

## Effects of an online mindfulness-based intervention on Fear of Cancer Recurrence and quality of life among Chinese breast cancer survivors

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### ABSTRACT

**Objective:** Mindfulness-based interventions (MBIs) targeting cancer-related emotions and quality of life have attracted extensive attention in recent years. The purpose of the current study was to assess the feasibility and acceptability of an online mindfulness-based intervention and examine its effects on Chinese breast cancer survivors.

**Methods:** Sixty-five breast cancer survivors were randomized to either an online MBI or to wait for the next available program. The control group received usual care, while the intervention group also received six weeks of online MBI training. Participants completed the Short Form of the Fear of Cancer Recurrence Inventory (FCRI-SF), Five Facet Mindfulness Questionnaire (FFMQ) and European Organization for Research and Treatment of Cancer questionnaire (EORTC-QLQ-C30) at baseline (T1), immediately after the intervention (postintervention: T2) and 1 month later (1-month postintervention: T3). In addition, answers provided to questions about the experience of participating in the course were analyzed.

**Results:** Compared with the control group, the mindfulness, emotional and cognitive function of the MBI group was significantly improved after the intervention, and the FCR of breast cancer survivors was significantly alleviated. These effects were still significant 1 month after the end of the intervention. Additionally, participants were satisfied with the online MBI through the qualitative survey.

**Conclusion:** This online MBI showed promise for Chinese breast cancer survivors, facilitating a reduction in FCR and improving their quality of life. The results of our study indicated that online MBI treatment could offer a scalable approach to manage FCR and maintain mental health for breast cancer survivors.

Breast cancer is the most commonly diagnosed cancer with the highest cancer incidence rate and fatality rate for women worldwide [1]. With the progress of modern medicine and the improvement of cancer diagnosis and treatment, the survival rate of breast cancer patients is exhibiting a rapid upward trend [2]. Meanwhile, the demand for follow-up rehabilitation and improvement in quality of life has become an important issue in public health. Currently, it has been reported that breast cancer survivors have the most common 5-year survival rate among all cancer types in China [3].

Although improvement in the early diagnosis and treatment of breast cancer has greatly prolonged the life span of patients, breast cancer survivors face chronic psychological stress and are vulnerable to negative emotions such as fear and anxiety [4]. Fear of cancer recurrence (FCR) is the fear that cancer could return or progress in the same place or

another part of the body [5] and has become the most prominent and prevalent emotional characteristic for breast cancer survivors [6]. According to previous studies, approximately 39%–97% of breast cancer survivors have experienced FCR [7]. Mild or temporary FCR has a certain protective effect on patients, as it can prompt individuals to pay attention to physical changes and detect signs of cancer recurrence in a timely manner, which is conducive to early intervention. However, excessive FCR will not only reduce patients' treatment compliance but also affect their prognosis of the disease, thereby even increasing the risk of recurrence [8]. Additionally, breast cancer survivors with high FCR engage in more medical behaviors and thus consume more medical resources [9]. Moreover, all aspects of patients' health-related quality of life, including physical, psychological, and social aspects, are continuously affected by psychosocial symptoms and side effects of cancer

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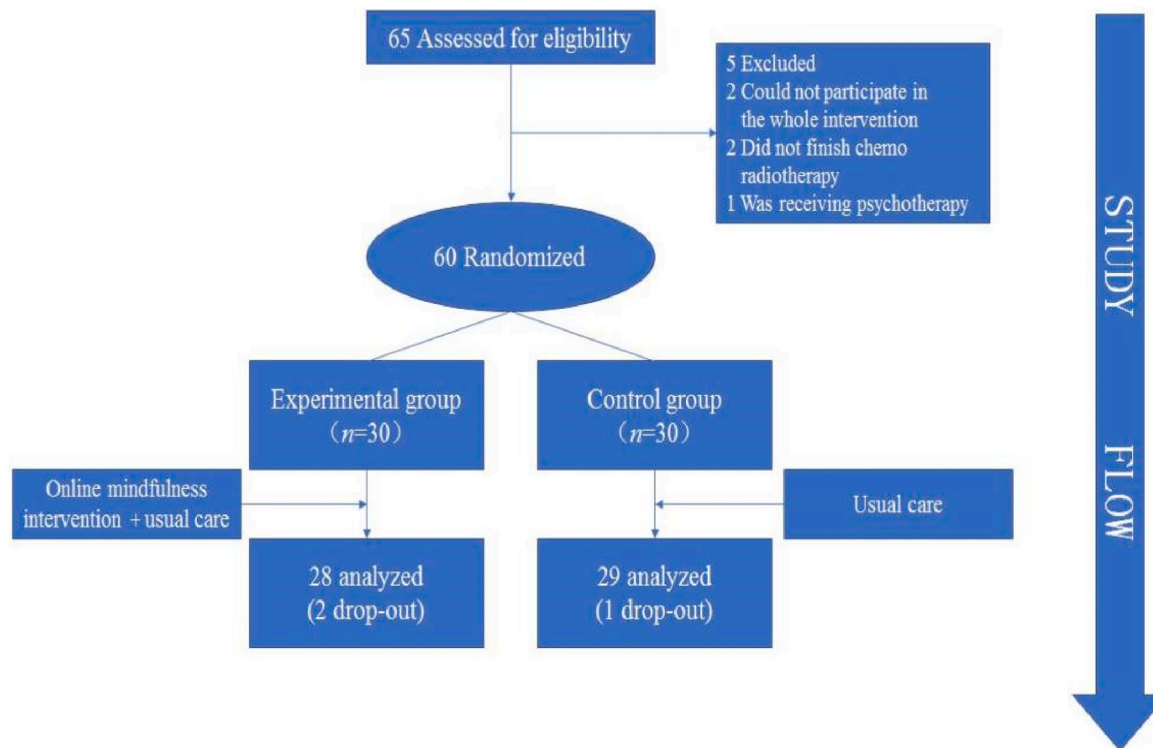


Fig. 1. Flowchart of recruitment and dropout.

treatment [10]. Tran and colleagues surveyed 333 long-term breast cancer survivors and found that FCR significantly and negatively impacted emotional functioning, and a higher FCR level may impair overall health-related quality of life in long-term breast cancer survivors [11].

Given the negative impact of FCR on quality of life, there has been growing interest in developing and conducting interventions to manage the FCR faced by breast cancer survivors. Extensive research has been carried out to alleviate breast cancer survivors' FCR through psychological interventions such as cognitive behavioral therapy, stress management, and mindfulness-based interventions (MBIs) [12,13]. Recently, MBIs have demonstrated benefits and have been found to moderate the negative impact of FCR on the quality of life of breast cancer survivors. Mindfulness is the practice of directing focused attention toward experiences occurring in the present moment and empowering a state of awareness without judgment or resistance. MBIs can regulate potential biological variables related to stress, such as immune function, hypothalamic pituitary adrenaline regulation and autonomic nervous system activity [14]. Among the interventions, mindfulness-based training was listed as the first and best recommended item for the treatment of anxiety and depression in cancer patients and measures to improve the quality of life by the International Association for Integrated Clinical Cancer Care in 2014. A randomized controlled trial of mindfulness-based stress reduction (MBSR) therapy for stage 0 to III breast cancer showed improvements in fear of recurrence, depression, anxiety, physical functioning, physical role functioning, energy, and pain [15]. This evidence indicated that MBSR was recommended to support survivors of breast cancer.

However, owing to service costs and patient mobility restrictions, the utilization and availability of MBIs for breast cancer survivors has been limited. Compared with face-to-face interventions, online interventions have a number of advantages. Online MBIs may be an acceptable alternative to face-to-face interventions, and online psychotherapeutic interventions have been demonstrated to be more suitable for individuals with psychological symptoms and physical symptoms [16].

Therefore, providing online therapies for breast cancer survivors after routine care has been shown to be a promising approach to address these challenges. However, although some foreign researchers have investigated the effect of online MBIs in high-income countries, little is known about the efficacy of this approach among Chinese breast cancer survivors.

Given the proven value of MBIs in promoting mental health outcomes in other populations, it is important to investigate the potential benefits of their online form among Chinese breast cancer survivors. Therefore, the purpose of this study was to assess the long-term effect of an MBI on FCR and quality of life among breast cancer survivors and to explore a feasible and propagable intervention scheme to reduce the FCR among breast cancer survivors and promote their quality of life.

## 1. Methods

### 1.1. Participants

All participants were recruited from the First Affiliated Hospital of Army Medical University from November 2019 to January 2020. The inclusion criteria were as follows: (1) women diagnosed with stage I-IV breast cancer; (2) women aged 18–65 years; (3) women with a junior middle school education or above; (4) completion of all treatments with the exception of hormonal or Herceptin therapy and no cancer recurrence or metastasis; and (5) no mindfulness-based training experience. The exclusion criteria for all participants were (1) current use of psychotropic medications; (2) severe cognitive impairment or mental disorder; and (3) inability to complete scale evaluation and mindfulness-based training. Finally, a total of 65 breast cancer survivors were recruited. Before entering the group, each participant was phone-screened for eligibility. The intervention settings and specific requirements were explained. Two patients voluntarily withdrew from the course because they could not participate in the whole intervention, 2 patients did not finish chemoradiotherapy, and 1 was receiving psychotherapy; ultimately, 60 breast cancer survivors were recruited. The

**Table 1**  
Six-week mindfulness-based intervention program.

Week	Theme	Mindfulness-based Intervention
1st week	Introduction to Mindfulness	Introduce mindfulness/mindfulness drinking practice, then discussion and response regarding this practice (formal practice following the audio and bringing mindfulness to daily life, e.g., bathing, walking, brushing teeth and dressing)
2nd week	Coping with Difficult Emotions	Share and discuss homework/core of MBCT/recognize own automatic thoughts/coping with fear of recurrence and other difficult emotions/Set homework (formal practice following the audio, record the delightful event and difficult event)
3rd week	Mindfulness in Relationships	Share and discuss homework/mindfulness and interrelationships/impart mindfulness communication skills/mindfulness listening practice/record the difficult relationship/set homework (formal practice following the audio, and complete Five-Finger Gratitude Exercise)
4th week	Reaction and Response to Stress	Share and discuss homework/how stress impacts physical and mental health/explain stress and recognize the reaction to stress of participants/attempt to "view" stress event by mindfulness thoughts/set homework (formal practice following the audio, record the delightful event)
5th week	Coping with Cancer-related Symptoms	Share and discuss homework/coping with cancer-related symptoms and treatment side effects with mindfulness/mindfulness self-care/differentiating treatment and cure/set homework (formal practice following the audio, practice "self-compassion, common humanity, accept pain")
6th week	End and Setting Out	Share and discuss homework/review and summarize the topics of the curriculum/share and discuss curriculum/ending

patients were randomly divided into the experimental group ( $n = 30$ ) and the waiting group ( $n = 30$ ). In addition to usual care, the experimental group received an online MBI, while the control group received routine usual care. Two participants in the intervention group and 1 in the control group dropped out during the study. The study participant flowchart is illustrated in Fig. 1.

## 1.2. Procedures

Each participant enrolled in this study voluntarily took part in the study and signed a consent form. Participants were surveyed online by demographic questions and self-report measures to assess their level of mindfulness, FCR, and quality of life at baseline (preintervention: T1), immediately after the intervention group completed their mindfulness-based training (postintervention: T2) and 1 month later (1-month postintervention: T3). All participants were administered the same survey without the baseline demographic questions. This study was registered in the Chinese Clinical Trials Registry ChiCTR-OOC-17012132. Ethical approval was obtained from the Ethics Committee of Army Medical University of China.

## 1.3. Interventions

Based on the MBSR protocol developed by Ref. [17] and mindfulness-based cancer recovery (MBCR) [18], this course was administered online in a 6-week group structured intervention with weekly 1.5-h meetings to guide participants in practicing, integrating, and applying mindfulness in their everyday lives. Apart from the weekly meetings, the intervention training also included assignments for daily home practice (30 min per day) accompanied by the recordings of the 5P Medical App (an app to promote mind and brain health and cultivate happiness). The app recorded whether the participants had completed the practice. The specific mindfulness intervention programs are shown in Table 1.

## 1.4. Quantitative measures

Demographic characteristics (including age, marital status, education level, employment status, and yearly family income) and clinical information (including time since cancer diagnosis, TNM stage and cancer treatment received) were assessed.

**The Short Form of the Fear of Cancer Recurrence Inventory (FCRI-SF):** The original scale has a total of 42 questions, including 7 factors (trigger, severity, psychological stress, coping strategies, functional impairment, self-awareness and sense of security) [19]. Due to the high positive correlation between the severity factor and the total FCR score, the severity factor is directly used as the short version in many studies. Therefore, the short form of the FCRI with 9 items was used to

assess the severity of invasive thinking related to FCR in this study [20]. Each item was rated on a Likert scale from 0 ("none" or "never") to 4 ("many" or "always"). A higher score indicated a higher level of FCR. The Cronbach's  $\alpha$  coefficient in this sample was 0.865.

**Five Facet Mindfulness Questionnaire (FFMQ):** This 39-item scale was used to assess individuals' inclination toward experiencing mindfulness [21]. The participants were asked to rate on a 5-point scale (1 = "ever true", 5 = "always true"), with higher scores indicating more mindfulness. This scale includes 5 dimensions: acting with awareness, nonjudgment of inner experience, nonreaction to inner experience, describing, and observing. Cronbach's  $\alpha$  coefficient in this study was 0.897.

**European Organization for Research and Treatment of Cancer questionnaire (EORTC-QLQ-C30):** This 30-item questionnaire is widely used to evaluate the quality of life of patients with cancer, including 5 functional scales (physical function, role function, cognitive function, emotional function and social function), 3 symptom scales (fatigue, pain, nausea and vomiting), a two-item general health and quality of life (QoL) scale, and 6 single symptoms (dyspnea, insomnia, loss of appetite, constipation, diarrhea and economic difficulties) [22]. Among the 30 items, the first 28 items are scored on a 4-point Likert scale (1 = "not at all", 2 = "a little", 3 = "quite a lot" and 4 = "very much"), and the two items on the global health/QoL scale are scored on a 7-point linear analog scale. The higher the scores on the functioning and global QoL subscales, the better the health status and QoL. However, the higher the scores on the symptom subscales, the worse the QoL. In this study, the symptom subscales were not considered. The Cronbach's  $\alpha$  coefficient was 0.962 in this sample.

## 1.5. Qualitative measures

Qualitative course feedback was obtained postintervention from participants via a feedback survey. This consisted of 4 questions: (a) How much does mindfulness help you in your daily life? (b) How often do you practice mindfulness? (c) If you feel better, how much do you benefit from mindfulness? (d) Which mindfulness technique helps you most?

## 1.6. Data analyses

All data were analyzed by IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA). Group differences in demographic characteristics and clinical information were tested using chi-square tests. Baseline levels of FCR and mindfulness in the control and intervention groups were compared using three independent measures *t* tests. For the different analyses of corresponding variables at each time point between the two groups, repeated measures analysis of variance was conducted. The level of significance was set at 0.05. Common method

**Table 2**  
Demographic and clinical characteristics of participants.

	MBI group (n = 28)	Control group (n=29)	$\chi^2$ Value	P Value (two- tailed)
<b>Age</b>			0.05	0.98
30≤age<40	6(21.4%)	6(20.7%)		
40≤age<50	15(53.6%)	15(51.7%)		
age≥50	7(25%)	8(27.6%)		
<b>Marital status</b>			1.07	0.59
married	23(82.1%)	25(86.2%)		
divorced	4(14.3%)	4(13.8%)		
widowed	1(3.6%)	0(0%)		
<b>Education level</b>			1.11	0.58
junior high school	6(21.4%)	5(17.2%)		
high school	15(53.6%)	13(44.8%)		
university and above	7(25%)	11(37.9%)		
<b>Employment status</b>			0.22	0.90
working	10(35.7%)	12(41.4%)		
unemployed	8(28.6%)	8(27.6%)		
retired	10(35.7%)	9(31%)		
<b>Yearly family income (RMB)</b>			1.11	0.78
<50,000	8(28.6%)	7(24.1%)		
50,000≤income<100,000	13(46.4%)	11(37.9%)		
100,000≤income<300,000	5(17.9%)	8(27.6%)		
≥300,000	2(7.1%)	3(10.3%)		
<b>Time since cancer diagnosis</b>			0.33	0.85
time<2 years	13(46.4%)	15(51.7%)		
2 years ≤ time< 5 years	12(42.9%)	12(41.4%)		
5 years ≤ time<10 years	3(10.7%)	2(6.9%)		
<b>TNM stage</b>			3.71	0.30
I	6(21.4%)	3(10.3%)		
II	15(53.6%)	22(75.9%)		
III	6(21.4%)	4(13.8%)		
IV	1(3.6%)	0(0%)		
<b>Cancer treatment received</b>			2.54	0.28
mastectomy	20(71.4%)	25(86.2%)		
conservative therapy	6(21.4%)	2(6.9%)		
mastectomy + breast construction	2(7.1%)	2(6.9%)		

variance was established using Harman's single-factor test. Exploratory factor analysis showed that the interpretation rate of the first factor was 10.90%, which was <40% of the reference value and indicated that there was no serious common method bias.

## 2. Results

### 2.1. Demographic and clinical characteristics of participants

No statistically significant differences were revealed in terms of age, marital status, education level, employment status, yearly family income, time since cancer diagnosis, TNM stage or cancer treatment received between the MBI group and the control group at baseline, indicating similar demographic and clinical characteristics across the two groups. The details are shown in Table 2.

### 2.2. Effects of MBI on all variables

As for the baseline (T1), there were no statistically significant between-group differences in mindfulness ( $t = 0.33, P = 0.74$ ), FCR ( $t = 0.50, P = 0.62$ ), physical function ( $t = -0.25, P = 0.81$ ), role function ( $t = -0.59, P = 0.56$ ), emotional function ( $t = -0.58, P = 0.57$ ), cognitive function ( $t = -1.04, P = 0.31$ ), social function ( $t = -1.13, P = 0.26$ ), or global QoL ( $t = -0.50, P = 0.62$ ). In addition, the results of repeated measures of ANOVA suggested that there existed significant differences between the MBI group and the control group over time in mindfulness ( $F = 9.12, P = 0.00$ ), FCR ( $F = 9.63, P = 0.00$ ), emotional function ( $F = 11.61, P = 0.00$ ) and cognitive function ( $F = 4.21, P = 0.04$ ); the interaction effect between two groups were significant as well in mindfulness ( $F = 3.74, P = 0.03$ ), FCR ( $F = 5.32, P = 0.01$ ), emotional function ( $F = 6.61, P = 0.00$ ) and cognitive function ( $F = 4.80, P = 0.01$ ) (Table 3).

### 2.3. Qualitative results

Fig. 2 indicates that through the qualitative survey with the intervention group, 60.71% of the patients thought that mindfulness was

**Table 3**  
Mindfulness, FCR and quality of life outcomes at three time points for the two groups.

	Time	Group		Group main effect		Time main effect		Time × Group Interaction effect	
		Mean(SD)		F	P	F	P	F	P
		MBI group (n = 28)	Control group (n = 29)						
Mindfulness	T1	117.89(6.05)	117.34(6.35)	9.12	0.00	3.44	0.04	3.74	0.03
	T2	124.36 (6.92)	117.83 (6.96)						
	T3	123.14 (11.15)	116.03 (10.65)						
FCR	T1	14.00(4.26)	13.38(5.10)	9.63	0.00	3.37	0.04	5.32	0.00
	T2	10.61(4.30)	13.97(4.99)						
	T3	9.79(4.40)	13.76(2.05)						
Physical function	T1	78.33(12.78)	79.08(10.04)	0.04	0.85	1.97	0.14	0.16	0.85
	T2	78.33(12.52)	78.16(10.06)						
	T3	83.10(12.63)	81.38(14.52)						
Role function	T1	80.36(18.73)	83.33(19.42)	0.88	0.35	0.27	0.76	1.27	0.29
	T2	79.76(20.47)	87.93(17.19)						
	T3	85.71(18.54)	82.76(18.08)						
Emotional function	T1	69.94(16.25)	72.41(16.08)	11.61	0.00	2.62	0.08	6.61	0.00
	T2	83.33(14.87)	69.25(8.94)						
	T3	80.95(13.20)	70.12(9.05)						
Cognitive function	T1	67.26(17.85)	71.84(15.50)	4.21	0.04	2.32	0.10	4.80	0.01
	T2	79.76(9.47)	70.69(13.10)						
	T3	77.98(13.65)	67.82(16.63)						
Social function	T1	76.79(15.27)	81.61(16.87)	0.93	0.34	0.20	0.82	0.18	0.84
	T2	80.36(17.00)	82.18(19.38)						
	T3	79.17(20.09)	79.89(20.11)						
Global QoL	T1	69.05(16.49)	71.26(17.05)	0.14	0.71	0.60	0.55	0.16	0.85
	T2	72.32(22.11)	71.26(15.04)						
	T3	66.67(24.00)	69.25(22.17)						

Note. T1: pre-intervention, T2: immediately post-intervention, T3: 1 month post-intervention. Global QoL: global quality of life.

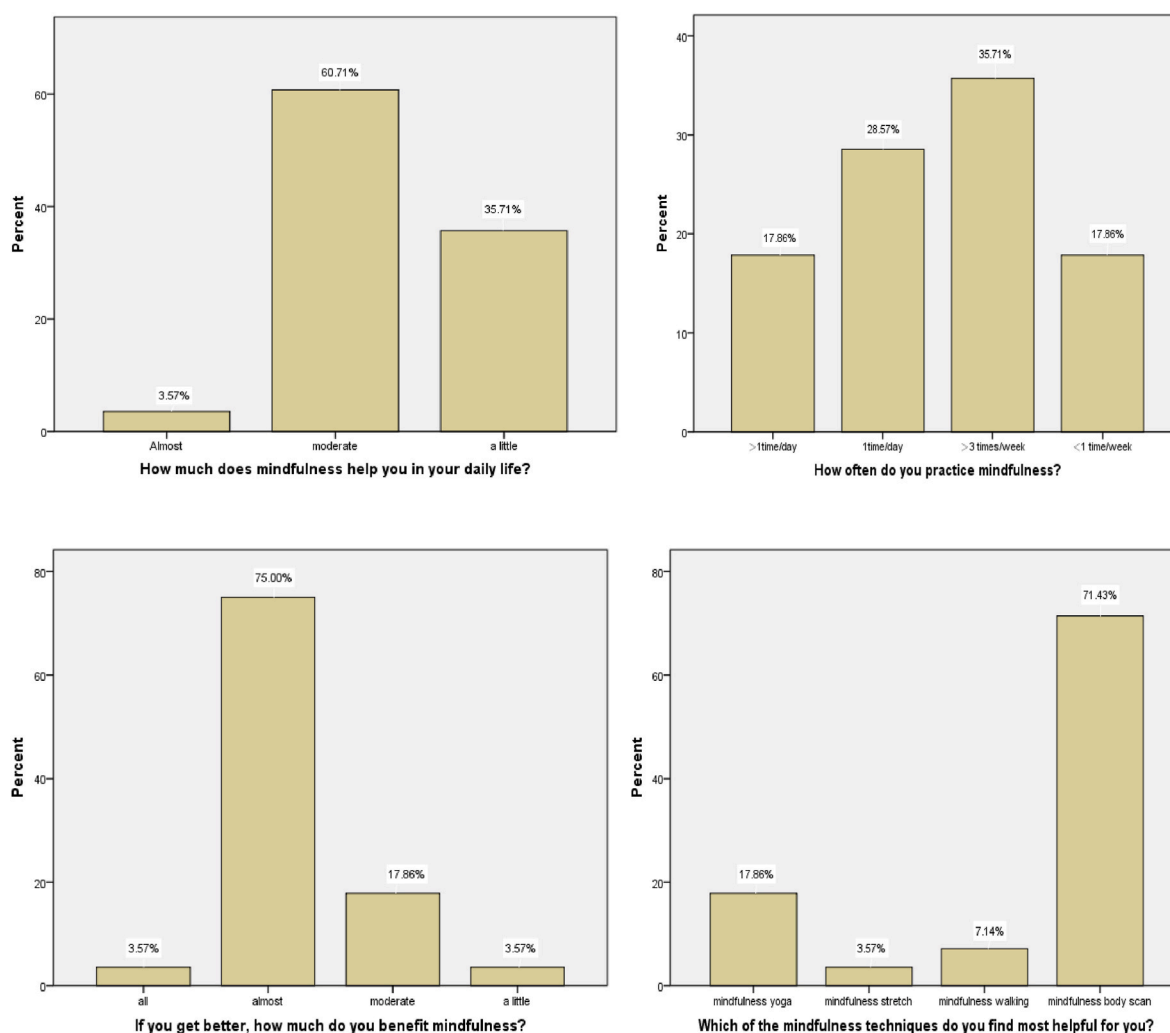


Fig. 2. Qualitative results related to the effects of the MBI.

very helpful in their daily life; 82.14% (17.86% + 28.57% + 35.71%) of the patients performed mindfulness exercises at least three times a week; and 75% of the patients thought their improvement was closely related to mindfulness exercises. Among mindfulness exercises, the most helpful mindfulness technique was body scanning (71.43%).

### 3. Discussion

This study successfully assessed the feasibility and acceptability of an online mindfulness course for Chinese breast cancer survivors. The results demonstrated that MBIs could improve the level of mindfulness, emotional function and cognitive function of breast cancer survivors, reduce the level of FCR, and maintain the positive effects 1 month after the end of the intervention.

A few studies of MBIs in women with breast cancer have previously been conducted. A study on 53 cancer patients who received a 7-week, 1.5-h group mindfulness course reported that compared to the waiting group, the intervention group had fewer negative emotions, such as fear, anxiety, anger and depression [23]. Similarly, another study on 82 breast cancer survivors found that compared with the control group, breast cancer survivors who participated in 6 sessions of MBSR training experienced a significant reduction in FCR and had improved QoL [24]. However, the effects of mindfulness training reached inconsistent conclusions and found no significant difference between the MBSR group and the control group in alleviating the FCR among breast cancer patients [15,25]. Such inconsistent results may be related to different

intervention plans, assessment of outcome and sample sizes. Therefore, more convincing experiments need to be designed to further analyze the effect of mindfulness interventions on breast cancer survivors.

Our results indicated that this mindfulness intervention improved emotional and cognitive function in breast cancer survivors but had little effect on other functions of QoL. Mindfulness is an uncritical awareness to present moment experiences, including thoughts, feelings, and physical sensations, with openness, curiosity, and acceptance [26]. As a psychological training of stress management widely used around the world, MBIs are a set of trainings with international standards that also have some flexibility in their implementation process [27]. This type of mind-body intervention could gradually cultivate mindfulness through formal meditation and informal practice [28]. Breast cancer survivors could observe their own internal experience from the perspective of an observer, master how to accept themselves, and create a real physical and psychological connection [10]. Therefore, MBIs have a more direct effect on emotion and cognitive function than other aspects of QoL for breast cancer survivors.

The strengths of our study include its prospective design and 1-month duration of follow-up. This 6-week online mindfulness training for breast cancer survivors had lasting and positive effects on their FCR and emotional and cognitive function, and through the qualitative study, most of the participants reported that they could benefit from this mindfulness training. Although it has been argued that online MBIs are a promising strategy to alleviate psychological symptomatology and reduce the prevalence of severe mental health problems, some previous



studies have also proven the effectiveness of online mindfulness training combined with self-help exercises through apps or other media [29,30]. It is worth noting that this study had an exceedingly low drop-out rate, which might be due to the user-friendly app, so the patients were more willing to attend this course and continue their practice. In this study, most patients thought this intervention was of great help in their daily life, with a practice frequency of at least three times a week, and the technique of mindful body scanning was the most helpful method. This may be because these methods are easy to learn, readily available and free from spatial constraints; they are of great convenience for cancer patients with physical inconveniences. Hence, the study provided an evidence-based intervention to alleviate FCR and improve QoL in Chinese breast cancer survivors, which could greatly reduce overall health care costs due to the more appropriate use of follow-up care and other health services in this large population of breast cancer survivors.

However, several limitations are recognized. First, this was a single-center study, and its sample size was relatively small, so the representativeness of our study might be insufficient. Second, this study failed to set up an offline MBI group to compare the efficacy of different intervention methods. Last, the measurement methods of this study were self-report scales, and more objective indicators are needed to evaluate effectiveness in future studies.

In conclusion, the current study highlights the challenges associated with conducting research in this area. This online MBI with low dose and low burden advantages was very suitable for Chinese breast cancer survivors. Such benefits could facilitate the transition to post treatment survival, which provides a potential effective psychological therapy for improving QoL and feasible policy recommendations for the ever-increasing numbers of breast cancer survivors.

## Author statement

Li Peng: Acquisition, Analysis, Interpretation of data, Writing – original draft, Writing – review & editing. Ying Yang and Xiaozhen Cao: Acquisition of data. Muyu Chen, Chen Xu, Yanli Chen and Rongqian Liu: Acquisition, Analysis, Interpretation of data. Min Li: Concept, design, and supervision.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ctcp.2022.101686>.

## References

- [1] X. Wang, C. Wang, J. Guan, B. Chen, L. Xu, C. Chen, Progress of breast cancer basic research in China, *Int. J. Biol. Sci.* 17 (8) (2021) 2069–2079.
- [2] P.A. Ganz, P.J. Goodwin, Breast cancer survivorship: where are we today? *Adv. Exp. Med. Biol.* 862 (2015) 1–8.
- [3] Y.Y. Lei, S.C. Ho, K.L. Cheung, V.A. Yeo, R. Lee, C. Kwok, A. Cheng, F.K.F. Mo, W. Yeo, Higher level of sports activities participation during five-year survival is associated with better quality of life among Chinese breast cancer survivors, *Cancers (Basel)* 13 (23) (2021) 6056.
- [4] S.M. Rosenberg, L.S. Dominici, S. Gelber, P.D. Poorvu, K.J. Ruddy, J.S. Wong, R. M. Tamimi, L. Schapira, S. Come, J.M. Peppercorn, V.F. Borges, A.H. Partridge, Association of breast cancer surgery with quality of life and psychosocial well-being in young breast cancer survivors, *JAMA Surgery* 155 (11) (2020) 1035–1042.
- [5] L. Sharpe, L. Curran, P. Butow, B. Thewes, Fear of cancer recurrence and death anxiety, *Psycho Oncol.* 27 (11) (2018) 2559–2565.
- [6] D.W.L. Ng, A. Kwong, D. Suen, M. Chan, A. Or, S.S. Ng, C.C. Foo, B.F.S. Fielding, W. T. Lam, Fear of cancer recurrence among Chinese cancer survivors: prevalence and associations with metacognition and neuroticism, *Psycho Oncol.* 28 (6) (2019) 1243–1251.
- [7] M. Tuman, K.E. Roberts, G. Corner, C. Beard, C. Fadalla, T. Coats, E. Slivjak, E. Schofield, W.G. Lichtenthal, Interpretation bias in breast cancer survivors experiencing fear of cancer recurrence, *Front. Psychol.* 12 (2021), 682174.
- [8] P. Butow, L. Sharpe, B. Thewes, J. Turner, J. Gilchrist, J. Beith, Fear of cancer recurrence: a practical guide for clinicians, *Oncology (Williston Park)* 32 (1) (2018) 32–38.
- [9] E.C. Soriano, R. Valera, E.C. Pasipanodya, A.K. Otto, S.D. Siegel, J.P. Laurenceau, Checking behavior, fear of recurrence, and daily triggers in breast cancer survivors, *Ann. Behav. Med.* 53 (3) (2019) 244–254.
- [10] H. Haller, M.M. Winkler, P. Klose, G. Dobos, S. Kümmel, H. Cramer, Mindfulness-based interventions for women with breast cancer: an updated systematic review and meta-analysis, *Acta Oncologica* 56 (12) (2017) 1665–1676.
- [11] T.X.M. Tran, S. Jung, E.G. Lee, H. Cho, N.Y. Kim, S. Shim, H.Y. Kim, D. Kang, J. Cho, E. Lee, Y. Chang, H. Cho, Fear of Cancer Recurrence and its Negative Impact on Health-Related Quality of Life in Long-Term Breast Cancer Survivors, vol. 9, *Cancer Research and Treatment*, 2021.
- [12] N.M. Tauber, M.S. O'Toole, A. Dinkel, J. Galica, G. Humphris, S. Lebel, C. Maheu, G. Ozakinci, J. Prins, L. Sharpe, A.B. Smith, B. Thewes, S. Simard, R. Zachariae, Effect of psychological intervention on fear of cancer recurrence: a systematic review and meta-analysis, *J. Clin. Oncol.* 37 (31) (2019) 2899–2915.
- [13] S. Cheli, L. Caligiani, F. Martella, P. De Bartolo, F. Mancini, L. Fioretto, Mindfulness and metacognition in facing with fear of recurrence: a proof-of-concept study with breast-cancer women, *Psycho Oncol.* 28 (3) (2019) 600–606.
- [14] L. Witek Janusek, D. Tell, H.L. Mathews, Mindfulness based stress reduction provides psychological benefit and restores immune function of women newly diagnosed with breast cancer: a randomized trial with active control, *Brain Behav. Immun.* 80 (2019) 358–373.
- [15] C.A. Lengacher, V. Johnson-Mallard, J. Post-White, M.S. Moscoso, P.B. Jacobsen, T.W. Klein, R.H. Widen, S.G. Fitzgerald, M.M. Shelton, M. Barta, M. Goodman, C. E. Cox, K.E. Kip, Randomized controlled trial of mindfulness-based stress reduction (MBSR) for survivors of breast cancer, *Psycho Oncol.* 18 (12) (2009) 1261–1272.
- [16] A. Barak, L. Hen, M. Boniel-Nissim, N. Shapira, A comprehensive review and a meta-analysis of the effectiveness of internet-based psychotherapeutic interventions, *J. Technol. Hum. Serv.* 26 (2008) 109–160.
- [17] J. Kabat-Zinn, *Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness*, Revised Edition, U.S.A.: Bantam, 2013.
- [18] J. Pedro, S. Monteiro-Reis, C. Carvalho-Maia, R. Henrique, C. Jerónimo, E.R. Silva, Evidence of psychological and biological effects of structured Mindfulness-Based Interventions for cancer patients and survivors: a meta-review, *Psycho Oncol.* 30 (11) (2021) 1836–1848.
- [19] A.B. Smith, D. Costa, J. Galica, S. Lebel, N. Tauber, S.J. van Helmondt, R. Zachariae, Spotlight on the fear of cancer recurrence inventory (FCRI), *Psychol. Res. Behav. Manag.* 13 (2020) 1257–1268.
- [20] J.E. Fardell, G. Jones, A.B. Smith, S. Lebel, B. Thewes, D. Costa, K. Tiller, S. Simard, A. Feldstain, S. Beattie, M. McCallum, Conquer Fear authorship group, P. Butow, Exploring the screening capacity of the Fear of Cancer Recurrence Inventory-Short Form for clinical levels of fear of cancer recurrence, *Psycho Oncol.* 27 (2) (2018) 492–499.
- [21] A. Shallcross, N.Y. Lu, R.D. Hays, Evaluation of the psychometric properties of the five facet of mindfulness questionnaire, *Journal of, Psychopathology and Behavioral Assessment* 42 (2) (2020) 271–280.
- [22] N.K. Aaronson, S. Ahmedzai, B. Bergman, M. Bullinger, A. Cull, N.J. Duez, A. Filiberti, H. Flechtner, S.B. Fleishman, J.C. de Haes, S. Kaasa, M. Klee, D. Osoba, D. Razavi, P.B. Rofe, S. Schraub, K. Sneeuw, M. Sullivan, F. Takeda, The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology, *J. Natl. Cancer Inst.* 85 (5) (1993) 365–376.
- [23] M. Specia, L. Carlson, E. Goodey, M.A. Angen, A randomized, wait-list controlled clinical trial: the effect of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients, *Psychosom. Med.* 62 (5) (2000) 613–622.
- [24] C.A. Lengacher, R.R. Reich, K.E. Kip, M. Barta, S. Ramesar, C.L. Paterson, M. S. Moscoso, I. Carranza, P.H. Budhrani, S.J. Kim, Influence of mindfulness-based stress reduction (MBSR) on telomerase activity in women with breast cancer (BC), *Biol. Res. Nurs.* 16 (4) (2014) 438–447.
- [25] C.A. Lengacher, R.R. Reich, C.L. Paterson, S. Ramesar, J.Y. Park, C. Alinat, V. Johnson-Mallard, M. Moscoso, P. Budhrani-Shani, B. Miladinovic, P.B. Jacobsen, C.E. Cox, M. Goodman, K.E. Kip, Examination of broad symptom improvement resulting from mindfulness-based stress reduction in breast cancer survivors: a randomized controlled trial, *J. Clin. Oncol.* 34 (24) (2016) 2827–2834.
- [26] Y. Matchim, J.M. Armer, B.R. Stewart, Mindfulness-based stress reduction among breast cancer survivors: a literature review and discussion, *Oncol. Nurs. Forum* 38 (2) (2011) E61–E71.
- [27] L. Cillessen, M. Johannsen, A.E.M. Speckens, R. Zachariae, Mindfulness-based interventions for psychological and physical health outcomes in cancer patients and survivors: a systematic review and meta-analysis of randomized controlled trials, *Psycho Oncol.* 28 (12) (2019) 2257–2269.
- [28] J.E. Bower, A.D. Crosswell, A.L. Stanton, C.M. Crespi, D. Winston, J. Arevalo, J. Ma, S.W. Cole, P.A. Ganz, Mindfulness meditation for younger breast cancer survivors: a randomized controlled trial, *Cancer* 121 (8) (2015) 1231–1240.
- [29] K.A. Zernicke, T.S. Campbell, M. Specia, K. McCabe-Ruff, S. Flowers, L.E. Carlson, A randomized wait-list controlled trial of feasibility and efficacy of an online mindfulness-based cancer recovery program: the e-Therapy for cancer applying mindfulness trial, *Psychosom. Med.* 76 (4) (2014) 257–267.
- [30] C.A. Lengacher, K.E. Kip, R.R. Reich, B.M. Craig, M. Mogos, S. Ramesar, C. L. Paterson, J.R. Farias, E. Pracht, A cost-effective mindfulness stress reduction program: a randomized control trial for breast cancer survivors, *Nurs. Econ.* 33 (4) (2015) 210–218, 232.