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ORIGINAL ARTICLE

Feasibility of Cognitively-Based Compassion Training (CBCT) for breast cancer survivors: a randomized, wait list controlled pilot study

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Abstract
Purpose This study assessed the feasibility of a meditation-based program called Cognitively-Based Compassion Training (CBCT) with breast cancer survivors. Enrollment and participant satisfaction with a novel intervention, adherence to program requirements, and differences between the intervention group and wait list controls on self-report measures were also assessed. Additionally, cortisol, a stress-related endocrine biomarker, was assessed.
Methods Participants (n = 33) were randomly assigned to CBCT or the wait list. CBCT provided eight weekly, 2-h classes and a "booster" CBCT session 4 weeks later. CBCT participants were expected to attend classes and meditate between classes at least three times per week. Pre-/post-intervention and follow-up questionnaires measured symptom change (depression, intrusive thoughts, perceived stress, fear of cancer recurrence, fatigue/vitality, loneliness, and quality of life). Saliva samples were collected at the same periods to assess the slope of diurnal cortisol activity.
Results Enrollment, class attendance, home practice time, and patient satisfaction exceeded expectations. Compared to controls, post-intervention, the CBCT group showed suggestions of significant improvements in depression, avoidance of intrusive thoughts, functional impairment associated with fear of recurrence, mindfulness, and vitality/fatigue. At follow-up, less perceived stress and higher mindfulness were also significant in the CBCT group. No significant changes were observed on any other measure including diurnal cortisol activity.
Conclusions Within the limits of a pilot feasibility study, results suggest that CBCT is a feasible and highly satisfactory intervention potentially beneficial for the psychological well-being of breast cancer survivors. However, more comprehensive trials are needed to provide systematic evidence.
Relevance CBCT may be very beneficial for improving depression and enhancing well-being during breast cancer survivorship.

Keywords Breast cancer · Survivorship · Meditation · Compassion · Depression · Stress · Fear of cancer recurrence

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Introduction

Interest in meditation for breast cancer (BC) patients has grown, especially for those who have survived the initial neoplasm and its treatment, but who often, as survivors, cope with lingering behavioral challenges, such as depression, fatigue, fear of cancer recurrence, and cognitive difficulties. For example, fear of cancer recurrence occurs in up to 70 % of survivors and is associated with long-term functional impairments [1, 2]. Even several years following successful treatment, intrusive cognitions of cancer or its treatment (i.e., as unwanted thoughts, images, or memories) occurs in almost half of all survivors [3]. Rates of clinically significant depression range from 10 to 25 % 1 year after treatment and decline only marginally over time. Further, even when depression wanes, overall well-being may not improve [4]. Fatigue and sleep problems are also clinically significant in up to 60 % of

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survivors and markedly impair both function and quality of life [5–8].

To date, studies examining the benefits of meditation for cancer patients have primarily focused on a technique known as mindfulness, which emphasizes moment-to-moment non-judgmental attention and awareness to induce physiological relaxation and help individuals emotionally disconnect from depressing and/or anxiogenic thought patterns. In particular, Mindfulness-Based Stress Reduction (MBSR) [9], an intensive 8-week program that combines mindfulness with basic yoga practices, has shown promise for cancer patients [10–12]. Systematic reviews of MBSR typically report moderate effect sizes for several mental health outcomes including anxiety, stress, fatigue, general mood and sleep disturbances, and quality of life [13]. MBSR has also been reported to impact hypothalamic-pituitary-adrenal (HPA) axis function in cancer patients that is especially relevant in cancer given its association with both behavioral pathology and overall survival time. For example, one study found that both MBSR and supportive-expressive group therapy maintained the diurnal cortisol slope, whereas subjects in the no-treatment group showed a flattening (i.e., worsening) of the cortisol rhythm [14].

Of relevance to the current study is the finding of a link between self-compassion and reduced depressive and stress-related symptoms more apparent in cancer patients than in those with other chronic illnesses [15]. Further, fewer of these symptoms have been found in subjects with greater self-kindness, non-judgment, and sense of inclusion in a common humanity (i.e., trait self-compassion) [16], strongly suggesting that interventions designed to promote positive psychological well-being may be of great benefit to BC survivors. Although development of compassion for self and others can result from mindfulness-based training, compassion is not generally the central focus of these techniques. In contrast, meditation protocols have recently been developed that focus specifically on training individuals to feel and act more compassionately toward themselves and others [17, 18]. Although none of these compassion-specific practices have been studied in the context of cancer, findings from medically healthy individuals suggest that these techniques may impart HPA axis and immune effects relevant to emotional and physical health in the context of cancer survivorship.

The goal of this pilot study was to assess the feasibility, adherence, patient satisfaction, and possible behavioral effects of one compassion meditation program, Cognitively-Based Compassion Training (CBCT). CBCT is a secular adaptation of traditional Tibetan Buddhist methods for cultivating compassion known as *lojong* (trans. "mind training" or "thought transformation"). *Lojong* uses an analytical approach that incorporates intellectual analysis into meditation practice. Although "cognitively based" in its use of logical arguments to demonstrate the benefits of compassion, CBCT does not involve simply thinking about something intellectually. Rather, a series of contemplative exercises make compassion experiential and personally relevant, giving CBCT an active affective component [19, 20]. In addition, CBCT begins with training in concentrative and mindfulness practices to help novice meditators develop the attentional stability and non-reactive awareness needed to engage in the compassion practices [19].

In this study, we first sought to examine the feasibility of implementing an 8-week CBCT program plus a 4-week booster session with disease-free BC survivors treated with systemic adjuvant chemotherapy within the past 10 years. We evaluated participant interest and retention in the study, and adherence to the CBCT course requirements (class attendance and regular home practice). Second, we sought to examine whether CBCT would potentially impact a range of relevant behavioral endpoints, as well as the diurnal rhythm of cortisol (by way of saliva cortisol concentrations measured at various points throughout the day), when compared to wait list controls both immediately after class participation and a month later. We also assessed the impact of the amount of home practice time on outcomes.

Methods

A randomized wait list controlled trial design was used. Participants were assessed pre-/post 8 weeks of CBCT or a wait list condition. At study week 12, all subjects were re-assessed just prior to the "booster" session. The University of Arizona Institutional Review Board approved this study, and all participants provided informed consent.

Participants An a priori sample size calculation determined that 30 subjects would yield a 5 % margin of error (95 % confidence interval half-width) of no greater than 18 % for feasibility outcomes, using the formula for a single binary proportion. Assuming an ANCOVA using baseline outcomes as a covariate for continuous outcomes, with the correlation between baseline and follow-up =0.7, $n = 30$ gave 90 % power to detect a standardized effect size of 0.6, 77 % power for a standardized effect size of 0.5, and 55 % power for a standardized effect size of 0.4.

Included were women aged 18 years and older with a history of BC treated with adjuvant systemic chemotherapy within the past 10 years with no current chemotherapy other than prophylactic use of a selective estrogen-receptor modulator. Excluded were non-English speakers and those with severe psychiatric or substance use disorders, cognitive impairment, or medical condition determined to pose a risk to the participant or increase the likelihood of non-adherence. Past and current psychiatric and medical history was determined by clinician assessment. Participants received $120.

Screening, recruitment, and consent Two sources were used to identify potential participants. One was through the University of Arizona Comprehensive Cancer Center (UACC) from other breast cancer studies of the principal investigator and from psychosocial programs. For these, permissions had been previously obtained for contact about future studies. Eligibility screening was by the study nurse coordinator through research files and the electronic medical record. The second source was from media advertisements online through the home page of the UACC and by print through local newspapers. To recruit those identified through record reviews, the nurse coordinator made outreach telephone calls. No more than three calls were made to potential participants, and most were contacted within one to two calls. For those from media outlets, interested women contacted the nurse coordinator directly through telephone and email contact information included in the advertisements. Recruitment began on December 16, 2013, and ended on February 3, 2014, with minimal recruitment over the holidays. A CBCT eligibility form and prepared talking points were used to guide the phone calls. Those interested in participating were mailed/emailed the informed consent and protected health information forms for review prior to a scheduled enrollment visit. Signed informed consent forms were obtained by the nurse coordinator through face-to-face contact at the enrollment visit. Women were informed of the nature of the intervention, the requirements for salivary samples and home meditation practice; the randomization procedure; and the incentive. Thirty-three women were enrolled.

Randomization and blinding After consent, participants were randomly assigned with an equal allocation to CBCT or the wait list. Randomization was performed by the study biostatistician using stratified block randomization using random block size, as implemented in the ralloc module of the Stata statistical software package [21]. Study participants were blinded to group assignment until completion of all baseline assessments. The interventionist delivering CBCT could not be blinded.

CBCT protocol CBCT was delivered in eight weekly, 2-h classes through didactics, class discussion, and guided meditation practice. Topics covered in order include the following:

- Class 1: Developing meditative concentration (*shamatha*)
- Class 2: Developing a non-judgmental awareness of thoughts, internal bodily states, and environmental circumstances (*mindfulness*)
- Class 3: Examining of the causes of suffering (e.g., cognitive contributions to stress reactivity) and the practicing self-compassion, defined as a resolve to "emerge" from suffering by correcting faulty cognitions and reactions
- Class 4: Practice in equanimity and the perspective that all persons are alike in the common aspirations for happiness and freedom from suffering. Thoughts and feelings are examined that contribute to social bias by categorizing individuals as "friends, strangers, and difficult persons"
- Class 5: Practice in appreciation and gratitude for benefits received through social interconnection and interdependence
- Class 6: Practice in affection (endearment) as leading to greater empathy and ultimately compassion, with focus on developing endearment toward all others regardless of their relationship to one's self
- Class 7: Meditative exploration of the first stage of compassion, the aspirational wish that all beings be happy and free from suffering and its causes
- Class 8: Meditative strategies for deepening the aspiration for happiness and freedom from suffering for self and others, with focus on developing active compassion (i.e., a motivational readiness to act altruistically)

"**At-home**" **meditation practice** Participants were asked to meditate at least three times per week using audio recordings of guided meditations (average length 30 min), and to maintain a practice log. Participants accessed a private website (and/or received a flash drive) for the recordings.

Treatment fidelity The interventionist was a clinically trained Ph.D. social work researcher and experienced 20-year meditator fulfilling requirements for CBCT teacher certification of the Emory University-Tibet Science Initiative (ETSI). To ensure fidelity, 50 % of classes taught were video recorded and reviewed by the CBCT training supervisor at ETSI. The supervisor reviewed CBCT class plans weekly. The CBCT teacher manual [19] guided class content.

Wait list controls

Wait list controls were assessed at the same time points as the intervention group. Wait list subjects were offered the CBCT course at study completion.

Measures

Self-report questionnaires Validated self-report questionnaires were completed online using REDCap [22], a secure, web-based application for electronic data capture. The battery included the following:

- Four-item version of the Perceived Stress Scale (PSS-4) to assess global appraisal of perceived stressfulness of situations in the preceding 7 days [23].

- Brief Center for Epidemiologic Studies—Depression questionnaire (CES-D-10) to assess frequency of depression symptoms in the past 7 days [24, 25].
- Five subscales of the Fear of Cancer Recurrence Inventory (FCRI) to assess psychological distress and functioning impairments linked to fears of cancer recurrence, as well as dimensions of associated cognitions [26].
- Impact of Events Scale—Revised (IES-R) to assess intrusive thoughts, avoidance, and hyperarousal in the prior 7 days [27].
- Revised UCLA Loneliness Scale Version 3 (R-UCLA) to assess both perceptions of loneliness [28, 29] and a three-factor model of social connectedness [30].
- Medical Outcomes Study Short Form 12-Item Health Survey (SF-12) [31] to evaluate pain (frequency and interference with usual roles) and vitality (fatigue and energy level). The SF-12's two quality of life summary measures, the Physical and Mental Health Composite Scores, were also used.
- Cognitive and Affective Mindfulness Scale—Revised (CAMS-R 10) to assess global attention, awareness, present focus, and acceptance/non-judgment of thoughts and feelings in daily experience [32].
- Gratitude Questionnaire—6 (GQ-6) was used to tap proneness to experiencing gratitude in daily life [33].
- Participant satisfaction was assessed with two items (CBCT was beneficial to me, would recommend to family and friends).
- Demographic and descriptive information (baseline).

Salivary cortisol At-home collection kits were used to determine salivary cortisol concentrations. At baseline, study week 8, and study week 12, saliva samples were collected in the morning upon waking, in the afternoon, and an hour before bed over three continuous days using the Salivette (Sarstedt, Nümbrect, Germany). Samples were frozen at −20 °C after collection for later batch assay. Participants recorded the actual time of saliva sample collection on the collection kit instructions sheet returned with the saliva samples. Saliva concentrations of cortisol were determined with a quantitative enzyme immunoassay from Salimetrics (State College, PA) per manufacturer's specifications, and run in duplicate. Inter- and intra-assay variability were each less than 10 %. Diurnal cortisol rhythm was assessed as the change in cortisol slope across the day (see "Statistical methods").

Adherence to the CBCT protocol Adherence was assessed in two ways. Participants logged home practice time between classes and during the 4 weeks prior to the booster class on a practice log form (number of sessions and minutes, use of audio recordings, open-ended reflections). In calculating practice time, only "at-home" practice was included, not meditation time during classes. Adherence was also assessed by participant attendance at weekly classes as recorded by the teacher.

Statistical methods

Feasibility outcomes were summarized using a proportion and 95 % confidence interval (CI), or a rate and confidence interval using the Poisson distribution. All continuous outcomes were analyzed using ANCOVA mixed models, with the baseline outcome measurement as a covariate and participant as a random effect. Differences at post-intervention and follow-up between the treatment and control groups for each outcome (participant reported and biomarkers) were computed from these models. All participants who had any data collected were included in the analysis by using a mixed model, which is consistent with an intent-to-treat analysis [34]. To assess possible dose-response relationships between engagement with CBCT and behavioral/biological outcomes, partial correlations were employed to examine the association of CBCT practice time during the study, measured as total minutes of practice time over the 8-week CBCT course, with all

Table 1 Feasibility outcomes

Outcome	Value (rate or proportion)	95 % CI	Feasibility criteria	Feasible?
Recruitment rate	19/month	11, 30	On average, 25 participants/month will be recruited over 2 months.	No[a]
Screening and enrollment rate	33 enrolled of 160 screened (21 %)	15, 28	At least 20 % of people contacted will be screened and enrolled.	Yes
Class attendance 6/8	12/16 = 75 %	48, 93	At least 50 % of participants randomized to the CBCT arm will attend at least 6 (75 %) classes.	Yes
Adherence			At least 70 % of participants randomized to the CBCT arm will practice 3 times/week min 20 min.	Yes
Retention	22/33 = 67 %	48, 82	At least 70 % of participants will have follow-up data.	No
Participant satisfaction	11/12 = 92 %	62, 100	At least 70 % of completing participants will rate their satisfaction with the program highly.	Yes

[a] But is contained in the 95 % CI

behavioral outcomes at study weeks 8 and 12 in the group randomized to CBCT, while accounting for baseline values of each measure. Given the exploratory nature of the study, no correction was made for multiple comparisons.

To evaluate diurnal cortisol rhythm, the mean cortisol slope was computed for each participant at each data collection period (baseline, post-intervention, and 1-month follow-up). Cortisol slope was computed taking into account the actual times of the day that the samples were collected. To be consistent with previous methods, cortisol values were log transformed before slopes were computed since these values are typically skewed. We graphed the standardized mean difference between intervention and control for each outcome, at post-intervention and follow-up. These were computed as the difference in means divided by the standard deviation. All analyses were performed in SAS v9.4.

Results

Feasibility Success in implementation feasibility was examined using pre-defined criteria (Table 1):

i. Recruitment, enrollment, and dropout. In a 7-week period, 160 BC survivors were screened for eligibility, 127 were excluded (did not meet criteria or declined participation), and 33 were enrolled and randomized. The recruitment rate was 19/month (95 % CI 11, 30), which was slightly less than our feasibility criteria of 25 per month, although this value is contained in the 95 % CI. Of the 16 randomized to the intervention, 4 withdrew due to medical problems requiring treatment or recurrent difficulties in scheduling due to conflicting medical appointments; 12 completed CBCT. Of the 17 randomized to wait list, one withdrew due to medical problems. Figure 1 presents the CONSORT participant flow diagram.

ii. Attendance. Twelve of the 16 participants randomized to the intervention arm did not withdraw from the study. Our pre-defined feasibility criterion was that at least 50 % of participants randomized to the CBCT arm would attend at least 6 (75 %) classes. These 12 participants met this criterion (75 %, 95 % CI 48, 93 %) with a mean = 7.33 (SD = 0.78) of the CBCT classes.

iii. Home meditation practice. The mean number of days per week of home practice for the CBCT group was 3.6

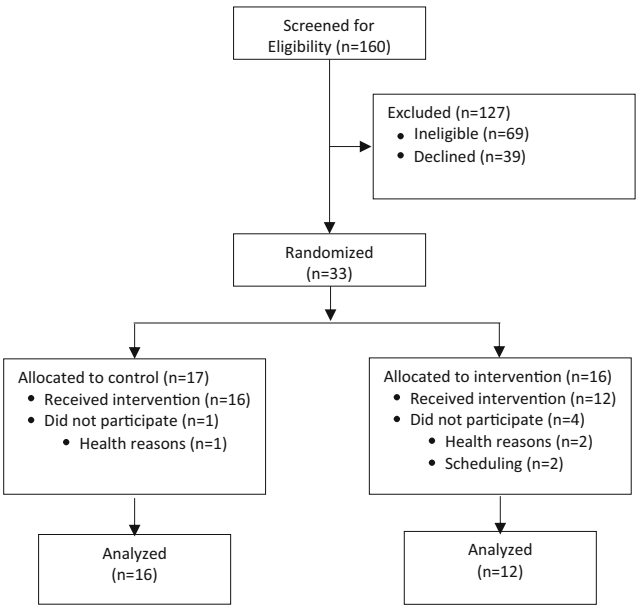

Fig. 1 CONSORT participant diagram

Table 2 Participant characteristics. Values shown as means (SD) or *n* (%)

Characteristic	CBCT (*n* = 12)	Control (*n* = 16)
Age (years)	54.7 (12.1)	55.8 (9.7)
Time since first diagnosis (years)	4.8 (3.2)	5.8 (6.0)
Stage at first diagnosis		
I	3 (25)	1 (6)
II	5 (42)	9 (56)
III	4 (33)	4 (25)
IV	0 (0)	2 (13)
Treatments for breast cancer[a]		
Partial mastectomy	3 (25)	3 (19)
Total mastectomy	7 (58)	9 (56)
Radiation therapy	8 (67)	14 (88)
Chemotherapy	12 (100)	16 (100)
Other	3 (25)	8 (50)
Cancer prophylaxis medication	8 (67)	5 (31)
Meditation experience		
None	7 (58)	10 (63)
Occasionally	3 (25)	6 (38)
At least once a week	2 (17)	0 (0)
Highest level of education		
High school diploma or less	0 (0)	2 (13)
Any college	6 (50)	8 (50)
Any graduate school	6 (50)	6 (38)
Employment status (employed)	8 (67)	10 (63)
Ethnicity		
White	11 (92)	12 (75)
Not White	1 (8)	4 (25)
Married	6 (50)	6 (38)
Income (family)		
<$25,000	0 (0)	2 (13)
$25,001–$49,999	3 (25)	2 (13)
$50,000–$99,999	6 (50)	9 (56)
>$100,000	3 (25)	3 (19)

[a] Participants could select more than one option

(range 2.8–4.3). The mean practice time in minutes across the 8-week intervention period was 738.5 (SD = 330.3).

iv. Retention. Of the 33 randomized participants, 22 had follow-up data (67 %, 95 % CI 48, 82 %), slightly less than the targeted proportion of 70 %.

v. Participant satisfaction. Eleven of the 12 participants who completed CBCT reported being highly satisfied with the CBCT program based on their responses to the satisfaction items administered following course completion (92 %, 95 % CI 62, 100 %).

Baseline characteristics Thirty-three women were randomized to the wait list ($n = 17$) or intervention ($n = 16$) (Table 2). Characteristics were similar between groups in terms of age, BC stage at diagnosis, treatment with total mastectomy, race/ethnicity, education, and household income. Time since diagnosis was 4.8 years in the CBCT group and 5.8 years in the control group. More controls (88 %) had received radiation treatment than those in the CBCT group (67 %), but more in the CBCT group (67 %) were on cancer prophylaxis (31 %). The majority of women in both groups had no prior meditation experience.

Behavioral and psychosocial outcomes Table 3 displays the means, standard deviations, and differences for the study assessments at each time point (see also Fig. 2). From baseline to study week 8, participants assigned to the CBCT group demonstrated reduced depressive symptoms (−3.7, 95 % CI −6.3, −1.1); reduced functional impairment due to fear of cancer recurrence (e.g., future planning, close relationships, social and work activities) (−1.3, 95 % CI −2.5, −0.1); reduced avoidance (−0.3, 95 % CI −0.6, −0.02); improvement in fatigue/vitality (5.5, 95 % CI 1.5, 9.6); and enhanced mindful presence (3.6, 95 % CI 1.2, 6.0). There were no other significant differences between the groups in behavioral or psychosocial outcomes at study week 8. At the 4-week follow-up

Table 3 Means, standard deviations, and differences between intervention and control for all psychosocial and biomarker outcomes at baseline, post-intervention, and at the 4-week FU

Outcome	Possible range	Mean (SD)					Intervention–control (95 % CI)		
		Intervention			Control		1-month FU ($N = 11$)	Post	1-month FU
		Baseline ($N = 12$)	Post ($N = 12$)	1-month FU ($N = 11$)	Baseline ($N = 16$)	Post ($N = 16$)			
Perceived stress	0–16	5.4 (2.1)	3.5 (1.5)	3.5 (2.7)	5.4 (2.9)	4.7 (2.5)	5.1 (3.0)	−1.2 (−2.5, 0.2)	−1.6 (−3.1, −0.2)*
Depression	0–30	6.4 (4.6)	2.8 (3.1)	4.2 (5.2)	6.3 (5.7)	6.5 (6.3)	5.5 (5.0)	−3.7 (−6.3, −1.1)**	−1.3 (−4.2, 1.6)
FCR: triggers	0–32	14.3 (6.3)	12.4 (5.6)	14.2 (8.2)	13.3 (5.4)	14.6 (6.9)	12.5 (5.8)	−2.2 (−6.0, 1.6)	1.7 (−2.4, 5.8)
FCR: severity	0–36	15.2 (5.6)	12.9 (6.6)	14.2 (6.9)	15.1 (8.0)	13.8 (6.8)	13.7 (8.5)	−0.9 (−2.9, 1.2)	0.6 (−1.7, 2.8)
FCR: psychological distress	0–16	4.9 (4.2)	3.3 (3.1)	3.7 (3.4)	4.6 (2.7)	3.4 (2.3)	3.3 (4.5)	−0.1 (−1.5 1.3)	0.4 (−1.2, 2.0)
FCR: functioning impairments	0–32	2.7 (3.5)	1.2 (1.9)	3.0 (3.2)	2.6 (3.7)	2.5 (3.0)	1.7 (2.7)	−1.3 (−2.5–0.1)*	1.3 (−0.1, 2.7)
FCR: insight	0–12	1.4 (2.1)	0.9 (2.0)	0.7 (1.5)	1.2 (2.0)	1.2 (1.8)	1.1 (2.1)	−0.3 (−0.8, 0.2)	−0.3 (−0.9, 0.3)
Traumatic stress: intrusion	0–4	0.7 (0.8)	0.6 (0.6)	0.4 (0.8)	0.6 (0.3)	0.6 (0.4)	0.5 (0.3)	−0.1 (−0.3, 0.2)	−0.1 (−0.3, 0.2)
Traumatic stress: avoidance	0–4	1.0 (1.0)	0.6 (0.6)	0.8 (0.8)	0.9 (0.8)	0.9 (0.8)	0.7 (0.8)	−0.3 (−0.6, −0.02)*	0.1 (−0.2, 0.4)
Traumatic stress: hyperarousal	0–4	0.6 (0.6)	0.3 (0.4)	0.4 (0.7)	0.5 (0.5)	0.4 (0.5)	0.4 (0.4)	−0.1 (−0.3, 0.2)	−0.003 (−0.3, 0.3)
Traumatic stress: global	0–16	2.2 (2.2)	1.5 (1.4)	1.7 (2.1)	2.1 (1.4)	1.9 (1.2)	1.6 (1.3)	−0.4 (−1.0, 0.2)	0.04 (−0.6, 0.7)
Loneliness	20–80	38.3 (10.6)	34.5 (9.4)	35.5 (10.2)	38.8 (16.2)	37.4 (15.4)	37.9 (16.6)	−2.9 (−7.7, 2.0)	−2.5 (−7.9, 3.0)
Mindfulness	10–40	28.8 (4.1)	31.9 (4.2)	31.2 (4.8)	28.6 (5.5)	28.3 (5.0)	28.1 (5.3)	3.6 (1.2, 6.0)*	3.1 (0.4, 5.8)*
Gratitude	6–42	36.1 (4.9)	38.1 (5.8)	38.2 (5.3)	35.7 (6.4)	37.5 (5.0)	37.0 (5.7)	0.5 (−1.9, 3.0)	1.2 (−1.5, 3.9)
Vitality/fatigue	0–100	54.6 (6.6)	56.2 (5.8)	53.6 (6.9)	54.5 (8.9)	50.7 (9.4)	53.3 (9.1)	5.5 (1.5, 9.6)**	0.3 (−4.2, 4.9)
Bodily pain	0–100	48.2 (10.2)	51.6 (8.1)	50.1 (10.3)	48.4 (9.8)	49.6 (10.2)	52.0 (7.0)	2.0 (−3.1, 7.0)	−1.9 (−7.5, 3.8)
Physical well-being	0–100	50.4 (7.0)	50.9 (7.6)	49.7 (7.6)	50.6 (9.8)	51.1 (8.8)	54.0 (4.9)	−0.1 (−3.2, 2.9)	−4.3 (−7.7, −0.9)*
Mental well-being	0–100	49.6 (5.9)	50.4 (5.4)	50.9 (7.1)	48.9 (11.7)	48.4 (10.6)	46.5 (10.4)	2.0 (−2.4, 6.5)	4.4 (−0.6, 9.3)
Biomarkers									
Salivary cortisol (a.m.)		−1.3 (0.4)	−1.1 (0.3)	−1.3 (0.5)	−1.3 (0.3)	−1.2 (0.5)	−1.2 (0.5)	0.1 (−0.2, 0.4)	−0.01 (−0.3, 0.3)
Salivary cortisol (p.m.)		−3.0 (0.5)	−3.3 (0.9)	−2.9 (0.8)	−3.0 (0.8)	−3.0 (0.8)	−2.8 (1.0)	−0.3 (−0.9, 0.3)	−0.01 (−0.6, 0.6)
Change in salivary cortisol/h[a]		−0.1 (0.1)	−0.2 (0.1)	−0.1 (0.1)	−0.1 (0.1)	−0.1 (0.1)	−0.1 (0.1)	−0.04 (−0.1, 0.005)	−0.02 (−0.1, 0.04)

SD standard deviation, *CI* confidence interval, *FCR* fear of cancer recurrence

***<0.05; <0.01

[a] Salivary cortisol (*N*): intervention (12, 12, 12); control (15, 13, 14)

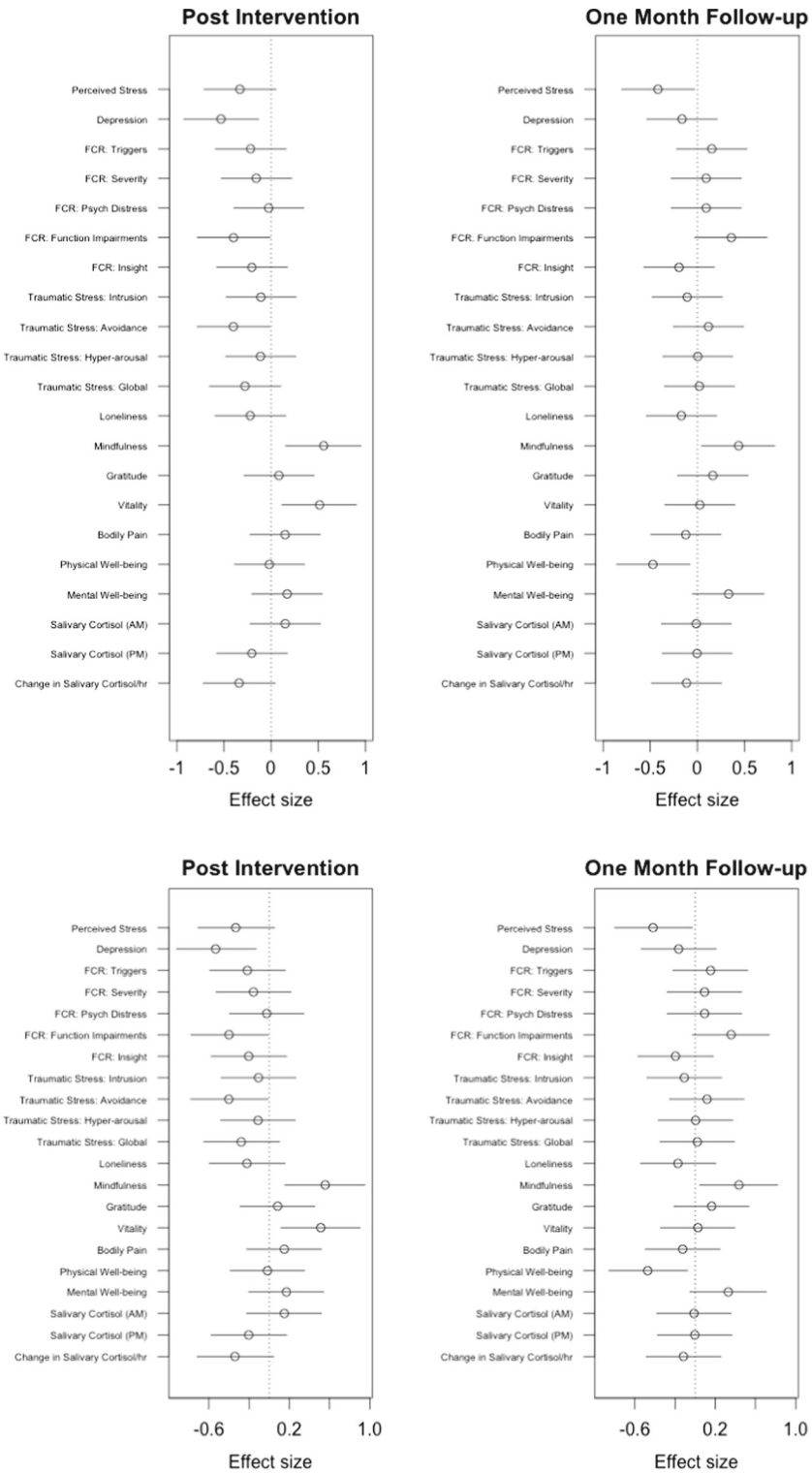

Fig. 2 Standardized effect sizes of differences between intervention and control for all psychosocial and biomarker outcomes at post-intervention and 4-Week FU

Abbreviations: FCR = Fear of Cancer Recurrence

assessment (study week 12), the CBCT arm had significantly lower levels of perceived stress in the past week (−1.6, 95 % CI −3.1, −0.2) as well as enhanced mindful presence (3.1, 95 % CI 0.4, 5.8), but lower physical well-being (−4.3, 95 % CI −7.7, −0.9) when compared to the wait list control group. There were no other significant differences at the 4-week follow-up.

Cortisol and diurnal cortisol rhythm The mean saliva cortisol concentration upon morning waking was 0.33 μg/dL

(SD = 0.10), and before bed was 0.09 μg/dL (SD = 0.08). There were no significant differences between groups in any measure of saliva cortisol or diurnal cortisol rhythm at either of the post-baseline assessments.

Home meditation practice Table 4 displays the partial correlation of practice time with each outcome at post-intervention and at 4-weeks follow-up (FU). The severity and psychological distress scales of the fear of cancer recurrence showed significant, inverse correlations with total practice time (ρ = −0.65, 95 % CI −0.91, −0.03, and ρ = −0.65, 95 % CI −0.91, −0.04, respectively) at 4-week FU. Total practice time across the entire 12-week study period moderately correlated with vitality at 4-week FU (ρ = 0.55, 95 % CI −0.12, −0.88). No associations were observed between total practice time and saliva cortisol.

Conclusions and relevance

Given the complex co-occurring psychosocial and physiological challenges that face many BC survivors, a great need exists to provide restorative and possibly preventive interventions during survivorship. Although studies suggest that mindfulness-based meditation benefits well-being during cancer survivorship, to our knowledge, the current study is the first to explore a specific compassion-based meditation protocol with cancer survivors.

Results from this pilot study suggest that CBCT is a feasible 8-week intervention that is well accepted and highly satisfactory to BC survivors. However, while our recruitment rate was contained within confidence interval calculations, it was still lower than planned. There was also a possible bias due to our recruitment strategy that may have resulted, for example, in more participants of higher educational status than the general population of breast cancer survivors locally. However, we believe this may be due to the appeal of novel interventions such as meditation to persons with more formal education. Both of these feasibility results indicate that future recruitment efforts will need to expand.

Our findings also suggest a potentially positive impact on self-report of problems commonly experienced during survivorship. These include depression, cognitive avoidance, distress, and functional impairment due to the anxiety of cancer recurrence, and vitality/fatigue. CBCT also increased self-reported mindfulness/presence. That CBCT reduced depression and fatigue is potentially quite important, not only because of the suffering and impairment from these symptoms

Table 4 Partial correlation of total practice time (in minutes) with psychosocial and biomarker outcomes at post-intervention and 4-week FU (accounting for baseline values) in the CBCT arm (n = 12)

Outcome	1-month follow-up	
	Correlation (95 % CI)	Correlation (95 % CI)
Perceived stress	−0.27 (−0.75, 0.39)	−0.01 (−0.64, 0.62)
Depression	0.17 (−0.48, 0.70)	−0.26 (−0.77, 0.44)
FCR: triggers	−0.16 (−0.72, 0.52)	−0.14 (−0.71, 0.53)
FCR: severity	−0.56 (−0.87, 0.07)	−0.65 (−0.91, −0.03)
FCR: psychological distress	−0.33 (−0.78, 0.33)	−0.65 (−0.91, −0.04)
FCR: functioning impairments	−0.13 (−0.51, 0.68)	−0.20 (−0.74, 0.49)
FCR: insight	−0.26 (−0.74, 0.41)	−0.15 (−0.71, 0.53)
Traumatic stress: intrusion	0.41 (−0.53, 0.66)	0.05 (−0.60, 0.66)
Traumatic stress: avoidance	0.10 (−0.68, 0.51)	−0.08 (−0.68, 0.58)
Traumatic stress: hyperarousal	−0.14 (−0.53, 0.66)	−0.01 (−0.63, 0.63)
Traumatic stress	0.11 (−0.68, 0.51)	−0.03 (−0.65, 0.61)
Loneliness	−0.07 (−0.64, 0.56)	−0.04 (−0.66, 0.60)
Mindfulness	−0.10 (−0.66, 0.53)	0.01 (−0.62, 0.63)
Gratitude	−0.03 (−0.62, 0.58)	0.21 (−0.49, 0.74)
Vitality/fatigue	0.39 (−0.28, 0.80)	0.55 (−0.12, 0.88)
Bodily pain	0.14 (−0.50 0.69)	−0.38 (−0.81, 0.33)
Physical well-being	0.22 (−0.44, 0.72)	−0.39 (−0.82, 0.31)
Mental well-being	0.07 (−0.56, 0.64)	0.13 (−0.54, 0.70)
Biomarkers		
Salivary cortisol (a.m.)	−0.08 (−0.65, 0.55)	0.21 (−0.45, 0.72)
Salivary cortisol (p.m.)	0.25 (−0.41, 0.74)	0.37 (−0.30, 0.79)
Change in salivary cortisol/h[a]	0.41 (−0.27, 0.81)	0.04 (−0.57, 0.62)

CI confidence interval, *FCR* fear of cancer recurrence

but also because both have been associated with reduced survival [35–38]. No effect of CBCT was observed on any measure of cortisol (including diurnal cortisol rhythm). Practice time in the CBCT group was not significantly associated with most behavioral or biological outcome variables.

Although CBCT participants reported meditating at home frequently and regularly on self-maintained logs, with the exception of associations between overall practice time during the 12-week study period and reductions in the severity of fear of recurrence and the resulting psychological distress caused by fear of cancer recurrence, practice time was not significantly associated with other variables assessed. Several reasons may account for this finding. First, three participants, 25 % of the group, did not return practice log data at the FU period, thus potentially accounting for the waning of effects over time. Second, although in our previous studies of CBCT with different populations we observed associations between behavioral and physiological outcomes and amount of practice time [18, 39], the women in this study actually engaged in more reported "at-home" practice than was observed in prior CBCT studies. This may have produced a "ceiling effect" masking the causal efficacy of increasing practice time in the current study. Nonetheless, efforts to enhance and accurately document participants' home practice are highly warranted, and future studies should incorporate supports such as email reminders, smartphone apps with time-tracking capacity, and possibly motivational interviewing techniques.

Past studies have also suggested that CBCT may impact the hypothalamic-pituitary-adrenal (HPA) axis and immune function in ways likely to benefit health via improved resilience to stress. In the current study, we examined the impact of CBCT on diurnal cortisol rhythm, as measured by salivary cortisol at various points throughout the day. In contradistinction to our earlier, unpublished, CBCT study of adolescents in foster care that found a correlation between practice time and a.m. cortisol levels, no associations of cortisol with either group assignment or practice time were observed in the current study. Whether this reflects differences in the respective study populations, the small sample size, or other unidentified factors is unknown, but an implication from the current study is that at least some of the short-term behavioral effects of CBCT are not dependent on, and may not be reflected in, changes in HPA axis function. Elucidation of other mechanisms would be critical in future studies.

In summary, while recognizing the limitations inherent in a pilot investigation, this study showed CBCT to be a feasible and well-accepted intervention for BC survivors. Moreover, though caution must be exercised in overestimating the effects of this trial given its limitations, results suggest that participants were able to acquire and practice a set of inter-related skills focused on enhancing compassion, and that these skills may show promise in improving dimensions of psychological well-being in the context of cancer survivorship.

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Conflict of interest The authors declare that they have no competing interests.

References

1. Thewes B, Brebach R, Dzidowska M, Rhodes P, Sharpe L, Butow P (2014) Current approaches to managing fear of cancer recurrence: a descriptive survey of psychosocial and clinical health professionals. Psycho-Oncology 23:390–396
2. Thewes B, Butow P, Bell ML, Beith J, Stuart-Harris R, Grossi M, Capp A, Dalley D (2012) Fear of cancer recurrence in young women with a history of early-stage breast cancer: a cross-sectional study of prevalence and association with health behaviours. Support Care Cancer 20:2651–2659
3. Bleiker EM, Pouwer F, van der Ploeg HM, Leer JW, Ade'r HJ (2000) Psychological distress two years after diagnosis for breast cancer: frequency and prediction. Patient Educ Couns 40:209–217
4. Burgess C, Cornelius V, Love S, Graham J, Richards M, Ramirez A (2005) Depression and anxiety in women with early breast cancer: five-year observational cohort study. BMJ 330:702
5. Bower JE, Ganz PA, Desmond KA, Rowland JH, Meyerowitz BE, Belin TR. (2000) Fatigue in breast cancer survivors: occurrence, correlates, and impact on quality of life. J Clin Onc 18:743–743.
6. Bower JE, Ganz PA, Irwin MR, Kwan L, Breen EC, Cole SW (2011) Inflammation and behavioral symptoms after breast cancer treatment: do fatigue, depression, and sleep disturbance share a common underlying mechanism? J Clin Onc 29:3517–3522
7. Rokach A (2000) Correlates of loneliness as perceived by the terminally ill. Curr Psychol 19(3):237–248
8. Rosedale M (2009) Survivor loneliness of women following breast cancer. Onc Nurs Forum 36:175–183
9. Kabat-Zinn J (1990) Full catastrophe living: using the wisdom of your body and mind to face stress, pain, and illness. Dell Publishing, New York
10. Carlson LE, Speca M, Patel KD, Goodey E (2003) Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer outpatients. Psychosom Med 65:571–581
11. Witek-Janusek L, Albuquerque K, Chroniak KR, Chroniak C, Durazo-Arvizu R, Mathews HL (2008) Effect of mindfulness-based stress reduction on immune function, quality of life and coping in women newly diagnosed with early stage breast cancer. Brain Behav Immun 22:969–981
12. Carlson LE, Beattie TL, Giese–Davis J, Faris P, Tamagawa R, Fick LJ, Degelman E, Speca M. (2014) Mindfulness-based cancer recovery and supportive-expressive therapy maintain telomere length relative to controls in distressed breast cancer survivors. Cancer 121:476–484.
13. Ledesma D, Kumano H (2009) Mindfulness-based stress reduction and cancer: a meta-analysis. Psycho Oncology 18:571–579
14. Carlson LE, Doll R, Stephen J, Faris P, Tamagawa R, Drysdale E, Speca M (2013) Randomized controlled trial of mindfulness-based cancer recovery versus supportive expressive group therapy for distressed survivors of breast cancer (MINDSET). J Clin Onc 31: 3119–3126

15. Pinto-Gouveia J, Duarte C, Matos M, Fráguas S (2014) The protective role of self-compassion in relation to psychopathology symptoms and quality of life in chronic and in cancer patients. Clin Psych Psychot 21:311–323
16. Hall CW, Row KA, Wuensch KL, Godley KR (2013) The role of self-compassion in physical and psychological well-being. J Psychol 147:311–323
17. Jazaieri H, Jinpa GT, McGonigal K, Rosenberg EL, Finkelstein J, Simon-Thomas E, Cullen M, Doty JR, Gross JJ, Goldin PR (2013) Enhancing compassion: a randomized controlled trial of a compassion cultivation training program. J Happiness Stud 14:1113–1126
18. Pace TWW, Negi LT, Adame DD, Cole SP, Sivilli TI, Brown TD, Issa MJ, Raison CL (2009) Effect of compassion meditation on neuroendocrine, innate immune and behavioral responses to psychosocial stress. Psychoneuroendocrino 34(1):87–98
19. Negi LT. (2013) Emory compassion meditation protocol: cognitively-based compassion training manual. Atlanta, Ga., Emory University.
20. Ozawa-de Silva B, Dodson-Lavelle B. (2011) An education of heart and mind: practical and theoretical issues in teaching cognitively-based compassion training to children. Practical Matters 4:1–28, Atlanta, Ga, Emory University.
21. StataCorp. (2013)Stata statistical software: release 13. College Station, TX: StataCorp LP.
22. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG (2009) Research electronic data capture (REDCap): a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform 42:377–381
23. Cohen S, Kamarck T, Mermelstein R (1983) A global measure of perceived stress. J Health Soc Behav 24:385–396
24. Radloff LS (1977) The CES-D scale: a self-report depression scale for research in the general population. Appl Psych Measure 1(3): 385–401
25. Kohout FJ, Berkman LF, Evans DA, Cornoni-Huntley J (1993) Two shorter forms of the CES-D depression symptoms index. J Aging Health. 5:179–193
26. Simard S, Savard J (2009) Fear of cancer recurrence inventory: development and initial validation of a multidimensional measure of fear of cancer recurrence. Support Care Cancer 17:241–251
27. Weiss DS, Marmar CR (1996) The impact of event scale—revised. In: Wilson J, Keane TM (eds) Assessing psychological trauma and PTSD. Guilford, New York, pp. 399–411
28. Russell D, Peplau LA, Cutrona CE (1980) The Revised UCLA Loneliness Scale: concurrent and discriminant validity evidence. J Person Soc Psychol 39:472–480
29. Russell DW (1996) UCLA Loneliness Scale (version 3): reliability, validity, and factor structure. J Personality Assessment 66(1):20–40
30. Dussault M, Fernet C, Austin S, Leroux M (2009) Revisiting the factorial validity of the Revised UCLA Loneliness Scale: a test of competing models in a sample of teachers. Psychol Rep 105:849–856
31. Ware J, Kosinski M, Keller SD (1996) A 12-item short-form health survey: construction of scales and preliminary tests of reliability and validity. Med Care 34:220–233
32. Feldman G, Hayes A, Kumar S, Greeson J, Laurenceau JP (2007) Mindfulness and emotion regulation: the development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). J Psychopathol Behav Assess *29*:177–190
33. McCullough ME, Emmons RA, Tsang JA (2002) The grateful disposition: a conceptual an empirical topography. J Person Soc Psychol 82:112–127
34. Jansen, C, Beunckens, MG, Kenward, C, Mallinckrodt, Carroll, RJ. (2004). Analyzing incomplete longitudinal clinical trial data. *Biostatistics* *5*(3):445–464.
35. Satin JR, Linden W, Phillips MJ (2009) Depression as a predictor of disease progression and mortality in cancer patients. Cancer 115: 5349–5361
36. Pinquart M, Duberstein PR (2010) Depression and cancer mortality: a meta-analysis. Psychol Med 40:1797–1810
37. Groenvold M, Petersen MA, Idler E, Bjorner JB, Fayers PM, Mouridsen HT (2007) Psychological distress and fatigue predicted recurrence and survival in primary breast cancer patients. *Breast Cancer Res Treatment 105*:209–219
38. Giese-Davis J, Collie K, Rancourt KM, Neri E, Kraemer HC, Spiegel D (2011) Decrease in depression symptoms is associated with longer survival in patients with metastatic breast cancer: a secondary analysis. J Clin Onc 29:413–420