.[27] It consists of the following five subscales: physical well-being (PWB), social/family well-being (SWB), satisfaction with the doctor/patient relationship, emotional well-being (EWB), and functional well-being (FWB). The FACT-G can be self-administered and is easily completed in 5 to 10 minutes. This measure has established reliability and validity.

FACT-Fatigue

The FACT-Fatigue is a commonly used 13-item instrument developed to assess fatigue in people with cancer.[28,29] Responses are made on a 5-point Likert scale ranging from 0 (not at all) to 4 (very much so) and summed to yield a total score. This brief measure demonstrates excellent internal consistency (Cronbach's $\alpha = .93–.95$) and test–retest reliability ($r = .90$). Higher scores indicate lower levels of fatigue.

FACIT-Spirituality

The 12-item FACIT-Spirituality (FACIT-Sp) scale assesses spiritual well-being.[30] It was developed with an ethnically diverse cancer patient population and has strong psychometric properties (Cronbach $\alpha = .87$). This scale taps both traditional religiosity and spirituality dimensions without assuming a belief in God; therefore, it can be completed by atheist or agnostic individuals. The FACIT-Sp has two domains: sense of meaning or peace (eight items) and the role of faith in illness (four items). Responses are made on a 5-point Likert scale ranging from 0 (not at all) to 4 (very much) and are summed for total and domain scores. Higher scores indicate higher levels of spirituality.

Center for Epidemiologic Studies–Depression Scale

The Center for Epidemiologic Studies–Depression Scale (CES-D) is a 20-item self-report measure developed to screen for depressive symptoms.[31] Items are rated on a 4-point scale (0 = rarely or none of the time to 3 = most or all of the time), and the total score ranges from 0 to 60. The measure has excellent reliability and validity in community and cancer patient samples.[31,32] Higher scores indicate greater risk of depression, with scores ≥ 16 indicating potentially significant levels of depression.[31]

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI) is a 40-item self-report measure of state and trait anxiety.[33] State anxiety represents an immediate sense of how one is feeling, whereas trait anxiety is thought to be dispositional and stable. To measure state anxiety, participants report the intensity of their feelings "right now, at this moment" to 20 items using a 4-point scale (1 = not at all to 4 = very much so). For the 20 trait anxiety items, respondents indicate how they "generally" feel by reporting how often they experience various feelings and cognitions using a 4-point scale (1 = almost never to 4 = almost always). Higher scores indicate greater anxiety. Both state and trait anxiety were assessed at baseline; since trait anxiety presumably remains stable over time, only state anxiety was assessed in follow-up questionnaires.

Positive & Negative Affect Schedule

The Positive & Negative Affect Schedule (PANAS) is a 20-item measure to assess current positive and negative affect.[34] Study participants respond to items regarding their affect over the past 1-week period using a 5-point scale: 1 = very slightly or not at all, 2 = a little; 3 = moderately; 4 = quite a bit; and 5 = extremely. The α internal consistency reliabilities for this scale are high, ranging from .86 to .90 for positive affect and from .84 to .87 for negative affect.[34]

Program Evaluation

Following the intervention, study participants were asked about the RY program with questions designed to elicit positive and negative feedback. They rated several items related to the quality of the classes and the instructor on a scale from 0 (lowest) to 4 (highest). Study participants were also asked a series of open-ended questions in which no sample responses were offered to avoid biased responses. These included asking why they had decided to participate in the intervention, what they had hoped to gain, what they liked best and least, what they had learned, what motivated them to continue in the program, suggestions for improvement, and additional comments.

Statistical Analysis

Mean scores and standard deviations were computed for all self-report measures. General linear mixed models were used to examine the change within participants over time (baseline, postintervention, 2 months postintervention). We estimated changes from baseline to postintervention and baseline to 2 months postintervention separately and used a *t*-test to test whether the change was significantly different from zero. We also tested whether both of these differences were simultaneously significantly different from zero by using a two degrees of freedom *F* test. Least squares means and standard errors were computed for each time point, and the differences in least squares means were computed for baseline to postintervention and baseline to 2 months postintervention. We tested whether changes in the measures over time differed by treatment during the intervention or cancer type by including the interaction of the variable with time in the model. The relationship between attendance and the measures was assessed by including the number of classes attended as a covariate in the model, as well as an interaction effect with time, if significant. Because of the small sample size, we considered a two-sided α level of .05 to indicate statistical significance but also noted changes with *p* values ≤ .10. All analyses were performed in *SAS* version 9.1 (SAS Institute, Cary, NC).

Qualitative analysis of program evaluation questionnaire data was performed separately by two independent researchers (S.C.D., D.F.F.). A multiple coding technique was used in which each researcher read all of the spontaneously generated responses to each evaluation question and extracted key thematic categories using a grounded theory approach.[35,36] The independent researchers met to compare extracted themes, address coding inconsistencies, and arrive at mutual agreement on thematic categories. Variations in coding categories between the two researchers provided a platform for refinement of categories.[35]

Results

Recruitment

Participants were recruited from two medical centers; from the first medical center, the recruitment rate was 16% (28 participants enrolled of 172 letters sent). Recruitment was not tracked systematically at the second medical center largely because of patient privacy issues and the tendency of patients to enter the study via self-referral to advertisements rather than recruitment letters. Although reasons for nonparticipation were not tracked systematically for all patients who received recruitment materials, the main reasons included the following: distance from local area, no response to recruitment materials, too busy, and health issues (too sick/not feeling well).

Sample Description

A convenience sample of 51 women with ovarian (*n* = 37) or breast cancer (*n* = 14) was recruited from two local cancer treatment centers. Demographic and clinical data and yoga-related information are shown in Table 1. The mean participant age was 58.9 years, and the majority of women were white, married/partnered, and well educated. Women had minimal experience with yoga. Of the four women who had practiced yoga in the past 12 months, only one had apparently done yoga on a regular basis (2–3 times/month). The mean number of RY classes attended was 5.9 (of 10 offered) (SD = 3.2).

Mental Health and Quality of Life

Least squares means (with standard errors), least squares mean difference scores (with standard errors), and significance statistics for mental health, quality of life, physical health, and fatigue are shown in Table 2. There was a significant decrease between baseline and postintervention follow-up for depression (*p* ≤ .01). There was a significant decrease between both baseline and postintervention follow-up (*p* ≤ .01) and between baseline and the 2-month follow-up (*p* ≤ .01) for negative affect. For state anxiety, there was a trend toward significance between baseline and postintervention follow-up (*p* ≤ .10) and a significant decrease between baseline and the 2-month follow-up (*p* ≤ .01). For the SF-12 MCS and total FACT-G scores, significant improvements were seen between both baseline and postintervention follow-up (*p*'s ≤ .05), as well as between baseline and the 2-month follow-up (*p*'s ≤ .05). The change in the FACT-G score appeared to be due primarily to changes in physical and functional well-being. No significant changes were noted for positive affect or spirituality.

Physical Health and Fatigue

The SF-12 PCS showed a trend toward significance between baseline and postintervention follow-up (*p* ≤ .10); however, there was a significant change in this score between baseline and the 2-month follow-up (*p* ≤ .05).

Table 1. Demographic and Clinical Characteristics of Analytic Sample at Baseline ($N = 51$)

Demographic/Clinical Characteristics	% (n) of Sample	Mean (SD)
Age (range 34–82 yr)		58.9 (11.2)
Race/ethnicity		
Non-Hispanic white	88.2 (45)	
African American	9.8 (5)	
Asian/Pacific Islander	2.0 (1)	
Marital status		
Married/partnered	64.7 (33)	
Single	9.8 (5)	
Divorced/separated	13.7 (7)	
Widowed	11.8 (6)	
Years of education		
High school diploma/GED	11.8 (6)	
Some college or vocational school	43.2 (22)	
College graduate	19.6 (10)	
Graduate study or degree	25.5 (13)	
Income (total annual)*		
< $35,000	29.4 (15)	
$35,000–$49,999	21.6 (11)	
$50,000–$99,999	29.4 (15)	
$100,000+	11.8 (6)	
Diagnosis and stage[†]		
Ovarian cancer	72.5 (37)	
Stage 1	10.8 (4)	
Stage 2	5.4 (2)	
Stage 3	67.6 (25)	
Stage 4	16.2 (6)	
Breast cancer	27.5 (14)	
Ductal carcinoma in situ	7.1 (1)	
Stage 1	42.9 (6)	
Stage 2	28.6 (4)	
Stage 3	14.2 (2)	
Stage 4	7.1 (1)	
Received chemotherapy during study[‡]	56.9 (29)	
Ovarian cancer	70.3 (26)	
Breast cancer	21.4 (3)	
Received radiation therapy during study	9.8 (5)	
Ovarian cancer	0.0 (0)	
Breast cancer	35.7 (5)	
Time since diagnosis (mo)		14.5 (17.3)
Ovarian cancer		15.1 (18.7)
Breast cancer		12.9 (13.2)
Time since recurrence (if applicable, $n = 10$) (mo)		7.4 (7.9)
Ovarian cancer ($n = 8$)		7.8 (8.8)
Breast cancer ($n = 2$)		5.7 (2.9)
Number of yoga classes attended		5.9 (3.2)
Ovarian cancer		6.1 (3.3)
Breast cancer		4.8 (3.3)
≤ 2 classes	25.5 (13)	
3–6 classes	23.5 (12)	
≥ 7 classes	51.0 (26)	

Table 1. Continued.

Demographic/Clinical Characteristics	% (n) of Sample	Mean (SD)
Never had done yoga before	86.3 (44)	
No yoga experience in the past year	92.2 (47)	

*Reported family income had some missing values, so total *N* is less than 51. [†]Distribution by stage was significantly different by diagnosis using the Fisher exact test ($p < .01$).
[‡]Distribution for chemotherapy during study was significantly different by diagnosis (21.4% for breast cancer, 70.3% for ovarian cancer, $p < .01$ using the Fisher exact test).

Fatigue improved significantly between baseline and the postintervention follow-up ($p \leq .05$); however, no significant improvement over time was noted between baseline and the 2-month follow-up.

Changes by Treatment and Cancer Type

There were no significant differences in the measures by whether or not the participants received chemotherapy or radiation treatment during the intervention. There were significant differences in change over time in total FACT-G between participants with breast cancer and those with ovarian cancer ($p = .03$); no other measure showed a statistically significant difference. The FACT-G score increased for women with breast cancer but did not change significantly for women with ovarian cancer (Table 3). Changes in total FACT-G were due primarily to changes in the social/family and functional well-being subscales. It is notable that the women with ovarian cancer had a higher FACT-G score at baseline than those with breast cancer, although the difference was not statistically significant (difference = 5.5 points, $p = .10$).

Table 2. Least Squares Means (SEM) by Time ($N = 51$)

Variable	Baseline LS Mean (SE) (n = 51)	Postintervention (Week 10) LS Mean (SE)[†] (n = 43)	Final Follow-Up (Week 18) LS Mean (SE)[‡] (n = 38)	Overall $F_{2,78}$
Mental health and quality of life				
SF-12 MCS	48.4 (1.2)	52.0 (1.3)**	51.4 (1.3)**	3.78**
CES-D	12.3 (1.2)	9.2 (1.3)***	10.5 (1.4)	3.70**
Negative affect	15.8 (0.7)	14.1 (0.7)***	14.0 (0.8)***	5.28***
Positive affect	34.7 (1.2)	36.2 (1.3)	35.2 (1.3)	0.97
STAI state anxiety	34.2 (1.5)	31.8 (1.6)*	30.1 (1.7)***	3.79**
FACT-G	75.9 (1.5)	79.4 (1.6)**	79.4 (1.7)**	3.87**
SWB	24.0 (0.6)	24.8 (0.7)	24.4 (0.7)	1.04
FWB	18.0 (0.6)	18.8 (0.6)	19.5 (0.7)**	3.35**
EWB	14.0 (0.3)	13.8 (0.3)	13.4 (0.4)*	1.37
PWB	20.0 (0.8)	22.1 (0.8)***	22.1 (0.9)***	5.41***
FACIT-Sp	38.7 (1.0)	40.1 (1.1)	39.8 (1.1)	1.28
Physical health and fatigue				
SF-12 PCS	41.2 (1.6)	43.5 (1.6)*	44.2 (1.7)**	3.09*
FACT Fatigue	34.6 (1.7)	37.3 (1.8)**	36.2 (1.8)	1.97

CES-D = Center for Epidemiologic Studies–Depression Scale; EWB = emotional well-being; FACT = Functional Assessment of Cancer Therapy; FWB = functional well-being; LS = least squares; MCS = mental component score; PCS = physical component score; PWB = physical well-being; SE = standard error; SEM = standard error of measurement; STAI = State-Trait Anxiety Inventory; SWB = social/family well-being.
***$p \leq .01$; **$p \leq .05$; *$p \leq .10$ from a general linear mixed model.
[†]Denotes significant difference between baseline and postintervention.
[‡]Denotes significant difference between baseline and final follow-up.
For most measures, higher scores indicate a higher level of the variable (quality of life, depression, negative and positive affect, anxiety, spirituality). On the FACT-Fatigue, however, higher scores indicate less fatigue.

Table 3. Least Squares Means (SEM) for the FACT-G (Total Score and Subscales) by Diagnosis and Time ($N = 51$)

| | Ovarian Cancer | | | Breast Cancer | | | |
Variable	Baseline LS Mean (SE)	Postintervention (Week 10) LS Mean (SE)[†]	Final Follow-Up (Week 18) LS Mean (SE)[‡]	Baseline LS Mean (SE)	Postintervention (Week 10) LS Mean (SE)[†]	Final Follow-Up (Week 18) LS Mean (SE)[‡]	Overall $F_{2,74}$[§]
FACT-G	77.4 (1.8)	78.7 (1.9)	79.0 (2.0)	71.9 (2.9)	81.2 (3.1)***	80.1 (3.1)***	3.81**
SWB	24.7 (0.7)	24.8 (0.8)	24.2 (0.8)	22.2 (1.2)	25.0 (1.3)***	24.9 (1.3)***	4.33**
FWB	18.5 (0.7)	18.5 (0.8)	19.5 (0.8)	16.6 (1.2)	19.6 (1.2)***	19.6 (1.2)***	2.82*
EWB	14.1 (0.4)	13.8 (0.4)	13.3 (0.4)*	13.8 (0.6)	14.0 (0.7)	13.8 (0.7)	0.43
PWB	20.4 (0.9)	21.7 (1.0)*	22.0 (1.0)*	19.1 (1.5)	23.0 (1.6)***	22.0 (1.6)**	1.20

EWB = emotional well-being; FACT-G = Functional Assessment of Cancer Therapy; FWB = functional well-being; LS = least squares; PWB = physical well-being; SE = standard error; SEM = standard error of measurement; SWB = social/family well-being.

***$p \le .01$; **$p \le .05$; *$p \le .10$ from a general linear mixed model.

[†]Denotes significant difference between baseline and postintervention.

[‡]Denotes significant difference between baseline and final follow-up.

[§]Overall F for interaction term.

Adherence

For the SF-12 PCS, the interaction between the number of yoga classes and time was statistically significant ($p = .05$); for each class attended, there was an increase in the mean SF-12 PCS by 1.3 ($p = .01$) at postintervention follow-up and 1.7 ($p < .01$) at the 2-month follow-up. There were no other significant interactions between the number of yoga classes and time, indicating that change over time did not depend on the number of classes attended. For the CES-D, negative affect, STAI anxiety, and FACT-Fatigue, each measure was significantly associated with the number of classes attended, but this association did not differ by time. There were no significant associations for the SF-12 MCS, positive affect, or spirituality. The FACT-G showed a trend toward a significant association with the number of yoga classes ($p = .06$), driven primarily by the FWB subscale ($p < .01$).

Program Evaluation Ratings

Feedback was extremely positive; 88% of women reported that they liked the RY class "quite a bit" or "very much." Mean ratings (SD) (possible range 0–4) for various feedback items were as follows: "teacher is competent," 3.9 (0.5); "teacher made class enjoyable," 3.8 (0.7); "liked RY classes," 3.7 (0.8); "found RY classes helpful," 3.4 (1.0); and "will continue to practice RY," 2.7 (1.4).

Qualitative Feedback

Themes and representative quotations are summarized in Table 4. The most frequent reasons for participation in RY classes included physical benefits and exercise, relaxation, stress relief and emotional benefits, and interest in learning yoga. Most women liked the shared group experience, the personal benefits derived from the program, learning yoga, and interactions with the instructor. Women reported that they learned relaxation, increased their knowledge of yoga (such as postures and breathing), and enhanced self-awareness. The group experience was the most frequently cited motivation for continuing to come to classes.

The least liked aspects of the program centered on logistical concerns such as distance, timing and location of classes, lack of frequency of class sessions, and short duration of both the classes and the program. Women who did not complete the program cited schedule conflicts, competing responsibilities, and, rarely ($n = 3$), the effects of cancer treatment. Women suggested that the RY program could be improved by increased frequency and longer duration of classes, handouts of exercises, more strenuous activity, and more information on the benefits of yoga. Additional comments reiterated the positive experience, importance of the shared group experience and the social support it provided, enjoyment of the instructor, and stress relief and emotional benefits.

Discussion

This article details findings from a nonrandomized investigation of benefits of RY for women with ovarian or breast cancer. With respect to mental health and quality of life, significant improvements were seen over time for depression, negative affect, state anxiety, and overall quality of life. In terms of physical health quality of life, the SF-12 PCS also improved between baseline and the 2-

Table 4. Qualitative Feedback Themes

Questions (in bold) and Responses by Thematic Category (in order of frequency of occurrence) with Representative Quotations (in italics)	*Number of Responses in Thematic Category*
Reasons for participation	
Physical benefits/exercise	14
I thought it could possibly be a form of exercise I would enjoy; I thought it would help gain back some control of my body; Thought it would be beneficial for me to keep flexible	
Relaxation/stress relief/emotional benefits	13
I thought it would help gain back...peace of mind; To see if it would help me destress; To help relieve tension and stress	
Interest/curiosity in yoga (includes previous yoga experience)	13
I had always wanted to take some form of yoga; Something new, different	
Shared group experience	8
To meet people with similar concerns	
Recommendation from another (MD, family member)	4
Two doctors thought it would be a good idea; Husband signed me up in order to help me cope with chemotherapy	
What participants liked best about the RY program	
Group/shared experience	24
I enjoyed being with other people who have experienced the same problems I have; Being with other women who were able to give me support and who also accepted support	
Benefits (feeling better mentally and physically, time for self)	18
I always felt better after the class; The relaxed, peaceful feeling after the class; The opportunity to relax and work at my own pace; Learning to set aside time to relax and do something nice for myself	
Learning yoga	13
I liked the yoga itself	
Instructor	12
Fellowship with the instructor	
What participants liked least about the RY program	
Class format (short duration, group composition, repetitive material)	12
Class too short; Class size was too small; Mixture of gynecology and breast cancers; also no one else at my stage of disease; That it got a little boring doing the same things each week	
Logistics (day, time, location, length of drive)	11
Length of drive; Location deserted at night; Time class was offered	
What learned from RY program	
Relaxation	21
How to relax my mind; How important it is to relax	
Yoga knowledge/use of yoga in other situations	15
Positions in yoga; I learned about postures and counter postures; When I had to have an MRI for my back I practiced yoga in the tube—it helped a lot	
Breathing/breathing techniques	13
How to breathe for relaxation—self-awareness of body and mind, mood	
Inner awareness/self-awareness	9
To listen to your inner self; How important it is to take time out of my busy life to check in with my body and emotions on a regular basis	
Group experience/social support	6
Good sensitive people to converse with; Learning I was not alone in my emotions	
Suggestions for improvement	
More yoga (increased frequency, duration, class length)	8
Longer session; Maybe have the class twice a week	

Table 4.   Continued.

Questions (in bold) and Responses by Thematic Category (in order of frequency of occurrence) with Representative Quotations (in italics)	Number of Responses in Thematic Category
Content suggestions (more strenuous, provide handouts)	7
Helps if there's a handout to read and follow when doing yoga practice at home; Personally, I'd like to advance in the activities to be a little more strenuous	
Group composition (include anyone with cancer, different format for distance, timing relative to cancer treatment)	6
Maybe include other cancer patients; Could you devise some means of sharing and continuing the program with those people who live a considerable distance; Schedule these classes closer to the time that the patient had their surgery; Participate in the program after chemotherapy is complete	
Logistics (assistance with putting props away, other location, different time)	5
Have someone to help carry props if needed; After work hours	
Motivations to continue (if completed most/all classes)	
Group experience/support	20
I enjoyed talking to the other women, sharing problems, and realizing that so many people had the same concerns as I did; Fellowship with other cancer survivors; The instructor and my new friends that I met in the class	
Relaxation/stress relief/time for self/time for quiet/global sense of "feeling better"/enjoyed class	25
It was very relaxing; I was learning to better control some of my emotions; Knowing that the 1½-hour class was "my time" and my family knew it...knowing that I was going to enjoy my class and leave from there feeling relaxed and good about myself because I did something for me; I just loved the class	
Physical benefits/exercise	6
Becoming more comfortable in doing the exercises; Joint pain went away	

MRI = magnetic resonance image.

month follow-up. Fatigue, an important issue for cancer patients, improved significantly between pre- and post-intervention. There were no significant differences in the changes in the measures by whether the participant received cancer treatment (chemotherapy or radiation therapy) during the intervention. Analyses based on cancer diagnosis showed a greater increase in overall quality of life for women with breast cancer but no significant change for women with ovarian cancer. Changes in quality of life seemed largely driven by SWB and FWB subscales. It is difficult to speculate on the differences by cancer type owing to the small sample size, but the patterns in change in quality of life scores are worth noting. Between baseline and postintervention, women with breast cancer improved by 10 points more on average on the FACT-G compared with women with ovarian cancer, even after controlling for stage and treatment with chemotherapy during the intervention. However, even though the women with ovarian cancer tended to have a higher stage and were more likely to be undergoing chemotherapy compared with the women with breast cancer, they reported a higher quality of life score at baseline by over 5 points. After the intervention, the women with breast cancer reported a higher quality of life on average than women with ovarian

cancer owing to a significant increase in quality of life; however, the postintervention difference between the ovarian and breast cancer groups was only 2.5 points. It is plausible that the women with ovarian cancer were further from diagnosis and had adapted more to having cancer, whereas women with breast cancer had been diagnosed more recently and were in the midst of treatment, leaving more room for improvement in their quality of life. Similarly, lack of an increase in self-reported quality of life may have been influenced by a worse prognosis in the women with ovarian cancer. Further, response shift (change attributable to changes in the meaning of a construct to a respondent over time) may have affected quality of life responses and may help explain quality of life findings.[37] Previous research has shown that response shift is common in patients with both early- and later-stage cancers and may result from a change in their priorities on the relative importance of quality of life domains or in their internal standards or value in the conceptualization of quality of life.[37–40]

Analyses of the interaction of adherence to the intervention and time suggested that change in most of the outcome variables was not dependent on how many yoga classes women attended, except for the SF-12 physical

component summary score. For this score, the number of classes attended was positively associated with the change in the summary score. There were significant positive associations between several of the measures (depression, negative affect, anxiety, fatigue) and the number of classes attended, but the relationship did not differ by time, indicating that women may have had better adherence when they were functioning better physically and emotionally.

Women's ratings of the RY classes and the instructor and their qualitative feedback on the RY classes were predominantly positive. Although the RY intervention was not designed to provide group support, many of the participants noted the value of the social aspects of the RY classes. The findings from this study are consistent with the few other published studies demonstrating yoga as beneficial to cancer patients' quality of life.[22–24] Interestingly, a recent survey of CAM use by breast cancer survivors suggested that unlike most CAM modalities, reported use of yoga was associated with improved quality of life.[41]

As a pilot study of feasibility, there are a number of inherent limitations. First, this study employed a single-group design with no control group. It is not clear whether the changes we saw in several variables were related to the intervention or would have occurred naturally over time. Second, our sample size was relatively small and not demographically diverse. Because our recruitment rate was low, we do not know if the results would have differed with a more diverse group. The low recruitment rate limits the generalizability of these findings. Third, the study sample was a heterogeneous group of cancer patients, in terms of treatment status and diagnosis. Our sample included women both in the midst of cancer treatment (chemotherapy or radiation therapy) and out of treatment; treatment status was not linked to outcomes in this study, however. Initial data collection focused on women with ovarian cancer; however, study participation was opened to women with breast cancer owing to recruitment difficulties with ovarian cancer patients. Given that we had different findings for quality of life variables by diagnosis, future studies should focus on homogeneous patient groups. Finally, adherence to the intervention (number of classes attended) varied widely. Better adherence might be achieved through increasing the flexibility of the intervention (ie, classes at varied times, make-up classes, rolling entry into the intervention) and by following up with participants via telephone immediately after missed classes to determine issues or concerns that may need to be addressed.

Given our nonrandomized design and small sample size, the clinical significance of these findings must be interpreted cautiously. Previous research suggests that a 4-point change on the FACT-G indicates a clinically important difference,[42] suggesting clinically significant improvement in quality of life, particularly for women with breast cancer in this study (see Tables 2 and 3). The positive qualitative feedback may provide a stronger indicator of potential clinical significance of a yoga intervention for cancer patients. RY is a promising supportive therapy for women with cancer and seems to be well accepted. All limitations notwithstanding, our results add to the growing literature on the benefits of participation in yoga for cancer patients. Positive, qualitative responses about the RY intervention, combined with promising emotional and quality of life data, suggest that continued research in this area is worth pursuing. We learned that the intervention was gentle enough that participants were, in fact, able to participate in the midst of cancer treatment and that women appreciated the time to focus on themselves in a supportive environment.

It is clear from informal patient comments that sleep quality is an important outcome to target when studying the effects of RY. Additional pilot research is ongoing in which women are being randomized to a RY intervention or waitlist control group. Data on sleep quality are being collected and will be useful in comparing the intervention and control groups. Future directions in this line of research include narrowing the sample to determine when an RY intervention may be most useful (ie, during treatment or post-treatment), examining the benefits of this complementary therapy in patients with various types of cancers, and extending the intervention to groups that include or consist solely of men.

Acknowledgments

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