

**Clinical Note**

## Yoga for Women with Metastatic Breast Cancer: Results from a Pilot Study

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**Abstract**

Metastatic breast cancer (MBC) remains a terminal illness for which major treatment advances are slow to appear, and hence it is crucial that effective palliative interventions be developed to reduce the cancer-related symptoms of women with this condition during the remaining years of their lives. This pilot/feasibility study examined a novel, yoga-based palliative intervention, the Yoga of Awareness Program, in a sample of women with MBC. The eight-week protocol included gentle yoga postures, breathing exercises, meditation, didactic presentations, and group interchange. Outcome was assessed using daily measures of pain, fatigue, distress, invigoration, acceptance, and relaxation during two preintervention weeks and the final two weeks of the intervention. Thirteen women completed the intervention (mean age = 59; mean time since diagnosis = 7 years; two African American, 11 Caucasian). During the study, four participants had cancer recurrences, and the physical condition of several others deteriorated noticeably. Despite low statistical power, pre-to-post multilevel outcomes analyses showed significant increases in invigoration and acceptance. Lagged analyses of length of home yoga practice (controlling for individual mean practice time and outcome levels on the lagged days) showed that on the day after a day during which women practiced more, they experienced significantly lower levels of pain and fatigue, and higher levels of invigoration, acceptance, and relaxation. These findings support the need for further investigation of the effects of the Yoga of Awareness Program in women with MBC. *J Pain Symptom Manage* 2007;33:331–341. © 2007 U.S. Cancer Pain Relief Committee. Published by Elsevier Inc. All rights reserved.

**Key Words**

Metastatic breast cancer, pain, fatigue, yoga, meditation

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**Introduction**

Metastatic breast cancer (MBC) constitutes a serious life threat for women, with an average prognosis of 18–24 months to live.<sup>1</sup> Pain, fatigue, and emotional distress are often reported as the most debilitating symptoms of MBC patients.<sup>2–5</sup> Although pharmacological interventions may help these women to some degree, these symptoms rarely resolve.<sup>4,6,7</sup>

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Given that MBC is a terminal illness for which major treatment advances are slow to appear, it is crucial that effective adjunctive palliative interventions be developed to reduce the cancer-related symptoms of these women during the remaining years of their lives.

Few palliative behavioral interventions have been tested with MBC patients, with mixed results. A recent review of cognitive-behavioral group therapy<sup>8–11</sup> and supportive-expressive group therapy<sup>12–17</sup> trials concluded that although some evidence exists for short-term benefits from these approaches (e.g., better mood<sup>9,15</sup> and less increase in pain<sup>14,16</sup>), such changes are not maintained even for a few months.<sup>18</sup> More recently, results from an exercise intervention tailored for MBC demonstrated short-term effects in terms of slower rates of deterioration in well-being and fatigue.<sup>19</sup>

There is thus a clear need to test new behavioral approaches to ameliorating cancer-related symptoms in women with MBC.<sup>18</sup> Yoga is a popular approach to health maintenance, which holds promise for benefiting women with MBC. As a mind/body discipline originating in India, yoga has been practiced for its proposed physical, mental, and spiritual benefits for thousands of years.<sup>20</sup> Yoga is one of a variety of complementary and alternative medicine adjunctive approaches that cancer patients of all cultural backgrounds have been seeking out in dramatically larger numbers in recent years.<sup>21–24</sup> Yoga is now offered at several major treatment centers (e.g., M.D. Anderson, Memorial Sloan-Kettering, UCLA/Jonsson) via their complementary therapy services, and recently yoga has been the focus of several cancer studies.<sup>25–29</sup> Results from two randomized trials of yoga for cancer patients have been published. Cohen et al. reported improvement in sleep disturbance in a trial with lymphoma patients,<sup>27</sup> and Culos-Reed et al. demonstrated improvements in mood, quality of life, and stress in breast cancer survivors.<sup>28</sup>

However, thus far no study has investigated the use of yoga with MBC patients. The rationale for applying a yoga-based intervention in this population rests on several premises. First, research suggests that yoga can produce an “invigorating effect on mental and physical energy” that improves physical fitness and counteracts fatigue,<sup>30</sup> a problematic symptom

in MBC. Second, historically in the practice of yoga, a fundamental emphasis is placed on accepting one’s moment-to-moment experiences, whatever they may be, without forcing the body beyond its comfortable limits. This is because struggles to control the body, or to control one’s physical sensations, thoughts, or emotions often only exacerbate problems. Such struggles also detract from focusing on the personally fulfilling activities at hand. The important role of a healthy sense of acceptance in decreasing distress in the face of unpleasant symptomology has received increased research and clinical attention,<sup>31</sup> and may be especially important for individuals dealing with a life-threatening illness.<sup>32</sup> Third, studies have demonstrated that yoga produces the relaxation response characterized by decreased sympathetic and increased parasympathetic activity.<sup>33–38</sup> The relaxation response is likely to improve symptoms of pain, fatigue, and distress.<sup>39,40</sup>

In summary, yoga appears to promote at least three therapeutic processes—invigoration, acceptance, and relaxation—which are likely to have a favorable effect on MBC patients. The purposes of this pilot study were to determine the feasibility of a novel, yoga-based eight-week group intervention in women with MBC and to examine the intervention’s effects on pain, fatigue, distress, invigoration, acceptance, and relaxation. We did not specify a priori hypotheses regarding improvements in these outcomes because of (a) the preliminary, uncontrolled design of the study and (b) the fact that significant findings from intervention studies with this population have often consisted of less deterioration in the intervention vs. control conditions, rather than actual improvement in symptoms.<sup>12,14,16,17,19</sup> The intervention we used—the Yoga of Awareness Program—was specifically designed for MBC patients, and included gentle yoga postures, regulated breathing, guided meditations, brief didactic presentations, and group discussions.

Compared to previous MBC intervention studies, this study makes a unique contribution in terms of the method of analyzing treatment outcome. Data on symptoms (pain, fatigue, distress) and therapeutic processes (invigoration, acceptance, relaxation) were collected in the form of prospective daily diaries. Relative to traditional survey questionnaires,

diaries offer improved accuracy, reduced recall bias, and increased recall of symptoms and related events, especially regarding the *temporal* sequencing of events.<sup>41–45</sup> To analyze the diary data, we used multilevel random effects models.<sup>46</sup> These analyses are preferable to data analytic strategies that aggregate daily assessments (e.g., ordinary regression models) because they permit 1) tracking of symptom-related processes as they occur in naturalistic settings, 2) accounting for two levels of sampling, that is, both within-person variation and between-person variation, 3) controlling for autocorrelation, that is, the serial dependency that results from successive daily assessments, and 4) handling missing data that often occur in intensive longitudinal data collection.<sup>46–49</sup>

## Methods

### *Participants and Setting*

Volunteers for this study included 21 adult women with MBC referred by oncologists at the Duke University Medical Center breast oncology unit and affiliate sites. Sample illustrations of the postures used during the yoga sessions were provided to referring physicians and to potential participants to give them a better sense of what the intervention would involve. Patients were excluded if they had less than six-month life expectancy, if changes had taken place in their use of any antidepressants during the previous three months, if they had received treatment for serious psychiatric disorders (e.g., schizophrenia) in the previous six months, if they were currently engaged in intensive yoga practice (>three days per week), if driving time to attend weekly sessions was excessive (>one hour as a rule of thumb), or if they were not English speaking. Of the women who volunteered for the study, three withdrew before beginning the intervention (2 = scheduling difficulties, 1 = custody-case court appearances). Of the 18 remaining women, four withdrew shortly after beginning the intervention (1 = scheduling difficulties, 1 = traveling distance, 1 = relocated to another state, 1 = health status deterioration), and one woman did not complete post diaries because of mental status deterioration (dementia-like). Attrition subsequent to beginning the intervention was thus 28%, which is similar to other intervention studies with MBC patients (e.g., Edelman

et al.<sup>9</sup> = 26%, Goodwin et al.<sup>14</sup> = 32%, Spiegel and Bloom = 31%<sup>16</sup>).

This left 13 women who completed the intervention and provided pre- and postmeasures. The mean age of this sample was 59 years (range = 44–75). The average time since diagnosis was seven years (range = 0–26). Seven were concurrently receiving chemotherapy treatments, and six were not; four had new cancer recurrences while participating in the study. Six patients previously practiced yoga or meditation to some extent (of which two had practiced during the previous year). Eleven patients were Caucasian and two were African American. Eleven were married, one was widowed, and one was divorced. Fifteen percent had graduated from high school, 54% had attended college, and 31% had attended graduate school.

### *Procedure*

The protocol for this study was approved by the Duke Institutional Review Board. Prior to the study, informed consent was obtained from all participants. All women were asked to provide basic demographic information and information relevant to their breast cancer treatment history. Participants continued to receive the standard care provided by their health care providers. To control for a potentially important medication-related confound, after completing the intervention, patients were asked about any changes in antidepressant use; no changes were reported. After completing the yoga program and postintervention measures, women were invited to participate in a focus group to give qualitative feedback regarding the program.

### *Data Collection*

*Daily Symptom and Process Measures.* A brief daily-diary measurement strategy was chosen because of the demonstrated reliability and validity of this method in health-related fields, and the fact that diaries allow subjective events, such as sensations and feelings, to be reported unobtrusively and with little introspection in individuals' natural settings.<sup>45</sup> Data from diaries also permit a careful analysis of day-to-day interrelated happenings for each person and provide increased statistical power when analyzing a small clinical sample.<sup>48</sup>

Before going to bed each evening, patients completed a daily-diary log, in which they recorded their levels of pain, fatigue, distress, invigoration, acceptance, and relaxation during two preintervention weeks (pre), and during the last two weeks of the intervention period (post). All daily variables were indicated by marking 100-mm visual analogue scales (VAS), in which higher scores reflected greater amounts (e.g., for pain, the item read "Please indicate the average level of pain you had today," with anchors set as "No Pain" and "Pain as Bad as it Can Be"; for acceptance, the item read "Please indicate how easy it was for you today to accept and let be the ways you have been affected by your medical condition," with anchors set as "No Acceptance" and "Complete Acceptance"). Similar VAS measures are extensively used in clinical settings to measure subjective phenomena, and have been shown to be valid, reliable, rapid, and sensitive in measuring such variables as global affect, pain, and fatigue.<sup>50</sup> The post diary also asked participants to indicate how many minutes were spent in completing the day's yoga practice assignment.

An important requirement for the effective use of diary measures is that participants receive adequate training in the completion of diaries.<sup>45</sup> Participants in this study were trained in how to complete the diary by a research assistant who helped them complete sample diaries. Patients also were called during the first week of each recording period to inquire about any difficulties and to answer any questions. Another key requirement of most daily-diary studies is that each day's responses be recorded by the end of that day.<sup>51</sup> To bolster this expectation, we asked participants to mail each day's diary back to us the following morning in preaddressed stamped envelopes. To further facilitate motivation and compliance, patients were paid \$0.25 for each completed daily diary and a \$1.50 bonus for each week of complete recording. The diary completion rate was 89% (324 of 364 potentially reportable days across 13 participants; range, 71–100%). On average, patients completed 12 of the 14 diaries at both pre and post ( $SD = 2$ ).

*Focus Group Feedback.* After all participants had completed the intervention, the women were invited to a focus group meeting to give

qualitative feedback regarding the Yoga of Awareness Program. Ten of the 13 participants attended. Open-ended questions were used to explore women's experiences regarding the various yoga methods used, the length and number of sessions, and the overall program. Women were invited to offer suggestions for how the program could be better tailored to their needs.

*Focus Group Anonymous Questionnaire.* Focus group participants were also asked to rate the success of the program on a five-item anonymous questionnaire. The questionnaire asked patients to rate, on 10-point Likert-type scales, how helpful the program was overall, how successful the program was in helping cope with feelings of distress, how successful the program was in helping manage pain, how successful the program was in helping manage fatigue, and whether they would recommend the program to a friend who has similar concerns.

#### *Yoga of Awareness Program*

The intervention consisted of eight weekly group sessions (four to five patients per group) conducted at the Duke Pain Prevention and Treatment Research Program offices. The groups were jointly led by a certified yoga teacher (registered with the national Yoga Alliance) who holds a master's degree in health behavior and education (KMC) and a clinical health psychologist (JWC). Both intervention leaders had received comprehensive training in traditional schools of yoga and had extensive experience in teaching yoga and meditation techniques to medical patients and the general public. On average, participants attended seven of the eight sessions (range, five to eight). To ensure consistency in delivering the intervention, a manual was developed to delineate the program and provide detailed session guidelines to be followed by the intervention leaders. All sessions were videotaped and reviewed in weekly treatment team meetings.

Yoga of Awareness is an innovative behavioral intervention specifically designed and tailored to address patients' pain, fatigue, and emotional distress. The intervention is based in the ancient Indian discipline of *yoga* (meaning "yoking" or "union"). During recent years, as the physical exercises of yoga have become popularized in Western countries, the term *yoga* in

common usage has largely become synonymous with this single aspect of the fuller discipline. Yoga in actuality comprises a wide variety of methods and approaches.<sup>27,52</sup> The Yoga of Awareness intervention is a comprehensive yoga program that systematically integrates a broad spectrum of traditional yogic techniques and tenets. Each 120-minute session included gentle physical stretching postures (*asanas*, e.g., seated forward folds, supine lateral twists) complemented by breathing exercises (*pranayama*, e.g., extended exhalation, breathing into sensation), meditation techniques (*dhyana*, e.g., awareness of breath, awareness of awareness itself), study of pertinent topics (*swadhyaya*, e.g., themes such as the value of watching oneself in one's daily life with the intention to understand rather than to judge and of maintaining one's poise even amid the tumult of ever-changing challenges), and group discussions (*satsang*, e.g., discussion of experiences of practicing yoga at home, changes in cancer-related symptoms during the week). Patients were supplied with a yoga mat, a blanket, CDs/audiotapes, and illustrated handbooks to guide them in home practice. Participants were encouraged to spend at least 10 minutes a day practicing yoga strategies on their own, and applications of yoga to daily living were assigned each week (e.g., acceptance during intervals of pain).

During sessions, the intervention leaders emphasized the importance of gentle posture practice when one's body is challenged by chronic illness, and instructions were modified to appropriately address individual patient needs (e.g., backache). Although the yoga postures used in this study presented no more risk of permanent injury than is associated with everyday activities such as climbing stairs or kneeling down to pick something up, nonetheless, as a precaution, a physician assistant or nurse was present during all sessions to address any medical concerns that may have arisen. However, their medical services were never needed. [Please contact the first author for a full description of the yoga postures used in the study.]

## Results

Because of the preliminary nature of this study, analyses of outcome measures were

based on data from study completers only.<sup>41,53</sup> A series of regression and Chi-square analyses comparing study completers and those who withdrew (either prior to or soon after beginning the intervention) indicated no significant differences in demographic characteristics. However, a significant effect was found for mean baseline scores on fatigue ( $F[1, 19] = 8.26, P < 0.01$ ). Those who withdrew were likely to have lower scores on fatigue ( $M = 46.92$  for completers vs. 26.15 for non-completers). There were also findings approaching significance for noncompleters to have higher baseline scores on relaxation ( $M = 45.21$  for completers vs. 63.16 for non-completers,  $F[1, 19] = 3.89, P = 0.06$ ) and invigoration ( $M = 39.99$  for completers vs. 54.58 for noncompleters,  $F[1, 19] = 3.19, P = 0.09$ ) and lower scores on pain ( $M = 33.92$  for completers vs. 21.53 for non-completers,  $F[1, 19] = 2.65, P = 0.12$ ). Note that statistical power for these tests was low due to the small sample size.

### Approach to Multilevel Data Analyses

The analyses for this study are based on a set of recently developed statistical procedures called multilevel modeling.<sup>54</sup> Multilevel modeling is an advanced methodology for integrating data from multiple levels of sampling, such as this study's two levels (within-person and between-persons). Multilevel models are particularly advantageous in analyzing data sets with many repeated measures, such as daily-diary records.<sup>48,53</sup> By preserving the rich detail in each individual's full data set, multilevel models allow for a sensitive independent determination of day-to-day interrelated happenings for each patient, as well as aggregation of individual estimates for reliable results for the average patient. The SAS Proc Mixed procedure<sup>55</sup> produced parameters in the form of unstandardized maximum likelihood estimates ( $\beta$  coefficients). These are partial correlations, adjusted for between-person differences, which serve as effect size estimates of magnitude and direction of changes in dependent variables associated with changes in independent variables.<sup>56</sup> Multilevel models allow for strict control for potential confounds, such as serial autocorrelation in measurements. For all analyses, we allowed intercepts to vary randomly, thus allowing us to generalize the

findings to the population of persons from which the sample was taken and the population of observations from which their daily reports were drawn.<sup>46</sup> [For a more complete description of the multilevel equations reported herein, please contact the first author.]

#### *Treatment Effects on Daily Outcomes*

To examine treatment effects, models tested whether patients' intercept levels for daily pain, fatigue, distress, invigoration, acceptance, and relaxation changed significantly across time from the pre to the post recording periods.<sup>46,53</sup> Table 1 shows the outcomes for the effect of treatment (Time). Despite the small sample size, the results demonstrated significant improvements in daily invigoration and acceptance, along with trends for improvement in pain and relaxation.

#### *Length of Yoga Practice and Same Day Outcomes*

On 71% (SD = 25%) of post diaries (collected during the last 14 days of the intervention), patients reported spending some time formally practicing yoga techniques. On average, they reported practicing for 21 minutes per day (SD = 11). Analyses examined whether the number of minutes spent in yoga practice

were predictive of same-day levels of diary variables. These models controlled for individuals' mean levels of yoga practice, and practice rates were person-centered to control for potentially spurious within-person associations.<sup>56</sup>

Table 2 presents the results of these tests. Same-day tests indicated greater yoga practice was significantly associated with decreased pain, increased invigoration, and increased acceptance. Trends were also present for greater yoga practice to be associated with decreased fatigue ( $P = 0.07$ ) and increased relaxation ( $P = 0.07$ ).

#### *Length of Yoga Practice and Lagged Day Outcomes*

The preceding same-day analyses did not address the question of temporal precedence and hence cannot be used to make causal inferences. Yoga practice potentially could have influenced levels of pain, invigoration, and acceptance, or the reverse could be true. Therefore, to clarify whether increases in yoga practice preceded and may have had a causative influence on day-to-day fluctuations in outcome variables, tests were conducted for lags of one and two days' practice. In lagged models, along with controlling for individuals' mean levels of practice, the lagged day's level of the dependent variable was also included as a within-person control variable (e.g., the present day's pain when predicting next day's pain). As before, practice rates were person-centered to control for any spurious within-person associations.

The results for next-day lagged associations are shown in Table 2. Increased yoga practice was significantly predictive of improved levels of next-day pain, fatigue, invigoration, acceptance, and relaxation. For invigoration and acceptance, there were also trends for improved levels on the second day (not shown in Table 2; for invigoration,  $b = 0.11$ ,  $t = 1.82$ ,  $P = 0.07$ ; for acceptance,  $b = 0.08$ ,  $t = 1.64$ ,  $P = 0.10$ ).

#### *Focus Group Feedback*

Patients' responses to open-ended questions during the focus group meeting revealed a widespread consensus that the number and length of the yoga sessions, the techniques imparted, and the overall content of the program were appropriate and very useful. Comments included "The yoga program got me through

Table 1  
Multilevel Random Effects Estimates  
for Baseline Intercept and Effect  
of Treatment (Time)

Predictor	$\beta$	$t$	$P$
Daily pain			
Baseline intercept	34.62	8.38	<0.01 <sup>a</sup>
Treatment (time)	-3.26	-1.72	0.10 <sup>b</sup>
Daily fatigue			
Baseline intercept	46.77	11.81	<0.01 <sup>a</sup>
Treatment (time)	-3.29	-1.45	0.16
Daily distress			
Baseline intercept	35.49	10.09	<0.01 <sup>a</sup>
Treatment (time)	1.66	0.78	0.44
Daily invigoration			
Baseline intercept	39.46	12.46	<0.01 <sup>a</sup>
Treatment (time)	6.96	3.44	<0.01 <sup>a</sup>
Daily acceptance			
Baseline intercept	58.73	11.71	<0.01 <sup>a</sup>
Treatment (time)	4.27	2.69	<0.02 <sup>c</sup>
Daily relaxation			
Baseline intercept	44.15	13.20	<0.01 <sup>a</sup>
Treatment (time)	3.74	1.74	0.09 <sup>b</sup>

<sup>a</sup> $P \leq 0.01$ .

<sup>b</sup> $P \leq 0.10$ .

<sup>c</sup> $P \leq 0.05$ .

Table 2  
Multilevel Random Effects Estimates for Associations of Length of Yoga Practice with Day-to-Day Outcomes

Variable	Same Day Outcomes			Next Day Outcomes		
	$\beta$	<i>t</i>	<i>P</i>	$\beta$	<i>t</i>	<i>P</i>
Daily pain	-0.15	-2.71	<0.01 <sup>a</sup>	-0.13	-2.19	0.03 <sup>b</sup>
Daily fatigue	-0.11	-1.81	0.07 <sup>c</sup>	-0.13	-1.96	0.05 <sup>b</sup>
Daily distress	-0.04	-0.60	0.55	0.01	0.04	0.97
Daily invigoration	0.16	2.99	<0.01 <sup>a</sup>	0.21	3.41	<0.01 <sup>a</sup>
Daily acceptance	0.11	2.54	<0.02 <sup>b</sup>	0.11	2.34	0.02 <sup>b</sup>
Daily relaxation	0.11	1.83	0.07 <sup>c</sup>	0.14	2.18	0.03 <sup>b</sup>

<sup>a</sup>*P* ≤ 0.01.

<sup>b</sup>*P* ≤ 0.05.

<sup>c</sup>*P* ≤ 0.10.

a bad time and I am still applying the life skills I learned. I'm finding how to keep my balance even when the waves get rough," and "The program really helped me become more aware of my body and to adjust to the changes that were happening. I learned to be more kind to myself." Yet another woman said, "This program was extremely helpful. It made me realize how uptight I had become and how to deal with it. It also helped me deal with pain." Women also remarked on the value of going through the yoga training in the company of other women who were contending with the unique challenges of MBC, as opposed to a more heterogeneous group: "It was great to be part of a group [that] has the same problems and concerns and we could truly understand one another's feelings." Regarding suggestions for how the yoga training could be improved, several women indicated that it would be helpful if the program could be extended to include ongoing monthly yoga classes, as this would allow them to continue to build on their yoga practice and to share this experience with other women with MBC.

#### Means of Focus Group Anonymous Questionnaire

The means for the five items, all rated on 10-point scales, of the focus group anonymous questionnaire were as follows: how helpful the program was overall, *M* = 9.6 (range, 8–10); how successful the program was in helping cope with feelings of distress, *M* = 9 (range, 7–10); how successful the program was in helping manage pain, *M* = 8 (range, 6–10); how successful the program was in helping manage fatigue, *M* = 7.6 (range,

6–9); and whether they would recommend the program to a friend who has similar concerns *M* = 10 (all scores were 10). Thus, patients' scores indicated that they generally perceived the program as very helpful in addressing the concerns targeted by the intervention.

#### Discussion

This pilot study examined the impact of a novel, yoga-based palliative intervention in a sample of MBC patients. Our findings, though very preliminary, suggest the intervention was helpful in significantly boosting daily invigoration and a sense of acceptance in patients. There were also trends for improvements in pain and relaxation. Moreover, a dose/response relationship was observed between day-to-day variations in patients' length of yoga practice and their daily symptoms and processes. Patients who practiced yoga longer on a given day were much more likely to experience lower pain and greater invigoration and acceptance that same day. Furthermore, patients who practiced longer on a given day were also much more likely to experience lower pain and fatigue and greater invigoration, acceptance, and relaxation on the next day. Although yoga has been used for centuries to treat disease in the East,<sup>20</sup> only recently have researchers begun to demonstrate yoga's effects on patients with cancer<sup>27–29</sup> and various other conditions (e.g., osteoarthritis, low back pain, multiple sclerosis<sup>57–59</sup>). Heretofore, no studies have reported on yoga's effects in MBC patients. This study provides some of the first, tentative evidence for yoga's

potential benefits in this vulnerable population of women with limited life expectancy.

Because of the absence of a control group, it is difficult to directly compare the magnitude of our findings with those of other palliative intervention studies in MBC patients. As noted above, however, significant findings with this population have often consisted of less increase in symptoms in the intervention vs. control conditions rather than actual improvements.<sup>12,14,16,17,19</sup> So, while the absence of a control group does not allow us to test for differential decline in symptoms, the fact that the treatment-related coefficients for daily pain, fatigue, invigoration, acceptance, and relaxation (with the sole exception of daily distress) were in the direction of true improvements has important implications for the potential efficacy of the intervention.

Beyond examining the effects of the yoga-based intervention, this study marks the first time multilevel modeling has been applied to daily-diary outcomes in MBC patients. Importantly, the present multilevel treatment results were obtained by first calculating independent estimates for each participant and then aggregating them to derive reliable results for the average patient—thus avoiding the problem of overlooking the impact of individual differences, as in standard regression approaches. Moreover, the advantages offered by this statistical approach were particularly well suited for the analysis of real-time processes that have strong causal implications. The tangible impact of yoga practice was highlighted by the finding that greater practice on a given day was associated with improvements not only on the same day, but the next day as well. Future studies could profit from using daily data collection to examine more refined hypotheses about changes in patients' symptoms (e.g., would yoga lead to same-day or next-day fatigue becoming more resilient to the negative impact of a chemotherapy session<sup>60</sup>).

Attrition in this study was similar to previous palliative trials for MBC.<sup>9,14,16,19</sup> Analyses showed that completers tended to be patients who were experiencing higher levels of fatigue and other outcomes—presumably because these women were more highly motivated by the possibility of ameliorating their symptoms. In contrast, in the only previous psychosocial intervention study to report on a comparison

of completers and noncompleters, a trial of cognitive-behavioral group therapy, Edelman et al. found the opposite: the noncompleters tended to be patients with greater symptom levels (e.g., higher anxiety, lower vigor).<sup>9</sup>

The Yoga of Awareness intervention we used, which comprehensively integrates a wide spectrum of ancient yoga techniques—postures, breathing exercises, meditation, study of guiding tenets, and group discussions—stands in strong contrast to previous palliative interventions with MBC patients, such as cognitive-behavioral group therapy and supportive-expressive group therapy.<sup>8–17</sup> This intervention also contrasts with some yoga trainings that have been used with cancer patients, which emphasize only one component of the yoga system, that is, the posture exercises that have become widely popularized in Western countries (e.g., Culos-Reed et al.<sup>28</sup>). Notably, however, only a minority of the participants in our study had ever practiced yoga or meditation before, and among this minority, only a few had more than minimal exposure to these methods. Despite this unfamiliarity, our findings clearly demonstrated the feasibility of conducting future studies of the Yoga of Awareness Program with MBC patients. It is important to note that four of the 13 women in our sample experienced new cancer recurrences during the study, and the physical condition of several others was noticeably deteriorating. Nonetheless, no adverse events were related to yoga participation. It is likely that the gentle approach to yoga postures we used, including careful monitoring of teaching methods in weekly treatment team meetings, was vital to making the yoga program safe for these women. In addition, attendance at yoga sessions during the study was good (an average of seven of eight sessions), as was adherence to yoga practice (an average of 21 minutes per day). Further confirmation of the feasibility of offering this program to MBC patients came from the focus group meeting. Along with giving the program high ratings on the anonymous questionnaire, participants' comments confirmed the suitability of the yoga intervention's content and the number and length of yoga sessions. The only drawback patients noted was that the program did not lead to an ongoing opportunity to practice yoga in the company of other women with MBC.



Future studies should consider ways to create a structure for continuing specialized yoga classes past the study termination. Finally, patients' anecdotal reports revealed that the yoga training appeared to be very useful in helping them better adjust to the challenges of living with metastatic disease, including "keeping their balance even when the waves get rough."

Several important limitations of our study should be noted. The generalizability of these preliminary findings is restricted by the very small sample, the absence of a control group, and the lack of follow-up data. To clearly establish the efficacy of the Yoga of Awareness Program, a controlled (e.g., support group control), well-powered trial including follow-up evaluations is needed. Further methodological improvements for such a study could include supplementation of self-report data by other types of measures (e.g., immune response,<sup>61,62</sup> physical fitness<sup>28</sup>), formal analyses of treatment integrity,<sup>63</sup> and analyses of predictors of treatment outcome (e.g., is yoga more helpful for patients with certain characteristics). Future studies can also seek to determine minimum amounts of effective yoga practice, and given the dose/response effect observed, how adherence can be bolstered in those who practice less.

In conclusion, the findings of this pilot study provide promising preliminary support for the palliative health benefits of yoga in MBC patients. The improvements that have been documented, and the potential impact these improvements may have on patients' adjustment during the remaining years of their lives, are important enough to warrant further study.

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