Original Article

Yoga and Meditation for Menopausal Symptoms in Breast Cancer Survivors—A Randomized Controlled Trial

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BACKGROUND: Breast cancer survivors have only very limited treatment options for menopausal symptoms. The objective of this trial was to evaluate the effects of a 12-week traditional Hatha yoga and meditation intervention on menopausal symptoms in breast cancer survivors. **METHODS:** Patients were randomly assigned either to a 12-week yoga and meditation intervention or to usual care. The primary outcome measure was total menopausal symptoms (Menopause Rating Scale [MRS] total score). Secondary outcome measures included MRS subscales, quality of life (Functional Assessment of Cancer Therapy-Breast), fatigue (Functional Assessment of Chronic Illness Therapy-Fatigue), depression, and anxiety (Hospital Anxiety and Depression Scale). Outcomes were assessed at week 12 and week 24 after randomization. **RESULTS:** In total, 40 women (mean age ± standard deviation, 49.2 ± 5.9 years) were randomized to yoga (n = 19) or to usual care (n = 21). Women in the yoga group reported significantly lower total menopausal symptoms compared with the usual care group at week 12 (mean difference, −5.6; 95% confidence interval, −9.2 to −1.9; $P = .004$) and at week 24 (mean difference, −4.5; 95% confidence interval, −8.3 to −0.7; $P = .023$). At week 12, the yoga group reported less somatovegetative, psychological, and urogenital menopausal symptoms; less fatigue; and improved quality of life (all $P < .05$). At week 24, all effects persisted except for psychological menopausal symptoms. Short-term effects on menopausal symptoms remained significant when only women who were receiving antiestrogen medication (n = 36) were analyzed. Six minor adverse events occurred in each group. **CONCLUSIONS:** Yoga combined with meditation can be considered a safe and effective complementary intervention for menopausal symptoms in breast cancer survivors. The effects seem to persist for at least 3 months. ***Cancer*** **2015;121:2175-84.** © *2015 American Cancer Society.*

KEYWORDS: breast neoplasm, meditation, menopause, randomized controlled trial, yoga.

INTRODUCTION

With more than 1.6 million new cases each year, breast cancer is the most frequently diagnosed cancer in women worldwide.[1] Although greater than 520,000 women still die from breast cancer each year,[1] advances in cancer prevention, diagnosis, and treatment have led to a continuous increase in survival rates.[2] In hormone receptor-positive breast cancer survivors, antiestrogen treatment often induces or aggravates menopausal symptoms.[3,4] Because hormone-replacement therapy is normally contraindicated in these women,[5] they only have very limited treatment options for menopausal symptoms, including selective serotonin reuptake inhibitors and selective noradrenaline reuptake inhibitors, for treating hot flashes.[6,7] Lifestyle modifications, mainly regular exercise, also are recommended to improve hot flashes and arthralgia and to reduce the risk of osteoarthritis; the evidence for other lifestyle interventions like relaxation or breathing techniques is promising but is not sufficient to recommend them for use in clinical practice.[6,7]

Although yoga is rooted in Indian philosophy and has been a part of traditional Indian spiritual practice for millennia,[8,9] it has been adapted by Western societies for use in complementary and alternative medicine.[10] In the latter setting, yoga is most often associated with physical postures (*asanas*), breathing techniques (*pranayama*), and meditation (*dhyana*); and different yoga schools have emerged that put various focus on physical and mental practices.[9] Yoga is gaining increased popularity as a therapeutic practice; nearly 14 million Americans (6.1% of the US population) reported that yoga had been recommended to them by a physician or therapist.[11] Indeed, about half of the American yoga practitioners (greater than 13 million individuals) reported starting practice explicitly to improve their health.[12] Prior research has demonstrated positive effects of yoga on health-related quality of life, on physical and mental health in breast cancer

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survivors,[13-17] and on menopausal symptoms in healthy women.[18,19] Menopausal symptoms seem to be associated with changes in the noradrenergic system,[20,21] and there is preliminary evidence that yoga can induce neuroendocrine effects.[22-24] It also has been demonstrated that psychological stress can aggravate menopausal symptoms[25] and that yoga and meditation are effective means to decrease stress.[26,27] Thus, it seems likely that yoga and meditation can positively influence menopausal symptoms. Increased body awareness and coping ability, better symptom acceptance, and a perceived increase in symptom control seem to be further key mechanisms of yoga therapy in improving physical and mental health.[28] Explicitly including meditative practices in yoga interventions seems to be crucial for achieving pronounced effects on psychological symptoms.[29]

The objective of this trial was to evaluate the effects of a 12-week traditional Hatha yoga intervention complemented by Buddhist meditation techniques on menopausal symptoms in breast cancer survivors. We hypothesized that, after 12 weeks of yoga, breast cancer survivors would have lower total menopausal symptoms than after 12 weeks of usual care.

MATERIALS AND METHODS

Design

This was an open-label, randomized controlled clinical trial conducted at a single center: the Department of Gynecology Certified Breast Center at Malteser Hospital St. Anna (Duisburg, Germany). The study was approved by the Ethics Committee of the University of Duisburg-Essen (approval number 13-5421-BO) and registered at clinicaltrials.gov (registration number NCT01908270) before patient recruitment.

Participants

Women were recruited from the Department of Gynecology Certified Breast Center at Malteser Hospital St. Anna. To reduce possible selection bias, women who had been treated in the Breast Center were approached by the study physician rather than using advertisements.

Women were included if they were ages 30 to 65 years; had been treated for histologically confirmed, nonmetastatic breast cancer (International Union Against Cancer stages I-III); and had completed surgical (breast-conserving surgery, mastectomy, simultaneous breast reconstruction), Radiotherapeutic, and/or chemotherapeutic treatment. Women had to suffer from at least mild menopausal symptoms, reflected by a value of at least 5 points on the Menopause Rating Scale (MRS).[30]

Exclusion criteria included physical disability precluding even light yoga practice, regular yoga practice within the prior 12 months, diagnosed and pharmacologically treated psychosis, current participation in another clinical trial or planned during the next 24 weeks, surgical interventions during the prior 3 months or planned during the next 24 weeks, and hormone-replacement therapy within the prior 3 months or planned during the next 24 weeks. Antiestrogen medication, nonhormonal treatment of their menopausal symptoms, and antidepressant medication did not preclude study participation as long as the women were stabilized on a fixed dose for at least 4 weeks and no change in dose was anticipated in the next 24 weeks.

Randomization

Patients were randomly allocated either to yoga and meditation or to usual care by block randomization with randomly varying block lengths, which were stratified by the intake of antiestrogen medication during the study period (2 strata: no intake and intake). The randomization list was created by a biometrician who was not involved in patient recruitment or assessment using the Random Allocation Software.[31] The randomization list was password-secured, and no individual other than the biometrician was able to access it. On this basis, he prepared sealed, sequentially numbered envelopes containing the treatment assignments. After obtaining written informed consent and baseline assessment, the study physician opened the lowest numbered envelope to reveal that patient's assignment.

Interventions

Yoga and meditation

The yoga group participated in weekly, 90-minute, traditional Hatha yoga based on the teachings of Sivananda Saraswati, over a period of 12 weeks.[32] The yoga teachings were complemented by meditation practices derived from the Karma Kagyu school of Tibetan Buddhism according to Lama Ole Nydahl.[33] Classes were led by a single, certified Hatha yoga instructor with longstanding experience in yoga teaching who also was a direct student of Lama Ole Nydahl. Each class started with the corpse pose, lying supine during a guided relaxation, followed by breathing techniques and a series of sun salutations, a common sequence of yoga postures. Then, several yoga postures and/or meditation practices were performed. A complete list of postures, breathing, and meditation practices is provided in Table 1. Not all practices were included in each class. The yoga practices were adapted to the individual

TABLE 1. List of Yoga Postures, Breathing Techniques, and Meditation Techniques (in Alphabetical Order)

Yoga Postures (Asana)	Breathing Techniques (Pranayama)	Meditation Techniques (Dhyana)
Child pose (Balasana)[a]	Alternate Nostril Breathing (Anuloma viloma)[a]	Body scan[b]
Cobra pose (Bhujangasana)[a]	Diaphragmatic breathing[a]	Calm abiding meditation (Shine)[b]
Corpse pose (Shavasana)[a]	Kapalabhati[a]	Mantra meditation[a,b]
Crocodile pose (Makarasana)[a]	Vase breathing[b]	White Tara meditation[b]
Fish pose (Matsyasana)[a]		
Forward bend (Paschimothanasana)[a]		
Half bridge pose (Setu Bandhasana)[a]		
Half twist pose (Ardha Matsyendrasana)[a]		
Shoulder stand (Sarvangasana)[a]		
Staff pose (Dandasana)[a]		
Sun salutation (Surya Namaskara)[a]		

[a] These are derived from traditional Hatha yoga.
[b] These are derived from Buddhist meditation.

patient's needs and possibilities. Each class ended with another guided relaxation in the corpse pose. Classes were complemented by about 5 to 10 minutes of lectures on yoga (yogic theories on physiologic and psychological effects of postures, breathing techniques, and meditation and on the nature of the mind) and/or Buddhist philosophy (Buddhist theories on cause and effect and on negative emotions). Each class built upon the previous classes.

Women were encouraged to practice yoga and meditation daily at home, although no minimal practice time was required. Before home practice, practices were introduced in class. The women indicated their daily home practice time (minutes) in a daily log.

Usual care

Women in the usual care group were wait-listed and did not participate in any study intervention for the first 24 weeks of the trial. At week 24, they were offered the same yoga classes as the yoga group.

Outcome Measures

All outcome measures were applied at weeks 1, 12, and 24. Menopausal symptoms were assessed as total symptoms, somatovegetative symptoms, psychological symptoms, and urogenital symptoms using the MRS,[30,34] with higher scores indicating more severe menopausal symptoms. Total menopausal symptoms on the MRS at week 12 were defined as the primary outcome measure.

Along with menopausal symptoms, breast cancer-specific quality of life was assessed using the Functional Assessment of Cancer Therapy-Breast (FACT-B). Quality of life was calculated as the FACT-B total score as well as scores on the 5 subscales (physical, social, emotional, and functional well being and breast cancer-specific concerns),[35] with higher scores indicating better quality of life.

Fatigue was assessed using the Functional Assessment of Chronic Illness Therapy-Fatigue, in which higher scores indicate lower fatigue.[36] Psychological distress was measured using the Hospital Anxiety and Depression Scale to measure the 2 dimensions anxiety and depression, in which higher values indicate higher distress, and values >8 indicate potential subclinical anxiety or depressive disorders.[37] Global improvement was assessed at week 12 by a self-report on a 5-point numerical rating scale ranging from 1 ("very much worsened") to 5 ("very much improved").[38]

All adverse events that occurred during the study period were recorded. Patients who experienced such adverse events were asked to visit the study physician to assess their import and initiate any necessary response. Open-ended questions were used at week 12 and week 24 to assess any adverse events not previously mentioned. Participants were required to indicate any adverse events during the study period regardless of their potential relation to the study intervention.

Sample Size Calculation and Statistical Analysis

The required sample size was calculated a priori. A group difference of 7 points on the MRS total score has been recommended as a cutoff value to assess the efficacy of a treatment for menopausal symptoms compared with no specific treatment.[39] On the basis of the European validation sample, a standard deviation of 7.1 was assumed.[40] In this case, a 2-sided, level 5% t test requires a total of 36 participants to detect a 7-point difference between groups with a statistical power of 80%. Accounting for a potential

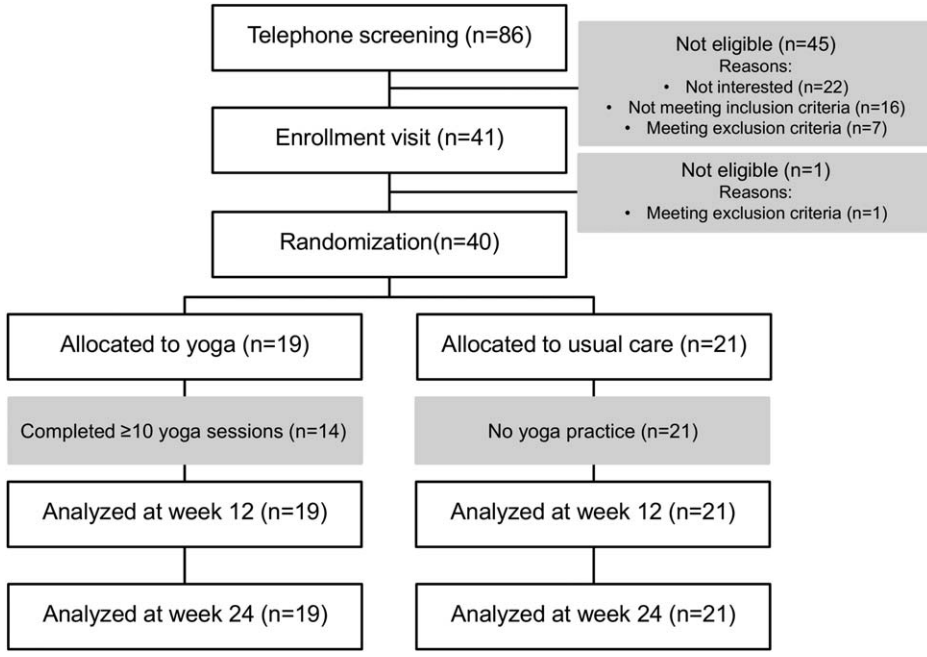

Figure 1. This is the participant flow diagram for the current study cohort.

loss of power because of a maximum of 10% dropouts, it was planned to include 40 participants in this trial.

Baseline group differences were analyzed using Student *t* tests for continuous data and chi-square tests for categorical data. Primary analyses were based on an intent-to-treat basis and included all patients who were randomized, regardless of whether or not they adhered to the study protocol. Because all participants provided a full set of data at all 3 assessment time points, no imputation was needed. Menopausal symptoms, assessed as the MRS total score at week 12, were defined as the primary outcome measure and were analyzed using a univariate analysis of covariance, which modeled the outcome at week 12 as a function of treatment group (classified factor) and the respective baseline value (linear covariate). All other outcomes were defined as secondary outcomes and were analyzed exploratively only using comparable models. This way, no α-level adjustment was necessary to maintain the overall Type I error rate of 5%.[41,42] Clinical relevance of the findings was assessed by comparing the number of participants who reached a clinical relevant reduction of at least 7 points in the MRS total score[39] between groups at weeks 12 and 24 using chi-square tests. Group differences in global improvement were assessed using the Mann-Whitney *U* test.

In addition, all women in the yoga group who attended at least 10 of 12 yoga classes and all women in the usual care group who did not practice yoga during the course of the study were included in a per-protocol analysis. In an a priori planned subgroup analysis, group differences in menopausal symptoms (MRS total score and subscale scores) were analyzed separately in the subsample of women who were receiving antiestrogen medication. All analyses were performed using the Statistical Package for Social Sciences software (IBM SPSS Statistics for Windows, release 22.0; IBM Corporation, Armonk, NY).

RESULTS

Patients

In total, 86 women were approached, and 45 of them were excluded after telephone screening because of lack of interest or inability to meet the inclusion criteria (Fig. 1). One other woman had to be excluded because she suffered from Meniere disease, which precluded yoga practice. In total, 40 women fulfilled all inclusion criteria and were enrolled after providing informed consent. All included participants completed all 3 assessments and provided full data sets (Fig. 1). There were no missing data.

Participants' characteristics are provided in Table 2. The mean age (± standard deviation age) was 49.2 ± 5.9 years, and the women reported an average of 28.1 ± 18.3 months since their surgery. Most women were currently

TABLE 2. Baseline Sociodemographic and Clinical Characteristics

Characteristic	No. of Women (%)			*P*
	Total, n = 40	Yoga, n = 19	Usual Care, n = 21	
Sociodemographic characteristic				
Age: Mean ± SD, y	49.2 ± 5.9	48.3 ± 4.8	50.0 ± 6.7	.356
Height: Mean ± SD, cm	170.1 ± 6.3	169.9 ± 7.3	170.2 ± 5.4	.884
Weight: Mean ± SD, kg	72.2 ± 14.8	69.8 ± 11.9	74.3 ± 17.0	.341
Marital status				.164
Married	30 (75)	13 (68.4)	17 (81)	
Living together	6 (15)	2 (10.5)	4 (19)	
Single	1 (2.5)	1 (5.3)	0 (0)	
Divorced	3 (7.5)	3 (15.8)	0 (0)	
No. of children: Mean ± SD	1.4 ± 1.1	1.6 ± 0.9	1.1 ± 1.2	.740
Education				.256
No qualification	1 (2.5)	1 (5.3)	0 (0)	
Secondary modern school: "Hauptschule" qualification	4 (10)	1 (5.3)	3 (14.3)	
High school: "Realschule" qualification	11 (27.5)	3 (15.8)	8 (38.1)	
A level: "Abitur"	11 (27.5)	8 (42.1)	3 (14.3)	
University degree	11 (27.5)	5 (26.3)	6 (28.6)	
Other	2 (5)	1 (5.3)	1 (4.8)	
Employment				.194
Full time	12 (30)	6 (31.6)	6 (28.6)	
Part time	15 (37.5)	10 (52.6)	5 (23.8)	
Home keeper	5 (12.5)	1 (5.3)	4 (19)	
Retired	1 (2.5)	0 (0)	1 (4.8)	
Disabled	4 (10)	2 (10.5)	2 (9.5)	
Unemployed	3 (7.5)	0 (0)	3 (14.3)	
Clinical characteristics				
Cancer stage				.422
I	23 (57.5)	11 (57.9)	12 (57.1)	
II	14 (35)	7 (36.8)	7 (33.3)	
III	3 (7.5)	1 (5.3)	2 (9.5)	
Time since diagnosis: Mean ± SD, mo	30.3 ± 17.2	26.7 ± 14.0	33.6 ± 19.4	.207
Time since surgery: Mean ± SD, mo	28.1 ± 18.3	24.6 ± 15.1	31.2 ± 20.7	.260
Current antihormonal therapy				1.000
Yes	36 (90)	17 (89.5)	19 (90.5)	
No	4 (10)	2 (10.5)	2 (9.5)	
Prior chemotherapy				.727
Yes	29 (72.5)	13 (68.4)	16 (76.2)	
No	11 (27.5)	6 (31.6)	5 (23.8)	
Prior radiotherapy				1.000
Yes	36 (90)	17 (89.5)	19 (90.5)	
No	4 (10)	2 (10.5)	2 (9.5)	

Abbreviation: SD, standard deviation.

receiving antiestrogen medication (90%). No participant used any nonhormonal treatment for her menopausal symptoms or was receiving antidepressant medication. There were no significant baseline differences between groups. Women in the yoga group attended a mean of 9.7 ± 2.3 (80.8%) yoga classes (range, 3-12 classes), and 14 women attended ≥10 yoga classes. Women in the yoga group practiced at home for 35.3 ± 27.9 minutes per week.

Intention-to-Treat Analysis

At week 12 and week 24, total menopausal symptoms were lower in the yoga group compared with the usual care group (week 12: $P = .004$ [primary outcome measure]; week 24: $P = .023$) (Table 3). At week 12, 9 women (47.4%) in the yoga group obtained a reduction of at least 7 points on the MRS total score compared with only 2 women (9.5%) in the usual care group ($P = .012$). At week 24, 8 women (42.1%) in the yoga group and 5 women (23.8%) in the usual care group obtained a reduction of at least 7 points on the MRS total score ($P = .31$). At week 12, additional, significant group differences were observed for all MRS subscales ($P = .004$-$.035$) (Table 3). At week 24, group differences were significant for somatovegetative symptoms ($P = .028$) and urogenital symptoms ($P = .025$). Regarding quality of life, significant group differences were observed at week 12 for the FACT-B total score ($P = .002$) and for the social ($P = .024$), emotional ($P = .005$), and functional well being subscales ($P = .024$) and at week 24 for the FACT-B total score

TABLE 3. Effects of Yoga and Usual Care on Menopausal Symptoms, Health-Related Quality of Life, and Mental Health

	Effect: Mean ± SD									
	Yoga, n = 19			Usual Care, n = 21			Week 12		Week 24	
Variable	Week 1	Week 12	Week 24	Week 1	Week 12	Week 24	Group Difference (95% CI)	*P*	Group Difference (95% CI)	*P*
MRS										
Somatovegetative	9.0 ± 3.2	5.8 ± 3.6	4.2 ± 3.0	8.6 ± 2.7	7.4 ± 2.9	6.7 ± 3.9	−1.8 (−3.5, −0.14)	.035	−1.9 (−3.6, −0.22)	.028
Psychological	5.7 ± 3.6	3.5 ± 2.8	4.2 ± 3.0	7.4 ± 3.7	7.1 ± 4.4	6.7 ± 3.9	−2.4 (−4.2, −0.5)	.012	−1.35 (−3.1, 0.4)	.13
Urogenital	3.8 ± 2.7	2.3 ± 2.4	2.9 ± 2.3	4.6 ± 3.3	4.2 ± 2.8	4.8 ± 3.0	−1.5 (−2.7, 0.2)	.025	−1.3 (−2.5, −0.18)	.025
Total	18.5 ± 8	11.6 ± 7.2	13.0 ± 7.3	20.7 ± 6.6	18.7 ± 8.0	19.0 ± 8.2	−5.6 (−9.2, −1.9)	.004	−4.5 (−8.3, −0.7)	.023
FACT-B										
Physical	20.7 ± 5.8	23.9 ± 5.3	23.8 ± 4.7	20.7 ± 3.9	21.9 ± 4.3	20.2 ± 4.5	2.0 (−0.8, 4.7)	.158	3.6 (0.9-6.3)	.010
Social	22.2 ± 4.8	22.2 ± 4.9	22.4 ± 4.2	22.8 ± 3.0	20.3 ± 4.7	20.2 ± 4.4	2.4 (0.3-4.5)	.024	2.6 (0.5-4.7)	.016
Emotional	17.6 ± 4.8	20.3 ± 3.9	20.4 ± 3.5	17.4 ± 4.2	17.3 ± 3.7	18.7 ± 3.4	2.8 (0.9-4.7)	.005	1.6 (0.1-3.1)	.036
Functional	18.5 ± 4.4	20.7 ± 5.6	20.9 ± 5.3	19.4 ± 4.2	18.1 ± 5.0	19.1 ± 4.4	3.3 (0.5-6.0)	.024	2.4 (−0.1, 5.0)	.061
Breast cancer-specific	23.8 ± 5.8	26.6 ± 5.7	26.2 ± 5.8	23.8 ± 4.5	24.4 ± 4.7	23.8 ± 5.7	2.1 (0.2-4.5)	.074	2.3 (−0.2, 4.8)	.066
Total	102.9 ± 20.2	113.7 ± 20.5	113.8 ± 19.5	104.0 ± 12.3	102.1 ± 14.8	102.0 ± 16.1	12.5 (4.8-20.2)	.002	12.6 (4.2-21.1)	.004
FACIT-F										
Fatigue	36.4 ± 11.9	42.8 ± 11.1	41.7 ± 10.8	36.7 ± 7.9	37.0 ± 8.7	34.7 ± 11.7	6.0 (1.6-10.5)	.010	7.3 (1.7-12.9)	.012
HADS										
Anxiety	11.2 ± 2.5	11.4 ± 1.9	11.6 ± 1.8	10.8 ± 1.9	11.2 ± 1.8	10.8 ± 2.2	−0.13 (−1.0, 0.8)	.772	0.6 (−0.5, 1.7)	.267
Depression	8.8 ± 2.0	8.5 ± 1.5	9.0 ± 1.6	8.4 ± 1.7	8.8 ± 2.4	8.6 ± 2.1	−0.7 (−1.7, 0.3)	.182	0.1 (−0.8, 1.0)	.870

Abbreviations: CI, confidence interval; FACIT-F, Functional Assessment of Chronic Illness Therapy-Fatigue; FACT-B, Functional Assessment of Cancer Therapy-Breast; HADS, Hospital Anxiety and Depression Scale; MRS, Menopausal Rating Scale; SD: standard deviation.

($P = .004$) and physical ($P = .010$), social ($P = .016$), and emotional well being subscales ($P = .036$). Significant group differences for fatigue occurred at week 12 ($P = .010$) and at week 24 ($P = .012$). No group differences occurred for anxiety or depression (Table 3). At week 12, 16 women (84.2%) in the yoga group reported global improvement compared with 3 women (14.3%) in the usual care group ($P < .001$) (Table 4).

Per-Protocol Analysis

When only women in the yoga group who attended at least 10 yoga classes (n = 14) and women in the usual care group who did not practice yoga during the course of the study (n = 21) were included, differences between groups for urogenital symptoms ($P = .070$) and emotional well being ($P = .122$) at week 24 were no longer significant, whereas the difference between groups for depression at week 12 reached significance ($P = .039$). No other outcomes substantially changed.

Subgroup Analysis

In the subsample of women who were receiving antiestrogen medication (n = 36), total menopausal symptoms were lower in the yoga group compared with the usual care group at week 12 ($P = .013$), but not at week 24 ($P = .084$) (Fig. 2). At week 12, 7 women (41.2%) in the yoga group obtained a reduction of at least 7 points on the MRS total score compared with only 1 woman (5.3%) in the usual care group ($P = .016$). At week 24, 6 women (35.3%) in the yoga group and 5 women (26.3%) in the usual care group ($P = .41$) obtained a reduction of at least 7 points on the MRS total score. At week 12, significant group differences also were observed for psychological symptoms ($P = .029$) and urogenital symptoms ($P = .030$), but not for somatovegetative symptoms

TABLE 4. Global Improvement at Week 12

	No. of Women (%)[a]	
Week 12 Rating	Yoga, n = 19	Usual Care, n = 21
Much better	6 (31.6)	2 (9.5)
Somewhat better	10 (52.6)	1 (4.8)
About the same	3 (15.8)	13 (61.9)
Somewhat worse	0 (0)	4 (19)
Much worse	0 (0)	1 (4.8)

[a] Overall $P < .001$.

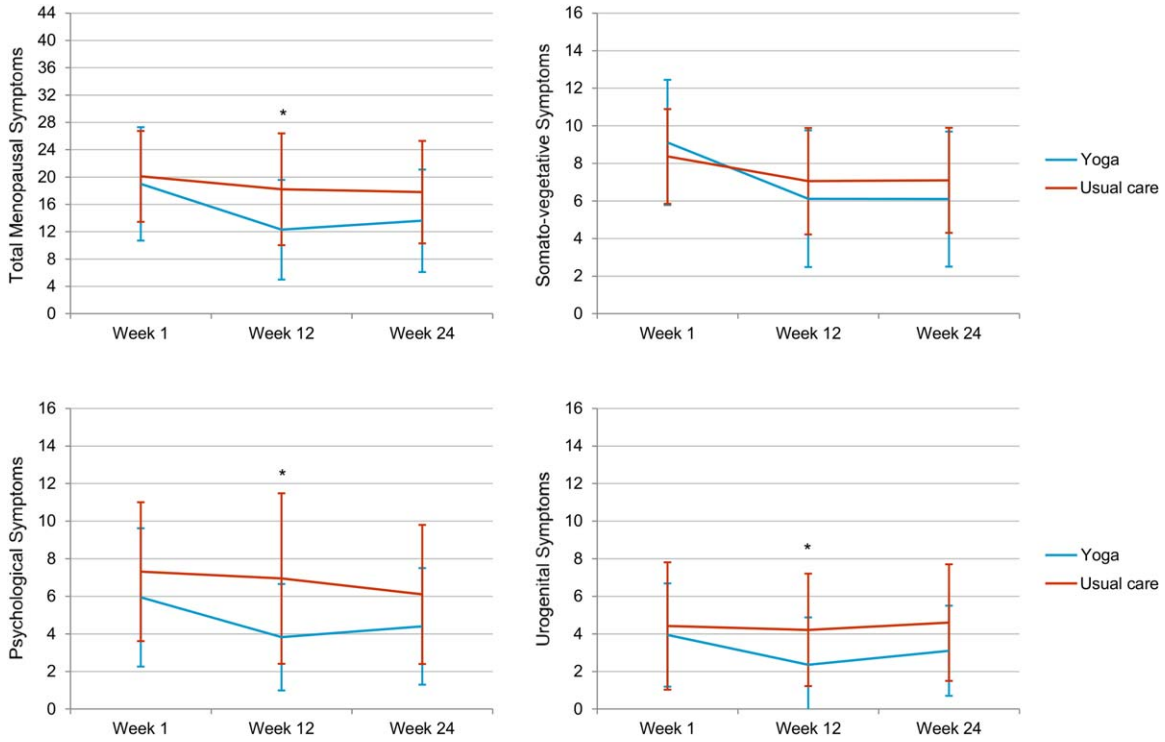

Figure 2. Subgroup analyses are illustrated for the women who received antiestrogen medication. Menopausal symptoms were assessed using the Menopause Rating Scale at weeks 1, 12, and 24. Values are expressed as means ± standard deviations; asterisks indicate significant group differences.

($P = .136$). At week 24, no group differences were observed for any of the MRS subscales in the subgroup analysis ($P = .075$-$.352$) (Fig. 2).

Safety

There were no serious adverse events from week 1 to week 24. Six women (31.5%) in the yoga group reported adverse events. Two adverse events (a panic attack and foot pain) were not temporarily related to yoga practice. The remaining 4 adverse events (transient muscle soreness [n = 3] and unilateral hip pain [n = 1]) were temporarily and probably causally related to the yoga intervention. Six women (28.6%) in the usual care group also reported adverse events, including sciatica (n = 1), port pain (n = 1), elbow pain (n = 1), knee pain (n = 2), and panic attacks (n = 1).

DISCUSSION

In this randomized controlled trial, a 12-week yoga and meditation intervention improved menopausal symptoms in breast cancer survivors immediately after the end of the intervention and at 3-month follow-up. The intervention also improved quality of life and fatigue. Immediate effectiveness also was demonstrated when we limited the analysis to women who were receiving antiestrogen medication. Overall, adherence to the intervention protocol was acceptable, and outcomes in the per-protocol population were not substantially different from those in the intent-to-treat population. No serious adverse events occurred, and minor adverse events were equally balanced between groups.

To the best of our knowledge, only 1 prior randomized trial has investigated the efficacy of yoga on menopausal symptoms in breast cancer patients.[43] Although that pilot trial demonstrated effects of yoga on menopausal symptoms and fatigue, the findings can only be considered preliminary because of the lack of an a priori sample size calculation. A major new finding of the current trial is that yoga can reduce menopausal symptoms in women who are receiving antiestrogen medication.

Trials of yoga for menopausal women without a history of breast cancer mainly have demonstrated positive effects on total menopausal symptoms, psychological symptoms, and physical symptoms.[19,44-46] However, meta-analyses have produced no evidence for any effects[47] or only limited evidence for small effects on psychological symptoms.[18] Along with the population of breast cancer survivors who normally suffer from stronger menopausal symptoms than postmenopausal and otherwise healthy women, a major difference between those earlier trials and the current study is the inclusion of Buddhist meditation as an important part of the intervention. A recent trial on mindfulness-based stress reduction, a psychosocial intervention deriving from Buddhist meditation, reported effects of the intervention compared with no treatment on somatovegetative menopausal symptoms immediately after the end of the intervention and at 3-month follow-up.[48]

In contrast to earlier findings on yoga for women with breast cancer,[49-52] no effects on psychological health were observed, although the women presented with elevated levels of anxiety and depression at the beginning of the study. A recent meta-analysis reported large effects of yoga interventions on anxiety and depression in women diagnosed with breast cancer. These effects, however, were limited to studies on women currently receiving radiotherapy or chemotherapy.[13] Apparently, the effects of yoga on psychological health are limited in women who have completed curative breast cancer treatment.

Regarding potential mechanisms, it is widely accepted that therapeutic exercise programs for breast cancer survivors can significantly improve physical functioning and quality of life and can mitigate fatigue.[53,54] Physical exercise reduces the blood insulin level,[55] strengthens the immune system, and promotes the catabolism of stress hormones and estrogens.[56] Furthermore, exercising together in a group of similarly affected women may enhance the individual's quality of life.[57] Although yoga involves physical activity, it differs from purely gymnastic exercise in that the practitioner focuses her mind on her body with inner awareness and a meditative focus of mind.[28,58] In menopausal women, it has been demonstrated that negative body image and low self-esteem are associated with more severe menopausal symptoms.[59] Because it has been demonstrated that yoga positively influences both body image[28,60] and self-esteem,[61] this may present a further mechanism by which yoga can alleviate menopausal symptoms.

Strengths of this study include the randomized study design, the completeness of data with no loss of participants during the study and no missing data, and the a priori sample size calculation. Although not all included women were receiving antiestrogen medication, there were still 36 women in this subgroup. Because the required sample size was 36 women, we still can assume that the subgroup analysis was adequately powered.

There are several limitations in this study. First, the usual care group was not controlled for nonspecific effects of the intervention, and participants were not blinded to the allocated intervention. Future studies should use an attention control group that controls for nonspecific

effects by, eg, applying educational classes with the same duration and attention from therapists as the yoga intervention. Second, there was no follow-up beyond 24 weeks. Third, as with all behavioral interventions, possible selection bias cannot be ruled out, because the women who choose to participate may not be completely representative of the underlying population. However, of the potentially eligible women who were approached by the study physician in the current study, only 22 of 86 women were not interested in participating.

In conclusion, yoga combined with meditation appears to be a promising intervention to relieve menopausal symptoms in breast cancer survivors for at least 3 months after the end of the intervention. For women who are receiving antiestrogen medication, the intervention seems to induce at least short-lasting effects.

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