Research Article

Iyengar-Yoga Compared to Exercise as a Therapeutic Intervention during (Neo)adjuvant Therapy in Women with Stage I–III Breast Cancer: Health-Related Quality of Life, Mindfulness, Spirituality, Life Satisfaction, and Cancer-Related Fatigue

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Received 3 December 2015; Accepted 28 January 2016

Academic Editor: Arroyo-Morales Manuel

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This study aims to test the effects of yoga on health-related quality of life, life satisfaction, cancer-related fatigue, mindfulness, and spirituality compared to conventional therapeutic exercises during (neo)adjuvant cytotoxic and endocrine therapy in women with breast cancer. In a randomized controlled trial 92 women with breast cancer undergoing oncological treatment were randomly enrolled for a yoga intervention (YI) (n = 45) or for a physical exercise intervention (PEI) (n = 47). Measurements were obtained before (t0) and after the intervention (t1) as well as 3 months after finishing intervention (t2) using standardized questionnaires. Life satisfaction and fatigue improved under PEI (p < 0.05) but not under YI (t0 to t2). Regarding quality of life (EORTC QLQ-C30) a direct effect (t0 to t1; p < 0.001) of YI was found on role and emotional functioning, while under PEI only emotional functioning improved. Significant improvements (p < 0.001) were observed at both t1 and t2 also for symptom scales in both groups: dyspnea, appetite loss, constipation, and diarrhea. There was no significant difference between therapies for none of the analyzed variables neither for t1 nor for t2. During chemotherapy, yoga was not seen as more helpful than conventional therapeutic exercises. This does not argue against its use in the recovery phase.

1. Background

The International Agency for Research on Cancer reported about “4.1 million new cancer cases […] in 2012 worldwide” [1]. The second most common form of cancer in the world is breast cancer. Operative interventions, adjuvant and neoadjuvant chemotherapy, radiotherapy, and endocrine therapy are the most common therapies for cancer in conventional medicine [2, 3]. However, cancer therapy has several attendant symptoms during and after therapy (e.g., a reduced physical fitness, fatigue, depression, and anxiety) [2, 4, 5]. In response to cancer therapy, a decrease in quality of life (QOL) is seen quite often. To reduce cancer therapies’ side effects, the use of physical exercises is part of the treatment concept [6, 7]. Because of the complexity of attendant symptoms in cancer therapy, complementary approaches gain importance. Therapies referring to Mind-Body-Medicine (MBM) consider the whole person with all of his or her needs [4]. Most MBM interventions consider also patients’ spirituality as relevant for disease management [4]. Spirituality may give an impulse for life reflection, or/and have positive impact on finding a meaning in life and/or for a reorientation in life
Yoga is among the most studied interventions of MBM and is assumed to “involve the union between mind, body, and spirit” (p. 2) [4]. The development of yoga began in the Indian culture [10]. Usually it is a combination of stretching exercises and various poses with a particular relevance of breathing and meditation [11].

The relevance of yoga in the scientific world was growing in the past years that is shown by the increase of scientific publications [10]. Previous research showed that yoga may have physiological as well as psychological effects for practitioners in a therapeutic context [11–13]. Different studies and systematic reviews confirm yoga’s beneficial effects, for example, on fatigue, vigor, cortisol levels, emotional well-being, and QOL in breast cancer patients [14–19]. Yet, most studies were performed with cancer patients after their conventional anticancer treatment and compared yoga with passive control groups.

We thus aimed to test whether yoga has a more comprehensive effect on health-related QOL (HRQOL) issues, life satisfaction, cancer-related fatigue, mindfulness, and spirituality on patients with breast cancer during their therapy than conventional therapeutic exercises. This study uses an active control group to assess the unique contribution of yoga compared to other exercise interventions.

2. Methods

2.1. Patient Recruitment/Sample Size Calculation. In this anonym prospective, randomized trial data of breast cancer patients undergoing oncological treatment at the moment of intervention were analyzed.

Preliminary results in patients with shorter than 12 months of yoga practice found an Inner Congruence with Practices (ICPH) score of 64.9±19.0 and 77.9±12.6 in patients with 1–5 years of practice. Based on a statistical power of \( 1 - \beta = 0.8 \), a two-sided level of significance of \( \alpha = 0.05 \), a conservative approximation of a minimal relevant difference of \( \Delta_0 = 10 \), and a pooled standard deviation of \( s = 16 \), a sample size of \( n_1 = n_2 = 42 \) was obtained. With an assumed dropout rate of 20% a total sample size of \( n = 102 \) (51 per group) seemed reasonable. Taking into account the short period of the intervention a sample size between \( n = 114 \) and \( n = 120 \) was finally considered as necessary to obtain the calculated sample size of 84 included patients.

After closing the database, 119 patients were included in the trial. Among them, 92 patients finished intervention so that their datasets were suited for statistical analysis. Patients were recruited from May 2011 to October 2014 in the Interdisciplinary Breast Center at the Klinikum rechts der Isar, Technical University of Munich (\( n = 102 \)), and in a gynaecological practice at Praxis Gynaäkologie Arabella, Munich (\( n = 17 \)).

Inclusion criteria were

(i) woman with stage I–III breast cancer,
(ii) undergoing cytotoxic (neo)adjuvant or endocrine adjuvant therapy,
(iii) signed informed consent.

Exclusion criteria were

(i) acute febrile or psychiatric diseases,
(ii) regular practice of yoga or experience in practicing yoga.

Participants were randomized to one of the two intervention groups.

2.2. Intervention. Participants of the yoga intervention (YI) group received weekly a 60-minute session of regenerative Iyengar-Yoga over a period of 12 weeks at the intervention center “Yoga München GbR” in Munich. Iyengar-Yoga is a form of Hatha yoga developed by the Indian yoga teacher Iyengar (1980–2014). It refers to the traditional elements of yoga such as the positions (asanas) and breath control (pranayama) but is unique because of the use of “probs” (i.e., belts, blocks, ropes, and blankets) to help the practitioners to perform and keep the respective positions [20]. This makes it useful particularly for (weak) cancer patients as it uses in the beginning simple poses and thus minimizes exertions and decreases the risk of injury.

The comparison group received conventional physical exercise intervention (PEI) which consists of a 60-minute physical exercise session per week over a period of 12 weeks at the intervention center “Gesund. Reha rechts der Isar GmbH” in Munich.

Both groups were encouraged to perform home-based practices (YI and PEI) twice a week for 20 minutes supported by written instructions. All patients filled an exercise protocol for their own practice at home.

The study was approved in 2011 by the IRB of the Technical University of Munich (#3069/II).

2.3. Outcome Measures. Measurements were obtained before \( t_0 \) and after the 12-week intervention period \( t_1 \) as well as 3 months after finishing interventions \( t_2 \) using standardized questionnaires. In several cases, the intervention periods were longer as planned (due to cancer treatment regimens) and thus the 12 interventions refer to the respective individual time frame. Demographic information was obtained at baseline.

The following instruments were used.

Health-Related Quality of Life. To measure cancer patients’ HRQOL, the cancer-specific EORTC QLQ-C30 (version 3.0) questionnaire was used. It consists of functional scales, symptom scales, a scale on the global health status, and single items according to cancer-related symptoms. Functional scales address physical functioning (i.e., strenuous activities, self-care, and long/short walk), role functioning (i.e., limited in work, limited in leisure), emotional functioning (i.e., depression, worry, tension, and irritability), cognitive functioning (i.e., concentration, memory trouble), and social functioning (i.e., family life, social activities). The symptom scales address nausea and vomiting, pain, dyspnea, sleep disturbance, appetite loss, constipation, diarrhea, and fatigue [21–23].
It uses a four-point Likert scale except the scales physical and role functioning with dichotomous response choices and the scale concerning the global health status/quality of life scale on a seven-point scale [22]. For an easier interpretation the scales are converted and range from 0 to 100 [22, 33]. The symptoms scales are originally formulated negatively, but in order to better interpret the scores within the course of time, they were inverted as suggested by the EORTC Guideline [34]. Only the symptoms “fatigue” and “nausea and vomiting” were not inverted and in this case the greater the score, the higher the symptom.

**Life Satisfaction.** To measure life satisfaction, the Brief Multidimensional Life Satisfaction Scale (BMLSS) was applied. It has good internal consistency (Cronbach’s alpha = .87) [25] and uses eight items addressing intrinsic, social, external, and perspective dimensions and three additional items on the health situation, abilities to deal with daily life activities, and the treatment success. Participants responded on a seven-point scale from dissatisfaction to satisfaction [25]. The BMLSS scores were referred to a 100% level (“delighted”).

**Fatigue.** Apart from EORTC QLQ-C30’s fatigue symptom scale, we also used the 15-item Cancer Fatigue Scale (CFS-D) [35]. It has a very good reliability coefficient (alpha = .94) and differentiates three dimensions, that is, affective, cognitive, and physical fatigue [26].

The instrument uses a five-point Likert scale with a range from 0 (not at all) to 4 (extraordinary).

**Mindfulness.** To quantify mindfulness, we used the 14-item Freiburg Mindfulness Inventory (FMI) (Freiburger Achtsamkeits-Inventar) with good internal consistency (Cronbach’s alpha = .86) [36]. Descriptive statements are, for example, “I am open to the experience of the present moment,” “I sense my body, whether eating, cooking, cleaning, or talking,” and “I see my mistakes and difficulties without judging them” [36]. The scales have one common factor and correlated strongly with a person’s self-awareness. Nevertheless, it covers the topics of acceptance (related to the nonjudgmental acceptance of the situation) and presence (related to the experience of the moment and a cognitive reflection of all actions). Response categories are rarely, occasionally, fairly often, and almost always [36, 37].

**Spiritual Attitudes and Coping with Illness.** To investigate whether or not patients rely on spirituality as a resource to cope with illness, we used the SprEUK questionnaire [29]. In its 15-item version it differentiates search for support/access to spirituality/religiosity, trust in higher guidance/source, and reflection: positive interpretation of disease [30]. The search scales deal with patients’ intention to find or have access to a spiritual/religious resource which may be beneficial to cope with illness and interest in spiritual/religious issues (insight and renewed interest). The trust scale is a measure of intrinsic religiosity dealing with patients’ conviction to be connected with a higher source which carries through and to be sheltered and guided by this source, whatever may happen. The reflection (positive interpretation of disease) scale deals with cognitive reappraisal because of illness and subsequent attempts to change (i.e., reflecting on what is essential in life, hint to change life, chance for development, illness that has meaning, etc.). The internal consistency coefficients (Cronbach’s alpha) of the three subscales range from .86 to .91 [30].

Items were scored on a five-point Likert scale ranging from disagreement to agreement.

### 2.4. Statistical Analysis

All data analyses were performed with SPSS 22.0.

To test whether the two groups differ at baseline in terms of the sociodemographic data and the outcomes of interest, Pearson’s Chi² test was used for categorical variables and for continuous variables either the t-test for normal distributed data or the Mann-Whitney test for nonnormal distributed data, respectively.

To compare data during the course of time (t₀, t₁, and t₂), the ANOVA for repeated measures was used when the data assumed normality. The nonparametric test of Friedman was used when no normality on the data was observed.

The nonparametrical test of Kruskal Wallis was used as a nonparametrical ANOVA. A nonparametrical measure of concordance between the time points was also reported to better understand the relationship between these measurements and also to not rely only on p values. Kendall’s coefficient of concordance "W" gives the proportion of agreement in the ranking of responses between measurements. Here, W = 0 means no agreement, indicating that ranks are completely random, whereas W = 1 indicates complete consistency between measurements. Thus, W gives a scaled measure of the effect size of consistency in ranks between measurements [40]; higher W values indicate stronger concordance.

To handle missing data, the multiple imputation MI method was used [41]. Although the last observation carried forward (LOCF) method is often applied for clinical studies, the National Research Council advised in 2010 [33] not to use this method because it leads to biased estimates. In our study, almost 55% of the t₂ data are missing, and therefore all statistical analyses were performed on an intention-to-treat basis.

The significance level considered in the analysis was 5%, α = 0.05 when the data without repeated measures was used, and after a Bonferroni correction for repeated measures (using three time measurements) the significance level was set at α = 0.017, when using only two time measurements α = 0.025.

For this analysis, the main outcome variable was patients’ HRQOL (EORTC QLQ-C30).

### 3. Results

Patients were randomized to either the YI (n = 45) or the PEI group (n = 47). ’Three patients dropped out at t₁ and finally 54 patients at t₂ (59%). Reasons could not be documented clearly. At t₁, we had data of 43 YI patients (2 dropouts) and 46 from PEI (1 dropout); at t₂ we had data of 16 YI patients (29
Table 1: Sociodemographic data of enrolled patients with breast cancer (baseline data).

| Variables                  | YI  | PEI  | p value  |
|----------------------------|-----|------|----------|
| Intervention               | 45  | 47   |          |
| Age                        | 51.0 ± 11.0 | 51.4 ± 11.1 | 0.882    |
| Family status              |     |      |          |
| Married                    | 23  | 29   |          |
| Living with partner        | 8   | 8    |          |
| Divorced                   | 3   | 3    | 0.531    |
| Single                     | 8   | 3    |          |
| Widowed                    | 3   | 2    |          |
| Education level            |     |      |          |
| Secondary (Hauptschule)    | 0   | 5    |          |
| Junior high school (Realschule) | 14 | 20 | 0.049*   |
| High school (gymnasium)    | 24  | 18   |          |
| Other                      | 6   | 3    |          |
| Therapy                    |     |      |          |
| Neoadjuvant chemotherapy   | 7   | 7    |          |
| Adjuvant chemotherapy      | 19  | 29   |          |
| Endocrine therapy          | 1   | 3    |          |
| Radiation                  | 0   | 1    | 0.120    |
| Endocrine therapy + radiation | 12 | 3   |          |
| Chemotherapy + radiation   | 2   | 2    |          |
| Chemotherapy + radiation + endocrine therapy | 4 | 2 |          |

*Significant at a significance level of 5%.

3.1. Baseline Data. Sociodemographic data of enrolled patients at baseline are displayed in Table 1. A significant difference in the sociodemographic data between groups was found only for the educational level. There were no significant differences between groups for the outcome variables (Table 2). We were unable to get further data on tumor grading, receptor status, and so forth. However, the treatment schemata did not significantly differ between both groups, yet there were somewhat more patients with endocrine therapy in the PEI group and more with chemotherapy and radiation in the YI group.

3.2. Direct Effects of Intervention ($t_0$ to $t_1$)

3.2.1. EORTC’s Functional Scales. PEI patients significantly improved on emotional functioning ($p < 0.001, W = 0.296$), while YI patients improved on role functioning ($p = 0.013, W = 0.139$) and emotional functioning ($p = 0.018, W = 0.093$). There was no significant difference between both groups regarding these scales (Table 3).

Table 2: Significant differences of outcome variables between both groups at baseline.

| Variables                          | YI  | PEI  | p value |
|------------------------------------|-----|------|---------|
| Quality of life: EORTC’s functional scales |     |      |         |
| Global health score                |     |      | 0.917   |
| Physical functioning               |     |      | 0.190   |
| Role functioning                   |     |      | 0.753   |
| Emotional functioning              |     |      | 0.060   |
| Cognitive functioning              |     |      | 0.164   |
| Social functioning                 |     |      | 0.697   |
| Quality of life: EORTC’s symptom scales |     |      |         |
| Nausea and vomiting                |     |      | 0.923   |
| Pain                               |     |      | 0.721   |
| Dyspnea                            |     |      | 0.347   |
| Sleep disturbance                  |     |      | 0.544   |
| Appetite loss                      |     |      | 0.360   |
| Constipation                       |     |      | 0.225   |
| Diarrhea                           |     |      | 0.487   |
| Fatigue                            |     |      | 0.434   |
| Other health-related variables     |     |      |         |
| Cancer-related fatigue (CFS-D)     | 0.141|      |         |
| Life satisfaction (BMLSS)          | 0.480|      |         |
| Spirituality                       |     |      |         |
| Mindfulness (FMI)                  | 0.179|      |         |
| Spiritual search (SpREUK)          | 0.214|      |         |
| Religious trust (SpREUK)           | 0.811|      |         |
| Reflection (SpREUK)                | 0.903|      |         |

*pSignificant at a significance level of 5% (t-test for normally distributed variables was used for CFS-D, FMI, BMLSS, and EORTC’s global health; all other variables were nonnormally distributed and thus the Mann-Whitney test was used).

3.2.2. EORTC’s Symptom Scales. PEI patients improved significantly ($p < 0.001$) on dyspnea ($W = 0.277$), appetite loss ($W = 0.539$), constipation ($W = 0.594$), and diarrhea ($W = 0.893$). Similarly, YI patients improved on dyspnea ($W = 0.517$), appetite loss ($W = 0.679$), constipation ($W = 0.888$), and diarrhea ($W = 0.909$), too. For “fatigue,” “nausea and vomiting,” “pain,” and “sleep disturbance” there were no significant changes over time. There were no significant differences between both intervention groups.

3.2.3. Life Satisfaction. Life satisfaction did not improve in YI ($p = 0.366, W = 0.018$) or in PEI group ($p = 0.366, W = 0.017$). Both did not differ significantly.

3.2.4. Cancer-Related Fatigue. Both interventions did not significantly improve CRF (YI’s $p = 0.763, W = 0.066$; PEI’s $p = 0.180, W = 0.038$). Both groups did not significantly differ.

3.2.5. Spirituality and Mindfulness. For patients in the YI group, neither search, trust, nor mindfulness improved significantly, while reflection did improve ($p = 0.002, W = 0.217$). However, search ($p = 0.009, W = 0.143$) and trust

3.3. Discussion.
Table 3: Mean values for variables per time measurement (ITT dataset).

| Variables                     | t₀ Mean values (±SD) | t₁ Mean values (±SD) | t₂ Mean values (±SD) | p value t₀ to t₁ | p value t₁ to t₂ | p value t₀, t₁, t₂ | YI PEI t₀ to t₁ Mean values (±SD) | YI PEI t₁ to t₂ Mean values (±SD) | YI versus PEI p value |
|-------------------------------|----------------------|----------------------|----------------------|------------------|-----------------|------------------|-------------------------------|-------------------------------|----------------------|
| **Health-related quality of life: EORTC’s functional scales** |                      |                      |                      |                  |                 |                  |                               |                               |                      |
| Global health                | 57.39 (±20.50)        | 60.37 (±17.95)       | 75.00 (±13.05)       | 0.862            | <0.0001         | 0.739            | 56.91 (±22.40)             | 58.33 (±21.13)             | <0.0001             |
| Physical functioning         | 113.33 (±14.87)       | 113.33 (±18.85)      | 114.96 (±12.72)      | 0.182            | 0.767           | 0.612            | 108.00 (±17.79)            | 108.08 (±21.66)           | 0.612                |
| Role functioning             | 82.19 (±23.40)        | 90.00 (±22.01)       | 104.81 (±19.98)      | 0.013            | <0.0001         | 0.106            | 79.62 (±29.27)             | 90.42 (±38.50)             | <0.0001             |
| Emotional functioning        | 92.05 (±23.07)        | 94.25 (±22.24)       | 103.51 (±15.53)      | 0.018            | 0.08            | 0.602            | 83.69 (±25.02)             | 85.17 (±26.42)             | <0.0001             |
| Cognitive functioning        | 108.91 (±21.00)       | 102.22 (±21.78)      | 111.48 (±17.70)      | 0.144            | 0.134           | 0.602            | 100.72 (±26.28)            | 98.22 (±28.28)             | <0.0001             |
| Social functioning           | 89.77 (±26.46)        | 86.66 (±28.99)       | 102.59 (±17.02)      | 0.739            | 0.011           | 0.602            | 91.67 (±28.05)             | 91.84 (±32.20)             | <0.0001             |
| **Health-related quality of life: EORTC’s symptom scales/items** |                      |                      |                      |                  |                 |                  |                               |                               |                      |
| Fatigue**                    | 15.90 (±22.01)        | 18.51 (±26.90)       | 4.19 (±17.12)        | 0.732            | 0.002           | 0.612            | 20.53 (±26.60)             | 17.49 (±30.71)             | 0.906                |
| Nausea and vomiting**        | 18.93 (±21.00)        | 22.88 (±17.28)       | 15.51 (±14.71)       | 0.808            | 0.924           | 0.457            | 20.21 (±23.35)             | 24.11 (±18.32)             | 0.571                |
| Pain                         | 1.85 (±30.31)         | 2.96 (±30.41)        | 4.81 (±20.90)        | 0.853            | 0.036           | 0.795            | 1.14 (±33.48)              | 0.35 (±23.17)              | 0.347                |
| Dyspnea                      | 9.85 (±24.46)         | 34.07 (±28.85)       | 42.22 (±25.02)       | <0.0001          | <0.0001         | 0.433            | 32.62 (±34.39)             | 43.26 (±29.41)             | <0.0001             |
| Sleep disturbance            | 18.18 (±29.16)        | 22.96 (±30.38)       | 24.22 (±32.87)       | 0.480            | 0.030           | 0.943            | 14.18 (±33.86)             | 16.31 (±33.95)             | 0.328                |
| Appetite loss                | −14.39 (±29.11)       | 42.96 (±31.48)       | 57.77 (±16.51)       | <0.0001          | <0.0001         | 0.622            | 47.51 (±30.88)             | 60.99 (±12.66)             | <0.0001             |
| Constipation                 | −18.93 (±20.83)       | 54.07 (±22.79)       | 57.03 (±15.27)       | <0.0001          | <0.0001         | 0.369            | 48.93 (±26.78)             | 59.57 (±15.44)             | <0.0001             |
| Diarrhea                     | −21.21 (±26.01)       | 49.62 (±26.22)       | 57.03 (±16.85)       | <0.0001          | <0.0001         | 0.369            | 52.48 (±23.81)             | 55.31 (±19.99)             | <0.0001             |
| **Other health-related variables** |                      |                      |                      |                  |                 |                  |                               |                               |                      |
| Cancer-related fatigue (CFD) | 19.87 (±18.09)        | 21.04 (±9.91)        | 17.60 (±6.05)        | 0.763            | 0.052           | 0.180            | 23.30 (±10.51)             | 24.32 (±10.63)             | 0.013                |
| Life satisfaction (BMLSS)    | 71.16 (±16.62)        | 72.79 (±15.74)       | 77.63 (±11.13)       | 0.366            | 0.029           | 0.168            | 68.68 (±16.23)             | 69.12 (±13.83)             | 0.431                |
| Mindfulness (FM)             | 1.93 (±0.50)          | 1.96 (±0.50)         | 1.98 (±0.31)         | 0.639            | 0.364           | 0.214            | 1.78 (±0.47)               | 1.80 (±0.45)               | 0.041                |
| Spiritual search (SpREUK)    | 42.20 (±28.66)        | 45.33 (±26.57)       | 41.66 (±18.37)       | 0.250            | 0.541           | 0.011            | 34.68 (±25.28)             | 40.00 (±28.85)             | 0.347                |
| Religious trust (SpREUK)     | 50.69 (±25.78)        | 54.22 (±23.95)       | 55.33 (±19.49)       | 0.040            | 0.246           | 0.376            | 51.81 (±34.45)             | 55.42 (±33.61)             | 0.245                |
| Reflection (SpREUK)          | 62.90 (±26.66)        | 66.22 (±26.88)       | 62.33 (±19.17)       | 0.002            | 0.055           | 0.539            | 64.36 (±22.08)             | 66.38 (±20.34)             | 0.574                |

**Higher scores = higher symptoms.**
(p = 0.024, W = 0.109) significantly improved in PEI. Both groups did not significantly differ for these variables.

3.3. End of Intervention (t₀, t₁ to t₂)

3.3.1. EORTC’s Functional Scales. Statistically significant results were found for most functional scales of the EORTC which indicates the spontaneous recovery of patients’ QOL after chemotherapy/radiation.

Patients of both groups improved significantly on global health, role, and social functioning. Yet, both groups did not significantly differ from each other for these variables (Table 3).

3.3.2. EORTC’s Symptom Scales. YI and PEI patients improved on fatigue, dyspnea, appetite loss, constipation, and diarrhea. For “nausea and vomiting” and “pain” there were no significant changes over time. Both groups did not significantly differ.

3.3.3. Life Satisfaction. Life satisfaction was quite high at baseline for YI patients, and thus no statistical improvement was observed (p = 0.03, W = 0.078), while PEI patients did significantly improve (p < 0.001, W = 0.165). Yet, there were no significant differences between both interventions.

3.3.4. Cancer-Related Fatigue. For YI we observed only a remarkable trend (p = 0.052, W = 0.066), while in PEI group a significant improvement was found (p = 0.013, W = 0.092). There was no significant difference between both groups.

3.3.5. Spirituality and Mindfulness. There were no significant differences between interventions for the SpREUK subscales, but for mindfulness (p = 0.034).

4. Discussion

This study aimed to test the effectiveness of yoga for women with stage I–III breast cancer during (neo)adjuvant cytotoxic and endocrine therapy on HRQOL, life satisfaction, cancer-related fatigue, mindfulness, and spirituality compared to conventional physical exercise.

Analyzing both therapies first separately, we saw no significant differences between YI and PEI regarding life satisfaction, fatigue, and mindfulness for the first comparison (t₀ – t₁) or for the second comparison (t₀ – t₂). Patients in PEI group showed improvements on life satisfaction and on cancer-related fatigue at the second follow-up assessment, but not directly after the intervention. In contrast to our findings, a number of studies reported significant reduction on fatigue after YI in women with breast cancer [14, 15, 34–36]. This might be explained by the fact that the effectiveness of yoga depends on the treatment status (patients within the treatment or cancer survivors) [20].

A possible mechanism by which yoga could have positive effects on different aspects of QOL might be its spiritual aspect [37]. In this study, a significant improvement on patients’ ability to reflect their life concerns was found in the YI group, and, however, an increase on spiritual search and religious trust scores for PEI patients at t₁. Nevertheless, no significant differences between both therapies were found on these dimensions. A small number of previous studies assessed issues of spirituality after a YI in cancer patients. Moadel et al., for example, reported significant improvements on spiritual well-being after a 12-week YI in multiethnic breast cancer patients [38]. In contrast Danhauer et al. found no significant changes for spirituality after 10 weeks of yoga in ovarian or breast cancer patients [34]. Again, these differences might be mainly due to the differences in the phases of observation. Nevertheless, we have no rationale why particularly the patients in the PEI group showed changes in trust and search although these topics are not specifically addressed in the PEI group.

EORTC QLQ-C30’s functioning scales significantly improved only on role and emotional functioning after YI and on emotional functioning in PEI group at t₁. On all other scales, no significant differences were found for the pre- and postmeasures. Comparing these interventions, no statistical difference could be found. Vadiraja et al. also assessed QOL using the EORTC QLQ-C30 questionnaire with focus on the functional scales in breast cancer patients undergoing adjuvant radiotherapy. In contrast to our findings they reported significant effects on emotional and cognitive functioning, but no effects on role functioning [37].

For the symptom scales of the EORTC QLQ-C30, dyspnea, appetite loss, constipation, and diarrhea, there were significant improvements over time for both therapies, at both t₁ and t₂. This is in line with the results of Rao et al. who found reduced symptom distress in (breast) cancer patients after YI [39]. The most common symptoms from chemotherapy, “nausea and vomiting” and “pain,” could not be improved in this study.

The present findings are in line with the results of previous research on QOL in breast cancer patients after YI which also found positive effects on this patient relevant outcome parameter [17, 18]. Levine and Balk summarized in their review on yoga and QOL in breast cancer patients that there are beneficial effects, for example, better coping with side effects, positive effects on emotional and cognitive functioning, reduced anxiety, and depression symptoms. However they emphasized that it remains unclear which mechanisms are responsible for its effectiveness and which components of yoga are the most important ones to increase QOL [40].

Because of the fact that cancer patients often perceive barriers to be physically active [41], it seems necessary to find attractive and effective supportive treatments in the therapy of breast cancer patients to improve HRQOL. In this study, positive results were found between the baseline assessment and the first follow-up assessment after 12 weeks of therapy for relevant outcome parameters; this indicates yoga as an effective intervention under specific conditions. However, the greatest improvements were found between t₁ and t₂ what is not surprising because most of the patients already have completed chemotherapy at that time. A certain proportion of improvements in QOL would thus be explained due to (spontaneous) recovery effects.
We see a need for further research for more specific information on the effects of Y1 during chemotherapy. Stan et al. summarized that because of “the increasing interest in yoga for cancer survivors and medical institutions, it appears that yoga is establishing itself into the mainstream management and treatment of cancer survivors” (p. 11) [4]. But the authors point out that previous studies have to be interpreted with caution because of small sample sizes and study limitations [4]. This study is a further step to close existing research gaps in this area as it was applied during patients’ chemotherapy phase instead of monitoring only the effects in their phases of convalescence.

To integrate yoga as supportive treatment during therapy in women with breast cancer, it will be necessary to spend more research activities on safety aspects [10]. A further challenge to integrate yoga in the therapeutic context and to improve the quality of interventions, standardized and improved curricula for yoga teachers are needed [10].

5. Limitations

Because of the high dropout rate between the first follow-up assessment and $t_2$ and therefore the large number of imputed data pieces, the results on the basis of these data pieces have to be interpreted with caution. The high dropout rate may reflect a low acceptance for supportive interventions during cancer treatment. Possibly an additional intervention during cancer treatment is too exhausting for breast cancer patients.

Another limitation could be that patients did not participate consistently and the sample size was not large enough to compensate for the dropouts. The number of lessons varied from 5 to 12, and the lapse of time, in between the patients performed, varied from 6 weeks to 25 weeks. This variation was not considered in the analysis. Maybe in some cases the frequency of training was just too poor to produce observable effects. Hence further research should also focus on extent and frequency of Y1 to learn more about appropriate training designs for patients undergoing chemotherapy.

6. Conclusion

The findings indicate that yoga may have beneficial effects on QOL issues in women with stage I–III breast cancer during (neo)adjuvant cytotoxic and endocrine therapy. Patients’ life satisfaction and cancer-related fatigue improved in both intervention groups, yet without significant between-group effects. Further studies on the specific effects of yoga during the phases of chemotherapy and radiotherapy are needed. So far, yoga is not better than conventional physical exercises. It might be that yoga styles and their components may vary in their effectiveness on outcomes in breast cancer patients. Thus, future research should therefore examine whether other styles create differing results.

Conflict of Interests

The study was not financed by any organization; the authors did not receive financial support by organizations, companies, and so forth, which could have influenced the interpretation of data.

Authors’ Contribution

Désirée Lötzke performed the literature research and drafted the paper. Daniela Rodrigues Recchia conducted the statistical analysis and contributed to draft of the paper. Florian Wiedemann and Arndt Büßing initiated and oversaw the project and contributed to draft of the paper. Thomas Ostermann contributed to draft of the paper. Johannes Ettl, Daniel Sattler, and Marion Kiechle managed patient recruitment, oversaw the investigation, and contributed to draft of the paper. All authors read and approved the final paper.

Acknowledgments

The authors express their gratitude to the team of the Gynaecological Clinic rechts der Isar, Munich. They especially want to thank Kirsten Große-Lackmann, Andrea Pintac-Pisar, Mirjana Dalic, and Heide Ludwig from the Interdisciplinary Breast Center as well as the physicians of the Department of Cytotoxic Therapy for informing their patients. Thanks go to Daniel Sattler and Ludwig Attenberger from the Gynaecological Practice Arabella in Munich for providing their patients, to the iyengar-Yoga-Studio iYoga in Munich and Michael Forbes for conducting the yoga sessions almost unsalaried, and to the team of Gesund. Reha rechts der Isar, especially Rick Goldmann and Oliver Tiska, for subsidizing and giving the physical exercise sessions.

References

[1] International Agency for Research on Cancer, GLOBOCAN 2012: Estimated Cancer Incidence, Mortality and Prevalence Worldwide in 2012, 2014, http://globocan.iarc.fr/Pages/factsheets_cancer.aspx.
[2] J. Weis and U. Domann, “Interventionen in der Rehabilitation von Mammakarzinompatientinnen—Eine methodenkritische Übersicht zum Forschungsstand,” Die Rehabilitation, vol. 45, no. 3, pp. 129–145, 2006.
[3] Leitlinienprogramm Onkologie der AWMF, Deutschen Krebsgesellschaft e.V., and Deutschen Krebshilfe e.V., Interdisziplinäre S3-Leitlinie für die Diagnostik, Therapie und Nachsorge des Mammakarzinoms, 2012.
[4] D. L. Stan, N. M. Collins, M. M. Olsen, I. Croghan, and S. Pruthi, “The evolution of mindfulness-based physical interventions in breast cancer survivors,” Evidence-Based Complementary and Alternative Medicine, vol. 2012, Article ID 758641, 15 pages, 2012.
[5] J. Weis and J. M. Giesler, “Rehabilitation for cancer patients,” in Psycho-Oncology, U. Goerling, Ed., vol. 197 of Recent Results in Cancer Research, pp. 87–101, Springer, Berlin, Germany, 2014.
[6] F. T. Baumann, W. Bloch, A. Weissn et al., “Physical activity in breast cancer patients during medical treatment and in the aftercare—a review,” Breast Care, vol. 8, no. 5, pp. 330–334, 2013.
[7] K. H. Schmitz, K. S. Courneya, C. Matthews et al., “American college of sports medicine roundtable on exercise guidelines for cancer survivors,” Medicine & Science in Sports & Exercise, vol. 42, no. 7, pp. 1409–1426, 2010.
[8] F. Bruns, D. Steinmann, and O. Micke, “Spiritualität in der onkologie,” Der Onkologe, vol. 13, no. 6, pp. 490–498, 2007.
[9] A. Büßing, T. Ostermann, and F. Matthiessen, “Adaptives coping und spiritualität als ressource bei krebspatienten,” Prävention, vol. 31, no. 2, pp. 51–53, 2008.
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[10] A. Michalsen and C. Kessler, “Science-based yoga—stretching mind, body, and soul,” Forschende Komplementarmedizin, vol. 20, no. 3, pp. 176–178, 2013.

[11] T. Field, “Yoga clinical research review,” Complementary Therapies in Clinical Practice, vol. 17, no. 1, pp. 1–8, 2011.

[12] P. Sengupta, “Health impacts of yoga and pranayama: a state-of-the-art review,” International Journal of Preventive Medicine, vol. 3, no. 7, pp. 444–458, 2012.

[13] M. Sharma, T. Haider, and A. P. Knowlden, “Yoga as an alternative and complementary treatment for cancer: a systematic review,” The Journal of Alternative and Complementary Medicine, vol. 19, no. 11, pp. 870–875, 2013.

[14] C.-J. Taso, H.-S. Lin, W.-L. Lin, S.-M. Chen, W.-T. Huang, and S.-W. Chen, “The effect of yoga exercise on improving depression, anxiety, and fatigue in women with breast cancer: a randomized controlled trial,” Journal of Nursing Research, vol. 22, no. 3, pp. 155–164, 2014.

[15] J. E. Bower, D. Garet, B. Sterrlieb et al., “Yoga for persistent fatigue in breast cancer survivors: a randomized controlled trial,” Cancer, vol. 118, no. 15, pp. 3766–3775, 2012.

[16] J. Banasik, H. Williams, M. Haberman, S. E. Blank, and R. Bendel, “Effect of Iyengar yoga practice on fatigue and diurnal salivary cortisol concentration in breast cancer survivors,” Journal of the American Academy of Nurse Practitioners, vol. 23, no. 3, pp. 135–142, 2011.

[17] K. D. Chandwani, G. Perkins, H. R. Nagendra et al., “Randomized, controlled trial of yoga in women with breast cancer undergoing radiotherapy,” Journal of Clinical Oncology, vol. 32, no. 10, pp. 1058–1065, 2014.

[18] F. Siedentopf, I. Utz-Billing, S. Gairing, W. Schoenegg, H. Ktenich, and I. Kollak, “Yoga for patients with early breast cancer and its impact on quality of life—a randomized controlled trial,” Geburtshilfe und Frauenheilkunde, vol. 73, no. 4, pp. 311–317, 2013.

[19] H. Cramer, S. Lange, P. Klose, A. Paul, and G. Dobos, “Yoga for breast cancer patients and survivors: a systematic review and meta-analysis,” BMC Cancer, vol. 12, article 412, 2012.

[20] B. K. S. Iyengar, Licht auf Yoga: Das Grundlegende Lehrbuch des Hatha-Yoga, Nikol, Hamburg, Germany, 2013.

[21] P. Fayers and A. Bottomley, “Quality of life research within the EORTC—the EORTC QLQ-C30,” EORTC—the EORTC QLQ-C30: A Multiple Dimensional Health Status Questionnaire, vol. 38, no. 4, pp. S125–S133, 2002.

[22] N. K. Aaronson, A. M. Cull, S. Kaasa, and M. Sprangers, “The European Organization for research and treatment of cancer (EORTC) modular approach to quality of life assessment in oncology: an update,” in Quality of Life and Pharmacoeconomics in Clinical Trials, pp. 179–189, Lippincott-Raven, Philadelphia, Pa, USA, 2nd edition, 1996.

[23] N. K. Aaronson, S. Ahinedzi, B. Bergman et al., “The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology,” Journal of the National Cancer Institute, vol. 85, no. 5, pp. 365–376, 1993.

[24] C. Johnson, N. K. Aaronson, J. M. Blazey et al., Guidelines for Developing Questionaire Modules, European Organisation for Research and Treatment of Cancer, 2011.

[25] A. Büssing, J. Fischer, A. Haller, P. Heusser, T. Ostermann, and P. F. Matthiessen, “Validation of the brief multidimensional life satisfaction scale in patients with chronic diseases,” European Journal of Medical Research, vol. 14, no. 4, pp. 171–177, 2009.

[26] M. Kroiz, R. Zerm, M. Reif et al., “Validation of the German version of the Cancer Fatigue Scale (CFS-D),” European Journal of Cancer Care, vol. 17, no. 1, pp. 33–41, 2008.

[27] H. Walach, N. Buchheld, V. Buttenmüller, N. Kleinknecht, and S. Schmidt, “Measuring mindfulness—the Freiburg Mindfulness Inventory (FMI),” Personality and Individual Differences, vol. 40, no. 8, pp. 1543–1555, 2006.

[28] N. Buchheld, P. Grossman, and H. Walach, “Measuring mindfulness in insight meditation (Vipassana) and meditation-based psychotherapy: the development of the Freiburg Mindfulness Inventory (FMI),” Journal for Meditation and Meditation Research, vol. 1, no. 1, pp. 11–34, 2001.

[29] A. Büssing, T. Ostermann, and P. F. Matthiessen, “Role of religion and spirituality in medical patients: confirmatory results with the SpREUK questionnaire,” Health and Quality of Life Outcomes, vol. 3, article 10, 2005.

[30] A. Büssing, “Spirituality as a resource to rely on in chronic illness: the SpREUK questionnaire,” Religions, vol. 1, no. 1, pp. 9–17, 2010.

[31] M. G. Kendall and B. B. Smith, “The problem of m rankings,” Annals of Mathematical Statistics, vol. 10, no. 3, pp. 275–287, 1939.

[32] D. B. Rubin, Multiple Imputation for Nonresponse in Surveys, Wiley Series in Probability and Mathematical Statistics, John Wiley & Sons, New York, NY, USA, 1987.

[33] National Research Council, The Prevention and Treatment of Missing Data in Clinical Trials, National Academies Press, New York, NY, USA, 2010.

[34] S. C. Danhauer, J. A. Tooze, D. F. Farmer et al., “Restorative yoga for women with ovarian or breast cancer: findings from a pilot study,” Journal of the Society for Integrative Oncology, vol. 6, no. 2, pp. 47–58, 2008.

[35] J. Sadja and P. J. Mills, “Effects of yoga interventions on fatigue in cancer patients and survivors: a systematic review of randomized controlled trials,” Explore, vol. 9, no. 4, pp. 232–243, 2013.

[36] J. W. Carson, K. M. Carson, L. S. Porter, F. J. Keefe, H. Shaw, and J. M. Miller, “Yoga for women with metastatic breast cancer: results from a pilot study,” Journal of Pain and Symptom Management, vol. 33, no. 3, pp. 331–341, 2007.

[37] H. S. Vadiraja, M. R. Rao, R. Nagarathna et al., “Effects of yoga program on quality of life and affect in early breast cancer patients undergoing adjuvant radiotherapy: a randomized controlled trial,” Complementary Therapies in Medicine, vol. 17, no. 5–6, pp. 274–280, 2009.

[38] A. B. Moadel, C. Shah, J. Wylie-Rosett et al., “Randomized controlled trial of yoga among a multiethnic sample of breast cancer patients: effects on quality of life,” Journal of Clinical Oncology, vol. 25, no. 28, pp. 4387–4395, 2007.

[39] M. R. Rao, N. Raghuram, H. R. Nagendra et al., “Anxiolytic effects of a yoga program in early breast cancer patients undergoing conventional treatment: a randomized controlled trial,” Complementary Therapies in Medicine, vol. 17, no. 1, pp. 1–8, 2009.

[40] A. S. Levine and J. L. Balk, “Yoga and quality-of-life improvement in patients with breast cancer: a literature review,” International Journal of Yoga Therapy, no. 22, pp. 95–99, 2012.

[41] L. M. Buffart, J. G. Z. van Uffelen, I. I. Riphagen et al., “Physical activity and mental health in non-Western countries: a systematic review and meta-analysis,” Journal of Alternative and Complementary Medicine, vol. 18, no. 3, pp. 216–227, 2012.