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Qigong intervention for breast cancer survivors with complaints of decreased cognitive function

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Abstract

Purpose—The purpose of this pilot study was to evaluate the feasibility of an 8-week Qigong intervention to improve objectively and subjectively assessed cognitive function in breast cancer survivors who were 2 months to 8 years post completion of chemotherapy and radiation therapy.

Methods—A randomized, single-blind, three-arm intervention pilot was conducted to compare Qigong to gentle exercise and survivorship support. Feasibility was measured by recruitment,

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Conflict of interest The authors have no financial relationship with the organization that funded the research (the Oncology Nursing Society Foundation through an unrestricted grant from Sigma Theta Tau International Foundation). The first author and the primary investigator for the study have full control of all primary data. However, data sharing agreement execution would be necessary if the journal requests data review.

Informed consent Informed consent was obtained from all individual participants included in the study.
Approval from the University of Kansas Human Subjects Committee was obtained and all procedures were performed in accordance with institutional ethical standards and the 1964 Helsinki declaration and its later amendments.

group session attendance, and adherence to home practice for the two exercise groups. Changes in self-report and objectively measured cognitive function were compared between the three groups from baseline (T1) to completion of the intervention (T2) and 4 weeks post intervention (T3).

Results—Fifty participants consented (83% of desired sample) with an overall attrition rate of 28%. Attrition was highest for the gentle exercise group (50%). Group attendance adherence ranged from 44 to 67%. The a priori established rate of 75% weekly attendance was not achieved, nor was the goal of 75% adherence to home practice for the two exercise groups (7 to 41%). Self-report of cognitive function improved most for the Qigong group ($p = .01$). Improvement was demonstrated for the Trail Making A (gentle exercise, $p = .007$) and F-A-S verbal fluency (support group, $p = .02$) tests. Qigong participants reported the most reduction of distress ($p = .02$).

Conclusions—The study results suggest that mindfulness-based exercise may be superior to gentle exercise alone or survivorship support for improving self-report of cognitive function and distress after treatment for breast cancer. The mindfulness component may enhance the positive impact of exercise on cognitive function.

Keywords

Breast cancer; Cognitive function; Qigong; Mindfulness-based exercise; Intervention

Introduction and purpose

Cancer and cancer treatment-related declines in subjective and objective cognitive functions continue to be of significant concern to breast cancer survivors and can be exacerbated by fatigue, sleep disturbance, and psychosocial distress (ranging from sadness/fear to depression/anxiety) [1–4]. The Oncology Nursing Society Practice Guidelines acknowledges this important area of concern for survivors and oncology nurses [4]. However, sufficient evidence is lacking to recommend specific interventions as standard care. Interventional studies are needed to provide the necessary evidence to inform health care professionals' practice for meeting the cognitive survivorship needs of women with breast cancer.

Various forms of physical activity and meditation have been studied in association with the reduction of symptoms related to cancer and cancer therapy [5, 6]. The body of intervention work conducted in the area of cancer and cancer treatment-related declines in cognitive function is growing, but published works lack consistency for randomization and control groups, and for the measurement of subjective and objective cognitive function [7]. However, some positive preliminary results have been demonstrated for the use of aerobic exercise, resistance training, mindfulness-based exercise, and meditation in improving cognitive function [8–15]. Adherence to aerobic and resistance training exercises can be challenging due to persistent fatigue following cancer therapy [16]. Mindfulness-based exercise (combining the modalities of meditation and low-intensity physical activity, such as qigong, tai chi, and yoga) can be tailored to less strenuous formats, and therefore may be less susceptible to the adherence challenges due to persistent fatigue or reduced performance status [16]. Preliminary evidence suggests that physical activity and meditation may influence cognitive function by different mechanisms [10]. This hypothesis makes the combination of physical activity and meditation very appealing as a potential intervention

for decreased cognitive function. However, since low-intensity physical activity (or gentle exercise) may positively affect cognitive function, studies must be carefully designed to discern the effect of the mindfulness-based exercise versus that of gentle exercise alone by keeping the intensity of exercise constant between groups [16]. Study design experts have suggested that usual care control groups may not be sufficient for interventions with a behavioral focus and that comparison groups should be included to create conditions needed to discern placebo effects, such as expectancy, social support, and attention [17]. Thus, a three-arm study design to explore the effect of Qigong, gentle exercise, and attention control was a logical step to begin to investigate the contributions of gentle exercise, mindfulness, and the combination of the two to improve cognitive function in breast cancer survivors.

Qigong (of which Tai Chi is one form) is a mindfulness-based form of exercise originating from Chinese medicine combining physical postures or movements with breathing techniques and meditation. Qigong sometimes is referred to as a meditative-movement therapy and differs from Tai Chi in that the movements are simpler, more repetitive, and easier to learn [16, 18].

Fatigue, sleep disturbance, and distress are known to contribute to deficits in cognitive function and quality of life [2, 19]. Results from a number of studies (including our own work) have demonstrated that Qigong has a positive impact on fatigue, sleep disturbance, and distress, for a variety of different patient populations [16, 20–24]. Studies designed to investigate the use of Qigong for cancer-related symptoms such as fatigue and quality of life have yielded positive results [13, 16, 20, 22, 23].

One study has been conducted to date to investigate the effect of Qigong on cognitive function for cancer survivors [13]. This study included 81 survivors who had received or were receiving chemotherapy. Participants ($n = 37$) who received the Qigong intervention demonstrated a significant improvement in subjective cognitive function compared to controls ($n = 44$) ($p < .05$) and were adherent to the intervention (70% attended 80% of ten weekly sessions). Objective cognitive function was not measured.

No published research to date has included objective measures of cognitive function to evaluate Qigong as an intervention to improve cognitive function for breast cancer survivors after primary treatment. Previous research conducted with cancer survivors has not been designed to differentiate between the individual effects of gentle exercise and the mindfulness-based component of breathing techniques and meditation employed in interventions such as Qigong on cognitive function. Neither has previous study designs controlled for the potential effect of the group participation component inherent in any facilitated group activity.

The *purpose and primary aim* of this pilot study was to evaluate the feasibility of conducting a three-arm, randomized, single-blind, controlled intervention trial to improve objectively and subjectively assessed cognitive function in breast cancer survivors who were 2 months to 8 years post completion of chemotherapy and radiation therapy. Interventions included 8-weekly group sessions of Qigong, gentle exercise, or attention control (survivorship support). The *exploratory aims* were to compare changes in: (1) objective or subjective

cognitive function; (2) other cancer and cancer treatment-related symptoms (fatigue, sleep disturbance, and distress); and (3) quality of life between the three groups following the 8-week intervention period.

Methods

Setting

Participants were recruited from the University of Kansas Cancer Centers, including one academic and five community practices, and from participating Midwest Cancer Alliance (MCA) sites including North Kansas City Hospital and Olathe Medical Center.

Eligibility criteria

Eligible participants included adult women (over age 18) diagnosed with stage I–III breast cancer who completed chemotherapy (and radiation if received) 2 months to 8 years prior to enrollment, and who reported clinically meaningful decreased cognitive function (a score < 59 on the Perceived Cognitive Impairment subscale of the Functional Assessment for Cancer Therapy-Cognition, FACT-Cog) [25]. Ongoing anti-estrogen therapy and anti-HER-2 therapy were allowed. Women were excluded for Alzheimer's disease, dementia, or other psychological diagnoses that would impact cognitive function, current/planned participation in mindfulness-based exercise programs, and physical limitations that would preclude gentle (low-intensity) exercise.

Procedures

At the time of consent, all participants were informed of the invitation to attend the group of their choice following completion of data collection. The baseline assessment (T1) was conducted by the primary investigator (PI, JM). Height, weight, and waist/hip circumference were measured for body mass index calculation (BMI). Participants completed the study questionnaire and neuropsychological testing. Participants subsequently were randomized to one of the three groups and informed of the result by a research assistant not involved with group leadership, neuropsychological testing, or data collection. Each group met for eight weekly 60-min sessions. Participants randomized to either of the exercise groups (Qigong or gentle exercise) were instructed to practice for 15 min at home twice a day and keep a log, including any barriers to home practice. The home practice logs were collected weekly at the group sessions. At the completion of 8 weeks (T2), group leaders administered the second study questionnaire and a satisfaction survey. Four weeks later (T3), neuropsychological testing was repeated by the PI and the final study questionnaire was administered. Once participants completed the T3 assessment, they could attend a different group if desired, without further data collection.

Intervention Fidelity

The form of Qigong selected for the study was the six healing sounds. This form of Qigong is comprised of the synchronous combination of controlled diaphragmatic breathing, quiet chanting of the six healing sounds (to enhance meditative focus), and specific gentle movement of the arms. Diaphragmatic breathing minimizes the role of the upper chest and neck muscles, relying primarily on the contraction and relaxation of the muscles in the lower

abdomen including the diaphragm. Participants were instructed to assume a posture with the knees slightly bent and feet approximately shoulder-width apart. Qigong group participants were instructed to calm their minds into a state of emptiness, not to feel bad if thoughts or feelings intrude, and to synchronize slow breathing with smooth arm movements. Concentration is focused on the feeling of the lower abdominal contraction and expansion. Qigong participants were instructed in the pronunciation of the six healing sounds and performance of accompanying postures. The gentle exercise participants were instructed only in the gentle arm movements and postures without the diaphragmatic breathing, clearing of the mind, or chanting of the six healing sounds. A very detailed description of the movements, postures, and sounds has been published previously [26].

Training and certification of the four Qigong and gentle exercise group leaders and intervention fidelity monitoring was carried out by a co-investigator (WL), a 29-year practitioner of the six healing sounds form of Qigong. The support group (attention control) consisted of sessions facilitated by a clinical psychologist (SK). The focus of these sessions was issues related to cancer survivorship. Participants in the support group were encouraged to share their concerns and discuss problem-solving strategies.

Instruments

The study questionnaire included demographic information collected at baseline (T1) and a series of psychometrically sound self-report instruments collected at all three time points (Table 1) [27–30]. The neuropsychological tests (administered at baseline and T3) were selected to be consistent with the core tests recommended by the International Cancer and Cognition Task Force (See Table 1) [31–33].

Data analyses

Descriptive statistics were used to summarize the distribution of all variables (SPSS Statistics 24). A preliminary analysis was used to assess accuracy of inputted data, potential outliers and influential points, the amount and pattern of missing data, and potential violations of assumptions necessary for planned analyses. Fisher’s exact tests and analyses of variance (based on whether variables were categorical or continuous) were used to assess for group differences at baseline and for differences for participants who dropped out of the study compared to those who completed the study.

Primary aim

The percentage of the desired sample achievement was used to define the success of recruitment for the three-arm study design. Retention was measured by the number, characteristics, and reasons for attrition for each group. Group means for weekly session attendance and documentation of twice-daily home practice were used to assess adherence. Successful feasibility was defined as achieving a total of 45 evaluable participants (15 in each group), 75% or greater adherence to weekly attendance for all 3 groups and twice-daily home practice for the Qigong and gentle exercise groups, with 25% or less attrition.

Exploratory aims

Mean changes in scores (and 95% confidence intervals) for the self-report instruments (T1 to T3 and T2 to T3) and domain-specific neuropsychological tests (memory, processing speed, and executive function from T1 to T3) were calculated for each group and used to describe change in cognitive function within and among Qigong, gentle exercise, and attention control groups. Independent sample *t* tests or Wilcoxon rank sum tests were used based on whether or not the normality assumption was satisfied. Mean scores for the self-report instruments and domain-specific neuropsychological tests at T2 and T3 were used to calculate effect sizes (as standardized mean difference of change scores, *d*) for the potential impact of Qigong, compared to gentle exercise, and/or attention control conditions. Additionally, we calculated effect sizes (i.e., *d*) at T2 and T3 for the effect of each of the three groups on fatigue, sleep disturbance, distress, and quality of life. No control for multiple tests was considered due to the exploratory nature of these analyses. The significance level for all tests was 0.05.

Results

Demographics

Fifty participants primarily were comprised of non-Hispanic, white, post-menopausal, married women diagnosed with early stage disease (Table 2). Most participants were educated at the college level or above (84%) and employed full-time (56%). Most had received, or were currently receiving, anti-estrogen therapy (78%). About half had received radiation therapy. Only a third received anti-HER2 therapy. The mean age was 53.68 and the mean time since chemotherapy was slightly more than 2 years. The mean BMI was 30 with a mean waist/hip ratio of .86. Participants' activity levels ranged from 3.5 to 80 total METs (metabolic equivalent of task) per week with a mean of 21.2 (range of 8–16 recommended by the Physical Activity Guidelines Advisory Committee, Office of Disease Prevention and Health Promotion), although 50% were below 18. Nine study cohorts were held over a 20-month timeframe. Group sizes ranged from two to seven.

No differences were noted between groups at baseline except that participants in the gentle exercise group reported lower quality of life (QOL) on the FACT-Cog QOL subscale ($p = .004$), and worse perceived cognitive function on the two PROMIS Cognition short forms (general concerns, higher scores = worse function, $p = .046$) (abilities, lower scores = worse function, $p = .049$) (Table 2). Baseline differences for participants who dropped out were significant for two variables, e.g., higher stage of disease (3 of 3 participants with stage III disease, $p = .006$) and lower QOL scores (mean difference = 3.1, $F = 4.82$, $p = .033$).

Primary aim

The recruitment feasibility goal was achieved (50 participants, 83% of desired sample); however, we did not achieve 15 evaluable participants in each group. Attrition was unequal across groups. Four participants dropped out of the gentle exercise group prior to attending any sessions and were excluded from further analyses. At the T3 assessment, attrition was 21% for Qigong, 50% for gentle exercise, and 0% for the support group (Table 3).

Group attendance adherence of 75% was not achieved. Mean weekly group session attendance was 5.2 for Qigong (52%), 4.4 for gentle exercise (44%), and 6.7 for the support group (67%). The twice-daily home practice adherence goal of 75% also was not achieved for the two exercise groups: Qigong (31% overall, 41% T1 to T2 and 13% T2 to T3) and gentle exercise (21% overall, 28% T1 to T2 and 7% T2 to T3).

Exploratory aims for subjective cognitive function/symptoms

FACT-Cog PCI subscale scores (higher scores, better perceived cognitive function) improved for the Qigong and gentle exercise groups and worsened for the support group (Table 4). PCI improvement for the Qigong was significantly better than the support group between T1 and T2 ($p = .01$, $d = 1.14$). A trend for higher improvement with gentle exercise compared to support group was noted ($p = .08$, $d = -0.83$). Similar results were seen for improvement in FACT-Cog PCA subscale scores with significantly higher scores in the Qigong group compared to support group ($p = .04$, $d = 0.75$). A trend for improvement was noted between gentle exercise and support group ($p = .08$, $d = -0.83$). No significant difference for PCI or PCA was noted between groups from T2 to T3.

All three group scores improved between T1 to T2 for the PROMIS cognitive general concerns scores (lower scores = better perceived cognitive function). No significant differences between groups were noted. However, effect sizes for the Qigong group were large compared to gentle exercise ($d = -0.65$) and support group ($d = -0.72$). No significant differences were noted between T2 and T3. The effect sizes were greatest for the gentle exercise group compared to Qigong ($d = 1.04$) and support groups ($d = 0.88$). No significant group differences were noted for PROMIS cognitive abilities short form scores.

QOL improved for all three groups between T1 and T2. Significant improvement was noted for gentle exercise between T2 and T3 when compared to support group ($p = .03$, $d = -1.02$), and the effect size compared to Qigong was large ($d = -0.8$).

No significant improvements in fatigue or sleep disturbance scores were noted (lower scores = less severity). A trend toward improvement was noted for gentle exercise compared to Qigong ($p = .05$, $d = 0.81$).

Improvement in distress scores (lower scores = less severity) was significantly better for Qigong compared to support group ($p = .02$, $d = -0.91$). A trend for improvement was noted between Qigong and gentle exercise ($p = .06$, $d = -0.76$).

Exploratory aims for objective tests of cognitive function

The Qigong group improved more than gentle exercise on the Trail Making A test between T1 and T3 (lower scores = better cognitive function; $p = .007$, $d = 1.21$). The gentle exercise group trended toward more improvement than the support group ($d = 0.76$). Only the Qigong group improved on the Trail Making B test. While not significant, moderately large effect sizes were noted in comparison to gentle exercise ($d = -0.43$) and support groups ($d = 0.56$). The support group improved more than gentle exercise on the test of verbal fluency ($p = .02$, $d = 1.14$). No correlation was seen between “dose” (total group or home practice sessions), BMI, or activity level and subjective or objective cognitive function.

Discussion

The study was faced with retention challenges, particularly in the gentle exercise group. Recruitment and consent language were neutral when describing the three intervention groups as participants could not be blinded to the randomization selection. The opportunity to attend a different group following completion of data collection was a study design strategy to minimize attrition (in the event participants were not randomized to their preferred group or wanted to try another group at the end of their formal study participation). The chief barriers to overall study retention were described as time commitment for 8 weekly sessions, driving long distances to the research center, and dealing with rush hour traffic to get to the sessions. A few participants expressed disappointment in the small group size. Several participants (and potential recruits who decided not to participate) expressed interest in a virtual attendance option. The most common barriers to home practice documented in the logs included: “too busy, too tired, forgot.”

We were disappointed in the higher than expected attrition rate and poor adherence to home practice. These results contrast with our earlier work. One co-investigator (WL) previously explored the use of the six healing sounds of Qigong, in two pilot studies. Fourteen participants with fibromyalgia were randomized to an 8-week Qigong intervention group (also with home practice twice daily) versus gentle exercise [21]. Adherence rates for the control group (75% home practice and 77% group attendance) and the Qigong intervention group (85% home practice and 79% group attendance) were higher than the current study. The Qigong group in the fibromyalgia study reported significant reduction in fatigue and pain and improvement in sleep quality ($p < .05$) compared to the gentle exercise group. A subsequent small single-arm pilot study was conducted for eight breast cancer survivors at least 3 months post completion of primary cancer treatment [24]. Participants received the 8-week Qigong intervention. Good adherence was demonstrated (78.5% home practice and 89.6% group attendance). Significant reduction in fatigue and improvement for sleep quality, insomnia, and quality of life was reported ($p < .01$).

Attrition rates for the current study were not unlike other published works. Oh and colleagues reported results for a 10-week medical Qigong intervention versus standard of care for 162 participants [23]. Their dropout rate was 32% for the intervention group and 35% for controls. Mean session attendance for those who completed the study was 8 of 10. Adherence to keeping the home practice diary was only 50%. They subsequently published results of a substudy in which self-report of cognitive function was added as an endpoint [13]. The attrition for the 81 substudy participants was 33%, and adherence to the home practice diary was reported to be less than 50%.

Results for the current study demonstrated significant improvement in the FACT-Cog subscales for PCI and PCA and distress (MDASI) for participants in the Qigong group. Trends for improvement (large effect sizes) were seen for improvement in the PCI and PCA subscales for the gentle exercise group. The gentle exercise group reported the highest improvement in the FACT-Cog subscale for QOL. However, this group reported lower QOL scores at baseline. Due to the significant attrition (and potential attrition bias) in the gentle exercise group, the results must be interpreted cautiously. The potential exists for dilution of

the effects of gentle exercise on cognitive function due to the loss of power from attrition and may bias the results for the improvement in QOL scores.

Only one secondary analysis of a randomized, controlled, trial (12-week mindfulness-based exercise intervention, yoga) has reported results for objective cognitive function. Neuropsychological tests conducted with 100 breast cancer survivors and 100 wait-list controls demonstrated a dose effect for frequency of yoga practice at 3 months ($p < .001$) [10]. In our study, improvement was seen for three of the neuropsychological tests: Trail Making A, RAVLT delay, and F-A-S. However, this improvement may have been due to practice effect as the neuropsychological testing was conducted approximately 12 weeks apart.

Overall, satisfaction surveys yielded excellent ratings for study participation and group leadership. One cohort in particular wanted to have the support group continue. A few participants in the exercise groups indicated they wished time had been allowed for more interaction with other participants and the opportunity to share experiences. Several participants indicated they intended to maintain Qigong as part of their ongoing lifestyle. One participant described significant improvement in sleep disturbance. She described using the breathing techniques and silently thinking the six healing sounds (so as not to disturb her spouse) to help her go to sleep at night.

Study limitations

Study strengths included the three-arm randomized design with attention control and sample homogeneity. The power of the study to investigate the exploratory aims was limited by small sample size and high attrition rates. Adherence may have been affected by small group sizes.

Conclusions

This three-arm pilot study involving eight weekly intervention sessions proved to be challenging to conduct. Initial recruitment met the study objective. However, significant attrition occurred, particularly in the gentle exercise group. Despite the reduction in power caused by high attrition rates, the study results suggest that mindfulness-based exercise may be superior to gentle exercise alone or group support for improvement in self-report of cognitive function and distress after treatment for breast cancer. The mindfulness component may enhance the positive impact of exercise on cognitive function. Further investigation that includes a virtual participation option (after mastery of the movements/postures/sounds to the satisfaction of the group leader) to improve adherence to group attendance may be warranted.

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References

1. Carlson LE, Bultz BD (2003) Cancer, distress screening: needs, models and methods. J Psychosom Res 55:403–409 [PubMed: 14581094]
2. Hampson JP, Zick SM, Khabir T, Wright BD, Harris RE (2015) Altered resting brain connectivity in persistent cancer related fatigue. Neuroimage Clin 8:305–313 [PubMed: 26106555]
3. Myers JS, Wick J, Klemp JR (2015) Potential factors associated with perceived cognitive impairment in breast cancer survivors. Support Care Cancer 23:3219–3228. 10.1007/s00520-015-2708-7 [PubMed: 25832894]
4. Von AD, Jansen C, Allen DH (2014) Evidence-based interventions for cancer- and treatment-related cognitive impairment. Clin J Oncol Nurs 18:17–25
5. Asher A, Myers JS (2015) The effect of cancer treatment on cognitive function. Clin Adv Hematol Oncol 13(7):441–450 [PubMed: 26353040]
6. Myers JS (2015) Complementary and integrative interventions for cancer-related cognitive changes. Asia Pac J Oncol Nurs
7. Myers JS, Erickson KI, Sereika SM, Bender CM (2017) Exercise as an intervention to mitigate decreased cognitive function from cancer and cancer treatment: an integrative review. Cancer Nurs:1 10.1097/ncc.0000000000000549
8. Baumann FT, Drosselmeyer N, Leskaroski A, Knicker A, Krakowski-Roosen H, Zopf EM, Bloch W (2011) 12-week resistance training with breast cancer patients during chemotherapy: effects on cognitive abilities. Breast Care 6:142–143
9. Crowgey T, Peters KB, Hornsby WE, Lane A, McSherry F, Herndon JE, West MJ, Williams CL, Jones LW (2014) Relationship between exercise behavior, cardiorespiratory fitness, and cognitive function in early breast cancer patients treated with doxorubicin-containing chemotherapy: a pilot study. Appl Physiol Nutr Metab 39:724–729 [PubMed: 24869976]
10. Derry HM, Jaremka LM, Bennett JM, Peng J, Andridge R, Shapiro CL, Malarkey WB, Emery CF, Layman R, Mrozek EE, Glaser R, Kiecolt-Glaser JK (2014) Yoga and self-reported cognitive problems in breast cancer survivors: a randomized controlled trial. Psychooncology 24:958–966. 10.1002/pon.3707 [PubMed: 25336068]
11. Knobf MT, Thompson A, Fennie K, Erdos D (2013) The effect of a community-based exercise intervention on symptoms and quality of life. Cancer Nurs 37:E43–E50
12. Milbury K, Chaol A, Biegler KA, Wangyal T, Spelmen A, Meyers C, Arun B, Palmer JL, Taylor JA, Cohen L (2013) Tibetan sound meditation for cognitive dysfunction: results of a randomized controlled pilot trial. Psychooncology 22:2354–2363 [PubMed: 23657969]
13. Oh B, Butow PN, Mullan BA, Clarke SJ, Beale PJ, Pavlakis N, Lee MS, Rosenthal DS, Larkey L, Vardy J (2012) Effect of medical Qigong on cognitive function, quality of life, and a biomarker of inflammation in cancer patients: a randomized controlled trial. Support Care Cancer 20:1235–1242. 10.1007/s00520-011-1209-6 [PubMed: 21688163]
14. Reid-Arndt AA, Matsuda S, Cox CR (2012) Tai chi effects on neuropsychological, emotional, and physical functioning following cancer treatment: a pilot study. Complement Ther Clin Pract 18:26– 30 [PubMed: 22196570]
15. Sprod LK, Mohile SG, Demark-Wahnefried W, Janelsins MC, Peppone LJ, Morrow GR, Lord R, Gross H, Mustian KM (2012) Exercise and cancer treatment symptoms in 408 newly diagnosed older cancer patients. J Geriatr Oncol 3:90–97 [PubMed: 22712028]
16. Larkey LK, Roe DJ, Weihs KL, jahnke R, Lopez AM, Rogers CE, OH B, Guillen-Rodriguez (2015) Randomized controlled trial of qigong/tai chi easy on cancer-related fatigue in breast cancer survivors. Ann Behav Med 49:165–176 [PubMed: 25124456]
17. Lindquist R, Wyman JF, Talley KM, Findorff MJ, Gross CR (2007) Design of control-group conditions in clinical trials of behavioral interventions. J Nurs Scholarsh 39:214–221 [PubMed: 17760793]
18. Kelley GA, Kelley KS (2015) Meditative movement therapies and health-related quality-of-life in adults: a systematic review of meta-analyses. PLoS One 10(6):e0129181 10.1371/journal.pone.0129181 [PubMed: 26053053]

19. Ahles TA, Saykin A (2002) Breast cancer chemotherapy-related cognitive dysfunction. Clin Breast Cancer 3(Suppl 3):S84–S90 [PubMed: 12533268]
20. Campo RA, Agarwal N, LaStayo PC, O'Connor K, Pappas L, Boucher KM, Gardner J, Smith S, Light KC, Kinney AY (2014) Levels of fatigue and distress in senior prostate cancer survivors enrolled in a 12-week randomized controlled trial of Qigong. J Cancer Surviv 8:60–69 [PubMed: 24170679]
21. Liu W, Zahner L, Cornell M, Le T, Ratner J, Wang Y, Pasnoor M, Dimachkie M, Barohn R (2012) Benefit of Qigong exercise in patients with fibromyalgia: a pilot study. Int J Neurosci 122(11): 657–664. 10.3109/00207454.2012.707713 [PubMed: 22784212]
22. Oh B, Butow P, Mullan B, Clarke S (2008) Medical Qigong for cancer patients: pilot study of impact on quality of life, side effects of treatment and inflammation. Am J Chin Med 36:459–472 [PubMed: 18543381]
23. Oh B, Butow P, Mullan B, Clarke S, Beale P, Pavlakis N, Kothe E, Lam L, Rosenthal D (2010) Impact of medical Qigong on quality of life, fatigue, mood and inflammation in cancer patients: a randomized controlled trial. Ann Oncol 21(3):608–614. 10.1093/annonc/mdp479 [PubMed: 19880433]
24. Liu W, Schaffer L, Herrs N, Choller C, Taylor S (2015) Improved sleep after Qigong exercise in breast cancer survivors, a pilot study. Asia Pac J Oncol Nurs submitted
25. Sanford SD, Beaumont JL, Butt Z, Sweet J, Cella D, Wagner L (2014) Prospective longitudinal evaluation of a symptom cluster in breast cancer. J Pain Symptom Manag 47:721–730
26. Moon S, Schmidt M, Smirnova IV, Colgrove Y, Liu W (2017) Qigong exercise may reduce serum TNF-alpha levels and improve sleep in people with Parkinson's disease: a pilot study. Medicines (Basel, Switzerland) 4(2). 10.3390/medicines4020023
27. Cleeland CS, Mendoza TR, Wang XS, Chou C, Harle MT, Morrissey M, Engstrom MC (2000) Assessing symptom distress in cancer patients: the M.D. Anderson symptom inventory. Cancer 89:1634–1646 [PubMed: 11013380]
28. Johnson-Kozlow M, Rock CL, Gilpin EA, Hollenbach KA, Pierce JP (2007) Validation of the WHI brief physical activity questionnaire among women diagnosed with breast cancer. Am J Health Behav 31:193–202 [PubMed: 17269909]
29. Lai J, Butt Z, Wagner L, Sweet J, Beaumont JL, Vardy J, Jacobsen PB, Jacobs SR, Shapiro CL, Cella D (2009) Evaluating the dimensionality of perceived cognitive function. J Pain Symptom Manag 37:982–995
30. Lai J, Wagner L, Jacobsen PB, Cella D (2014) Self-reported cognitive concerns and abilities: two sides of one coin? Psychooncology 23:1133–1141. 10.1002/pon.3522 [PubMed: 24700645]
31. Wefel J, Vardy J, Ahles TA, Schagen SB (2011) International cognition and cancer task force recommendations to harmonise studies of cognitive function in patients with cancer. Lancet Oncol 12:703– 708 [PubMed: 21354373]
32. Luo L, Luk G, Bialystok E (2010) Effect of language proficiency and executive control on verbal fluency performance in bilinguals. Cognition 114:29–41 [PubMed: 19793584]
33. Strauss E, Sherman EM, Spreen O (2006) A compendium of neuropsychological tests: Administration, norms, and commentary, vol 3rd edn. Oxford University Press, New York

Table 1

Instruments

Self-report	Neuropsychological tests
Functional assessment of cancer therapy- cognition (FACT-Cog, version 3) subscales:	Rey auditory verbal learning test (RAVLT; memory)
Perceived cognitive impairment (PCI)	RAVLT 1–5 total
Perceived cognitive abilities (PCA)	RAVLT interference
Quality of life (QOL)	RAVLT post interference
	RAVLT delay
	RAVLT recognition A
	RAVLT recognition B
Patient reported outcomes measurement system (PROMIS) applied cognition short forms 8a (version 1):	F-A-S test of verbal fluency
General concerns	
Abilities	
MD Anderson Cancer Symptom Inventory (MDASI) items:	Trail Making Test A and B (processing speed, executive function)
Fatigue	
Sleep disturbance	
Distress	
Women's health initiative brief physical activity questionnaire (WHI PAQ) (participants' activity levels)	

Table 2

Demographics for full sample and group differences at baseline ($n = 50$)

Characteristic (categorical)	Freq (%)	MD (%)	Qigong (n =19)	Gentle exercise (n = 20)	Support group (n = 11)	p (Fisher's exact)
Stage						
I	21 (42)		10	9	2	.081
II	26 (52)		9	8	9	
III	3(6)		0	3	0	
Ethnicity		2(4)				
Hispanic or Latino	3(6)		1	1	1	1.0
Not Hispanic or Latino	45 (90)		17	18	10	
Race						
Asian	2 (4)		0	1	1	.755
Black/African American	3 (6)		1	2	0	
Caucasian	45 (90)		18	17	10	
Menopausal status						
Pre-	2 (4)		1	0	1	.148
Peri-	4(8)		3	0	1	
Post-	44 (88)		15	20	9	
Education level		1 (2)				
High school	7(14)		2	4	1	.832
College	32 (64)		12	12	8	
Graduate school	10 (20)		5	3	2	
Employment		1 (2)				
Full time	28 (56)		10	9	9	.184
Part time	6(12)		1	4	1	
Medical leave	1 (2)		0	0	1	
Retired	9(10)		5	4	0	
Unemployed	5(10)		3	2	0	
Marital status						
Single	4 (8)		2	2	0	.439
Married	33 (66)		14	12	7	
Divorced	6(12)		0	3	3	

Widowed	4 (8)		2	1	1	
In relationship	3 (6)		1	2	0	
Radiation therapy	26 (52)		9	12	5	.672
Anti-HER-2 therapy	17 (34)		10	5	17	.120
Anti-estrogen therapy	38 (78)		15	15	9	1.0
Previous smoker	21 (42)		8	9	4	.932
Diabetic	6(12)		4	2	0	.243
Characteristic (continuous)	**Min, max**	**Mn (SD)**	**Qigong (*n* =19)**	**Gentle exercise (*n* = 20)**	**Support group (*n* = 11)**	***p* (ANOVA)**
Age (years)	29, 76	53.68 (11.19)	52.89 (11.96)	53.05 (10.74)	56.18 (11.30)	.744
Time since chemo (years)	.25, 8	2.3 (1.65)	2.34 (1.67)	2.429 (1.89)	1.98 (1.18)	.768
BMI	22.2, 45.0	30.2 (5.33)	31.46 (6.30)	20.08 (4.31)	28.28 (5.01)	.291
Waist/hip ratio	.76, 1.02	.86 (.06)	.88 (.068)	.85 (.60)	.85 (.03)	.273
Total METs per week	3.5, 80.42	21.2 (15.31)	23.32 (13.52)	19.57 (18.15)	20.52 (13.38)	.744
PCI	9, 57	32.32 (12.85)	33.26 (10.57)	28.55 (14.54)	37.55 (12.06)	.163
PCA	4, 26	13.4 (5.47)	14.79 (5.54)	4.90 (1.10)	5.72 (.77)	.118
QOL	0, 16	8.88 (4.29)	10.74 (4.13)	6.50 (3.74)	10.0 (3.69)	.004**
PROMISCogTS	30.9, 62.7	42.64 (7.02)	40.21 (5.13)	45.56 (8.27)	41.52 (5.85)	.046*
PROMISATS	27, 54.9	40.71 (6.88)	43.51 (6.0)	38.17 (7.37)	40.49 (5.60)	.049*
Fatigue	0, 10	4.4 (2.7)	3.74 (2.96)	5.25 (2.67)	4.0 (2.0)	.188
Sleep	0, 10	3.72 (2.97)	2.89(3.11)	4.95 (2.74)	2.91 (2.55)	.054
Distress	0,9	2.9 (2.85)	2.58 (3.04)	3.55 (3.02)	2.27 (2.10)	.413

* $p < 0.05$,

** $p < .01$

BMI, body mass index; *Freq*, frequency; *Mn*, mean; *Max*, maximum; *Min*, minimum; *MD*, missing data; *MET*, metabolic equivalent of task; *PCI*, perceived cognitive impairment; *PCA*, perceived cognitive ability; *PROMISAbility*, patient reported outcomes measurement system applied cognition, abilities; *PROMISCog*, patient reported outcomes measurement system applied cognition, general concerns; *QOL*, quality of life; *SD*, standard deviation; *Sig*, significance

Table 3

Study assessment completion by group

	Assessment completion			
Group	**T1 (baseline)**	**T2 (8 weeks)**	**T3 (12 weeks**	**Dropped (%)**
Qigong	19	16	15	4 (21)
Gentle exercise	20	11	10	10 (50)
Support	11	11	11	0 (0)
Total dropped	0	12	2	14 (28)
Total completed	50	38	36	

Table 4

Exploratory aims results

	Q T1 to T3		GE T1 to T3		SS T1 to T3		Q:GE		Q:SS		GE:SS	
	Mean change	**SD**	**Mean change**	**SD**	**Mean change**	**SD**	**p**	**d**	**p**	**d**	**p**	**d**
PCI	10.94	10.47	10.27	14.16	− 0.73	9.87	.89	0.06	.01*	1.14	.05	− 0.9
PCA	2.38	4.27	2.911	4.68	− 1	4.77	.76	− 0.12	.04*	0.75	.08	− 0.83
PROMISCog	− 4.48	4.47	− 1.75	3.78	− 1.42	3.98	.11	− 0.65	.08	− 0.72	.84	0.09
PROMISAbl	3.37	3.38	4.17	6.51	2.15	1.68	.71	− 0.16	.23	0.43	.34	− 0.43
QOL	2	3.52	1.36	4.11	1.82	2.96	.90	0.17	1	0.05	.77	0.13
Fatigue	0.94	2.67	− 0.36	2.42	− 0.73	3	.14	0.51	.14	0.59	.64	− 0.13
Sleep	0.69	2.73	− 1.36	2.25	− 0.36	3.04	.05	0.81	.36	0.37	.39	0.37
Upset	0.13	3.56	0.18	2.48	− 0.55	2.21	.96	− 0.02	.58	0.22	.48	− 0.31
	Q T2 to T3		**GE T2 to T3**		**SS T2 to T3**		**Q:GE**		**Q:SS**		**GE:SS**	
	Mean change	**SD**	**Mean change**	**SD**	**Mean change**	**SD**	**p**	**d**	**p**	**d**	**p**	**d**
PCI	3.47	10.2	5.2	11.48	2.36	11.3	65	− 0.16	.81	0.1	.58	− 0.25
PCA	0.6	4.84	0.9	3.18	0.18	4.9	1	− 0.07	.79	0.09	.70	− 0.18
PROMISCog	− 0.02	1.94	− 3.12	4.15	0.65	4.39	06	1.04	.65	− 0.21	.07	0.88
PROMISAbl	− 0.79	2.86	1.55	2.3	0.49	2.61	.06	− 0.88	.32	− 0.46	.34	− 0.43
QOL	0.07	2.05	1.6	1.71	− 0.64	2.62	.06	− 0.8	.45	0.31	.03*	− 1.02
Fatigue	− 0.87	2.64	− 0.7	2.36	0.64	2.66	.87	− 0.07	.17	− 0.57	.24	0.53
Sleep	− 0.13	2.33	0.3	1.83	− 0.73	1.74	.91	− 0.2	.22	0.28	.28	− 0.58
Upset	− 0.93	2.02	0.4	1.26	0.82	1.78	.06	− 0.76	.02*	− 0.91	.55	0.27
	Q T1 to T3		**GE T1 to T3**		**SS T1 to T3**		**Q:GE**		**Q:SS**		**GE:SS**	
	Mean change	**SD**	**Mean change**	**SD**	**Mean change**	**SD**	**p**	**d**	**p**	**d**	**p**	**d**
F-A-S	4.67	5.73	0.6	4.62	6.64	5.99	.07	0.76	.40	− 0.34	.02*	1.14
RAVLT 1 −5	3.07	8.51	1.4	6.85	− 1.64	4.80	.61	0.21	.11	0.65	.25	− 0.51
RAVLT int	− 0.27	2.34	− 0.5	2.01	− 0.18	1.33	.80	0.11	.92	− 0.04	.67	0.19
RAVLT post int	0.73	2.28	1.1	1.60	− 0.45	2.62	.66	− 0.18	.23	0.49	.12	− 0.73
RAVLT delay	0.2	2.37	1.7	1.34	− 0.91	2.26	.08	− 0.74	.24	0.48	.01*	− 1.43
RAVLT rec A	0	1.46	0.8	1.62	− 0.27	1.35	.21	− 0.52	.63	0.19	.11	− 0.72

RAVLT rec B	0.33	3.27	1.2	3.77	2.09	3.62	.55	− 0.25	.21	− 0.51	.59	0.24
TMT A	− 0.25	4.37	− 7.4	7.75	− 2.30	5.26	.01*	1.21	.29	0.43	.09	0.77
TMT B	− 9.11	29.08	2.374	22.59	5.9	23.87	.94	− 0.43	022	− 0.56	.73	0.15

Independent sample *t* tests or Wilcoxon rank sum tests were used based on whether or not the normality assumption was satisfied

*$p < .05$

d, Cohen's d effect size; *GE*, gentle exercise; *F-A-S*, test of verbal fluency, *int*, interference; *PCI*, perceived cognitive impairment; *PCA*, perceived cognitive abilities; *post int*, post interference; *PROMISAbl*, patient reported outcomes measurement information system, cognition abilities; *PROMISCog*, patient reported outcomes measurement information system, cognition general concerns; *Q*, qigong; *QOL*, quality of life; *RAVLT*, rey auditory verbal learning test; *RAVLT 1–5*, trials 1–5 total; *Rec*, recognition; *SD*, standard deviation; *SS*, survivorship support; *TMT*, trail making test