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Effects of Mindfulness-Based Cancer Recovery training on anxiety, depression, post-traumatic stress disorder, and cancer-related fatigue in breast neoplasm patients undergoing chemotherapy

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Abstract

Rationale: Mindfulness-Based Cancer Recovery (MBCR) program is a group course training for cancer patients that combines cancer knowledge and psychological knowledge, emphasizing focusing on the psychosomatic symptoms of cancer patients. Currently, the application value of Mindfulness-Based Cancer Recovery in improving psychosomatic health of cancer patients has been confirmed, however, its intervention effect on breast neoplasm patients has not yet been widely studied in China.

Patient concerns and Diagnoses: This study introduced the Mindfulness-Based Cancer Recovery protocol into the rehabilitation process of breast cancer patients, aiming to elucidate the effects of Mindfulness-Based Cancer Recovery on anxiety, depression, post-traumatic stress disorder, and cancer-related fatigue in breast neoplasm patients, to provide a practical basis for improving the physical and mental health of breast cancer patients.

Intervention: In this study, 80 patients with chemotherapy-stage breast neoplasm attending the oncology department of a tertiary-level hospital from January 2022 to December 2022 were selected, 40 patients attending from January 2022 to June 2022 were included in the study group, and 40 patients attending from July 2022 to December 2022 were included in the control group. The control group was administered conventional care, and the study group was administered Mindfulness-Based Cancer Recovery based on conventional care in the control group for 8 weeks. After the intervention, hospital anxiety and depression scale, impact of event scale-revised, and cancer fatigue scale were used for evaluation.

Outcomes: After the intervention, hospital anxiety and depression scale scores decreased in both groups compared with pre-intervention, with the study group scoring lower than the control group ($P < .05$). After the intervention, the impact of event scale-revised scores of the 2 groups decreased from the preintervention period, with the study group scoring lower than the control group ($P < .05$). After the intervention, cancer fatigue scale scores decreased in the 2 groups compared with the preintervention period, with the study group scoring lower than the control group ($P < .05$).

Lessons: Mindfulness-Based Cancer Recovery can effectively reduce the levels of anxiety, depression and post-traumatic stress disorder in breast neoplasm patients undergoing chemotherapy, reduce the levels of cancer-related fatigue, and promote the physical and mental health of patients.

Abbreviations: CFS = cancer fatigue scale, CRF = cancer-related fatigue, HADS = hospital anxiety and depression scale, HADS-A = hospital anxiety and depression scale-anxiety symptoms, HADS-D = hospital anxiety and depression scale-depressive symptoms, IES-R = impact of event scale-revised, MBCR = Mindfulness-Based Cancer Recovery, PTSD = post-traumatic stress disorder.

Keywords: anxiety, breast neoplasm, cancer-related fatigue, depression, Mindfulness-Based Cancer Recovery, post-traumatic stress disorder.

The authors have no funding and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Our study was approved by the Ethics Review Board of Deyang people's Hospital.

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1. Introduction

Breast neoplasm is a worldwide social burden and the most prevalent malignancy affecting women's health. According to the data of International Agency for Research on Cancer (IARC) in 2020, the number of new cases of breast neoplasm in the world was 2.26 million, ranking the first in the world, and the number of new cases of breast neoplasm in China was 420,000, ranking the fourth in the country.[1] Cancer implies the threat of death or serious physical injury and is a traumatic event that can have a significant impact on a patient's mental health and cause psychological reactions.[2] Meanwhile, the survival rate of breast neoplasm patients has been significantly improved due to the advances in early diagnosis, surgery, chemotherapy, and radiotherapy, but all these treatments will cause abnormalities in patients' body image, such as loss of secondary sex characteristics, hair loss, and pigmentation, etc. Together with the distress of disease symptoms and the pressure from the family and the society, patients are prone to mood swings and ups and downs, changes in temperament, and the emergence of self-denial and self-enclosure, further aggravating patients' psychological trauma and leading to psychological problems such as anxiety, depression, and post-traumatic stress disorder (PTSD). This causes difficulties in social functioning and further aggravates the patients' psychological trauma, leading to psychological problems such as anxiety, depression and PTSD.[3,4] Studies have reported positive rates of anxiety symptoms and depressive symptoms in breast neoplasm patients of 20.2% and 45.2%,[5] while the prevalence of PTSD is about 10%.[6] These negative emotions can lead to significant physical, psychological, cognitive, and social dysfunction,[7] and even increase the rate of suicide among patients, placing a heavy burden on patients and their families.[8,9] Cancer-related fatigue is a nonspecific, persistent subjective feeling of physical, emotional, and cognitive aspects of fatigue in cancer patients, which is mainly characterized by low mood and frustration, physical weakness and fatigue, and lack of passion and confidence in anticancer treatment, which seriously affects the patient's daily life and functioning.[10] Persistent cancer-related fatigue (CRF) exacerbates the development of psychoneurophysiological symptoms such as anxiety, depression, poor sleep quality, and cognitive deficits,[11] and is a major cause of poor quality of life,[12] which seriously affects the prognosis of breast cancer patients.[13] Therefore, it is important to find effective psychological interventions and provide effective psychological care interventions to improve the physiologic and psychological states of breast neoplasm patients.

Mindfulness training is considered to be particularly helpful in dealing with uncontrollable, unpredictable and emotional life stress. Mindfulness-based stress reduction is a structured 8-week group program, The initial goal was to alleviate chronic pain and stress-related symptoms by cultivating positive thinking (non-judgmental, accepting moment-to-moment awareness). Mindfulness-Based Cancer Recovery (MBCR) is a modification of mindfulness-based stress reduction, specifically for cancer patients, MBCR, which is positive mindfulness-based stress relief for cancer patients, is a group course training developed for cancer patients that combines knowledge of cancer with knowledge of psychology, emphasizing attention to the psychosomatic symptoms of cancer patients, psychological stress reduction, symptom management, and cognitive reconstruction of psychosomatic symptoms, it is not only possible to treat distressing symptoms, but also to encourage a series of positive changes after potential traumatic events.[14] Currently, the value of MBCR in improving anxiety, depression, and psychosomatic health of cancer patients has been confirmed,[15,16] however, its interventional role in breast neoplasm patients has not been widely studied in China. Based on the above background, this study introduced the MBCR protocol into the rehabilitation process of breast cancer patients, aiming to elucidate the effects of MBCR on anxiety, depression, PTSD, and CRF in breast neoplasm patients, with a view to providing a practical basis for improving the physical and mental health of breast cancer patients.

2. Materials and methods

2.1. General information

Convenience sampling method was used to select breast neoplasm patients in chemotherapy stage who attended the oncology department of a tertiary care hospital from January 2022 to December 2022 as the study population. Inclusion criteria: age ≥ 18 years, diagnosed with breast neoplasm by imaging or pathology, undergoing postoperative chemotherapy, conscious, with simple communication, reading and comprehension skills, voluntary participation and signing of informed consent. Exclusion Criteria: Combined organic heart disease, cerebrovascular accident and other serious heart and brain diseases, combined with other organ dysfunction or other tumors, unwilling to continue to participate in this study in the middle of the study or missing 2 consecutive group course training, deterioration of the condition or transferring to another hospital for treatment.

In this study, the sample size was calculated according to the sample size formula $n1 = n2 = 2 \times [(u_{a/2} + u_b) \times \sigma/\delta]^2$ for the grouped design. α was taken as 0.05 and β was taken as 0.1, checking the table shows that $u_{\alpha/2} = 1.96$, $u_\beta = 1.282$. The hospital anxiety and depression scale (HADS) score was used as the primary outcome, and a review of the literature showed that $\sigma = 2.13$ and $\delta = 1.73$,[17] which was substituted into the formula to obtain $n1 = n2 = 32$, and the minimum sample size was initially determined to be 64 cases. Considering the 20% lost to follow-up, a total of 80 study cases were finally determined to be included.

A total of 40 patients seen from January 2022 to June 2022 who met the inclusion exclusion criteria were included in the study group and 40 patients seen from July 2022 to December 2022 who met the inclusion exclusion criteria were included in the control group. No patients were lost to follow-up in either group.

The age of the study group ranged from 27 to 78 (53.18 ± 14.39) years. Educational level: 21 cases (52.5%) in junior high school and below, 12 cases (30.0%) in high school, and 7 cases (17.5%) in college and above. Marital status: 26 cases (65.0%) were married, 14 cases (35.0%) were unmarried\divorced\widowed. TNM staging: 5 cases (12.5%) were in stage I, 20 cases (50.0%) were in stage II, and 15 cases (37.5%) were in stage III. Age of the control group ranged from 26 to 75 (52.88 ± 12.61) years old. Educational level: 19 cases (47.5%) were in junior high school or below, 13 cases (32.5%) were in high school, and 8 cases (17.5%) were in junior college or above. Marital status: 29 cases (72.5%) were married, 11 cases (27.5%) were unmarried\divorced\widowed. TNM staging: 6 cases (15.0%) in stage I, 20 cases (50.0%) in stage II, and 14 cases (35.0%) in stage III. The differences observed between the 2 groups at baseline in terms of age ($t = 0.099$, $P = .921$), education ($\chi^2 = 0.207$, $P = .902$), marital status ($\chi^2 = 0.524$, $P = .469$), and TNM stage ($\chi^2 = 0.125$, $P = .939$) were not statistically significant ($P > .05$), and the groups were comparable. The study was approved by the Ethics Committee of the hospital and all patients gave informed consent and signed an informed consent form, Ethical number: 2021-04-076-K01.

2.2. Method

Patients in the control group implemented routine nursing instructions during the chemotherapy period in the oncology department. Medication instruction: the nurse in charge

introduces to the patient in detail the necessity of chemotherapy, the course of treatment, the efficacy, the role of chemotherapy drugs, adverse reactions and how to cooperate; Nutritional guidance: Instruct patients to eat protein-rich, light and easily digestible food; Psychological care: pay attention to the patient's psychological state, give sympathy, and instruct the patient's family members to give them spiritual and emotional support; Complications management; closely observe the patient's vital signs, and monitor all kinds of adverse reactions that may occur during the patient's chemotherapy treatment; Follow-up after discharge: follow up by phone or WeChat once a month to provide the patient with guidance on rehabilitation and answer their doubts. The study group implemented MBCR based on the control group, which was implemented as follows.

2.2.1. Setting up an intervention team. This includes one associate physician (psychotherapist with mindfulness-based stress reduction faculty) from the department of psychosomatic medicine, who is responsible for training the training intervention team and providing support to the team; 2 charge nurses (with mindfulness-based stress reduction faculty), who are responsible for the implementation of the intervention program; one oncologist, who is responsible for the day-to-day medical activities; one nurse manager, who is responsible for contacting and coordinating the patients; 2 nurse practitioners, who are responsible for guiding the training of the patients and the data collection; and 2 master's degree nursing students for program design and data compilation and analysis.

2.2.2. Developing intervention programs. The study protocol was based on Carlson's revised MBCR training program,[18] and the first draft of the intervention content was developed by searching the national literature, and the study protocol was revised using 2 rounds of focus group discussions. Focus group members included 8 experts, 4 nurses (2 with bachelor's degrees, 2 with master's degrees, 3 nurse practitioners in charge, and 1 associate nurse practitioner), and 4 physicians (1 in rehabilitation, 1 in oncology, 1 in psychosomatic medicine, and 1 in breast surgeon, with 3 associate physicians in charge, and 1 in chief of medicine, with 2 PhD's, and 2 MD's). The protocol of the study was set as 4 modules: theme, intervention form, intervention content, and homework. According to the actual situation of the patients, the lectures were given once a week, with one theme each time for a total of 90 minutes, and the forms of the lectures included face-to-face groups, micro-telecommunication videos, and one-on-one individual guidance, and 30 to 45-minute homework was assigned after each class, and all patients were instructed to download the audio materials of MBCR for reference in at-home practice. The study period was designed as 8 weeks.

2.2.3. Implementing intervention programs. The patients in the study group were divided into small groups of 5 to 8 patients/group, with the starting point of the intervention being 1 week before the first chemotherapy treatment and continuing for 8t weeks, with one topic per week for 90 min. Four time slots were arranged in the group training room each week so that all patients could participate, namely 9:30 to 11:00 and 15:30 to 17:00 on Tuesdays and Saturdays, and patients in the same group tried to be fixed and chose the same training time as much as possible. Each patient was provided with an instruction booklet, audio, and an exercise log sheet before the start of the first session, to urge the patient to be able to participate in the training continuously and to minimize missed visits. In addition to periodic face-to-face group exercises, this study also provides 2 supplementary ways of bedside guidance and WeChat coaching: for patients who are undergoing treatment or are not physically able to attend on time, bedside guidance will be provided to them at the end of the day's session; for patients who are in the intermittent period between chemotherapy treatments and are not admitted to hospitals, personalized guidance will be provided to the patients through the WeChat platform. Meanwhile, the nurse supervised the patients to complete the homework exercises through WeChat group and telephone follow-up every week, and punched the card to record in the exercise record book. The specific intervention program is shown in Table 1.

2.2.4. Observation indicators.

(1) Anxiety and depression. Researchers used HADS to evaluate the level of anxiety and depression of the patients before and after the intervention. The scale consists of two subscales, Hospital Anxiety and Depression Scale-Anxiety Symptoms (HADS-A) and Hospital Anxiety and Depression Scale-Depressive-Symptoms (HADS-D), each with 7 items, and the total scale has 14 entries, which is scored on a likert scale of 4 (0 to 3 points), and the total score ranges from 0 to 42, with the higher scores indicating the more serious degree of anxiety and depression.
(2) Post-traumatic stress disorder. Researchers assessed the level of PTSD in patients before and after the intervention using Impact of Event Scale-Revised (IES-R), which was Chineseized by Huang.[19] The scale includes 3 dimensions of intrusiveness, avoidance, and hypervigilance, with 22 entries. It was scored on a Likert 5-point scale (0–4), from asymptomatic, mild, moderate, severe, and very severe in order of 0 to 4, with a total score of 0 to 88, with higher scores indicating more severe post-traumatic stress symptoms.
(3) Cancer-related fatigue. Researchers evaluated the level of CRF in patients before and after the intervention using Cancer Fatigue Scale (CFS), which was Chineseized by Zhang.[20] The scale includes 3 dimensions of somatic fatigue, emotional fatigue and cognitive fatigue, with a total of 15 entries, and is scored on a Likert 5-point scale (0–4 points), with a total score of 0 to 60 points, with higher scores suggesting more severe CRF.

2.2.5. Data collection and processing methods. Researchers distributed questionnaires at the time of patient admission and at the end of the intervention to collect general information and relevant questionnaires from the patients. SPSS26.0 was applied for statistical analysis, count data were described by frequency and percentage, and χ^2 was used to assess the differences between groups; measure data were described by mean ± standard deviation, and data were tested for normality using the Shapiro–Wilk test and the Q-Q plot, and all were tested for variance chi-square, and the data conformed to normal distribution and variance chi-square, and the independent sample t test to assess differences between groups. Differences were considered statistically significant at $P < .05$.

3. Results

3.1. Comparison of HADS-A, HADS-D, and HADS scores before and after intervention in the 2 groups

Before the intervention, there was no statistically significant difference between the HADS-A, HADS-D, and HADS scores of the 2 groups ($P > .05$). After the intervention, the HADS-A, HADS-D, and HADS scores of both groups were lower than those before the intervention, and the difference was statistically significant ($P < .05$), and the HADS-A, HADS-D, and HADS scores of the study group were lower than those of the control group, and the difference was statistically significant ($P < .05$). The details are presented in Table 2.

Table 1

Content of MBCR in breast neoplasm patients.

Week	Topic	Form of intervention	Content of intervention	Homework
First week	Mindfulness and cancer	Face-to-face groups	① Introduce themselves, establish a good relationship with patients, explain the purpose of this study, and establish a WeChat group; ② Explain the cancer experience and the background, content, and current status of the application of the MBCR course; ③ How mindfulness practice can promote cancer recovery, introduce mindfulness of breathing, mindfulness of raisins, and body scanning; and ④ Instruct the patients to download the web-based audio and distribute the training manuals and journals.	Mindfulness for daily activities
Second week	Mindfulness and stress management	Face-to-face groups	① Group members discuss and share their experiences and lessons learned from the content of the previous session; ② The researcher discusses with the patients about the sources of stress and the relationship between stress and cancer; ③Explaining the relationship between mindfulness and stress as well as the clinical symptoms brought about by stress; and ④ Explaining ways of coping with stress and introducing the methods and significance of the Body Scanning and the Sitting Meditation.	Sitting meditation
Third week	Breathing and body sensing	Face-to-face groups	① Group members discussed the feelings of body scanning and sitting meditation; ② The researcher guided the patients to pay attention to matters with new eyes according to the principle of intention-attention-attitude; ③ Explained the method of mindfulness of breathing and carried out simulation exercises; ④ Instructed the patients to carry out a body scanning exercise according to the audio text.	Mindfulness of breathing
Fourth week	mindfulness exercise	WeChat video	① Group members discussed the relationship between mindfulness of movement and emotional feelings in the body; ②The researcher explained the method of mindfulness of walking exercises and asked patients to train according to the audio;	Mindfulness walking exercise
Fifth week	Acceptance and avoidance	WeChat video	① the researcher explains the paradox of avoidance; ②guidance on understanding one's fears and other difficult emotions; and③ "we tell ourselves stories" and instructs the patient to record what is perceived to be pleasant and what is not by means of written expression.	Perceive pleasant events
Sixth week	Symptom management	One-on-one coaching	① Patients were instructed to apply mindfulness to improve symptoms such as sleep, fatigue, pain, and nausea; ②patients were instructed to cope with hair loss and personal image as well as changes in roles; ands③patients were instructed to practice one-day meditations and mountain meditations.	Mountain meditations
Seventh week	Deepening and expanding	Face-to-face group	Group members shared their experiences and explained the benefits of the MBCR program and the problems they had during the practice; (2) the researcher explained the relationship between choiceless awareness and cancer recovery; and (3) conducted the "Who am I" meditation exercise.	Lake meditation
Eighth week	mindfulness-based living	Face-to-face group	①review, discuss, and summarize the mindfulness process, with group members sharing and exchanging experiences; ②explain the impact of mindfulness on the fear of cancer recurrence and emotions; and ③ emphasize that mindfulness healing is a healthy lifestyle worth adhering to for the rest of your life, and provide patients with electronic resources.	Body scanning

Table 2

Comparison of HADS-A, HADS-D, and HADS scores before and after intervention in the 2 groups ($\bar{x} \pm s$).

Time	Group	n	HADS-A	HADS-D	HADS
Before intervention	Study group	40	9.30 ± 3.32	8.21 ± 3.29	17.37 ± 6.69
	Control group	40	9.35 ± 3.01	9.05 ± 3.11	17.35 ± 5.51
	t		0.347	−0.372	0.019
	P		.729	.711	.985
After intervention	Study group	40	5.57 ± 2.96*	4.65 ± 2.56*	10.23 ± 5.39*
	Control group	40	7.33 ± 2.71*	6.27 ± 2.58*	13.60 ± 4.63*
	t		−2.757	−2.618	−2.989
	P		.007	.011	.004

Compared with the same group before treatment.

HADS = Hospital Anxiety and Depression Scale, HADS-A = Hospital Anxiety and Depression Scale-Anxiety Symptoms, HADS-D = Hospital Anxiety and Depression Scale-Depressive Symptoms.

*$P < .05$.

3.2. Comparison of IES-R dimension scores and total scores before and after intervention in the 2 groups

Before the intervention, there was no statistically significant difference in the IES-R scores and total scores between the 2 groups ($P > .05$). After the intervention, the IES-R scores of all dimensions and total scores of both groups were lower than those before the intervention, and the difference was statistically significant ($P < .05$), and the scores of all dimensions of IES-R and total scores of the study group were lower than those of the control group, and the difference was statistically significant ($P < .05$). The details are presented in Table 3.

3.3. Comparison of CFS dimension scores and total scores before and after intervention in the 2 groups

Before the intervention, there was no statistically significant difference between the CFS scores and total scores of the 2 groups ($P > .05$). After the intervention, the scores of CFS dimensions and total scores of both groups were lower than those before the intervention, and the difference was statistically significant ($P < .05$), and the scores of CFS dimensions and total scores of the study group were lower than those of the control group, and the difference was statistically significant ($P < .05$). The details are presented in Table 4.

Table 3

Comparison of IES-R dimension scores and total scores before and after intervention in the 2 groups ($\bar{x} \pm s$).

Time	Group	n	Intrusiveness	Avoidance	Hypervigilance	IES-R
Before intervention	Study group	40	20.45 ± 2.86	21.52 ± 2.65	15.65 ± 3.35	57.65 ± 6.96
	Control group	40	19.97 ± 3.10	21.25 ± 2.71	15.30 ± 3.63	56.87 ± 7.38
	t		0.713	0.458	0.416	0.483
	P		.478	.648	.679	.631
After intervention	Study group	40	17.05 ± 2.78*	18.67 ± 2.71*	12.97 ± 3.11*	48.70 ± 6.72*
	Control group	40	19.42 ± 3.38*	20.70 ± 2.58*	14.75 ± 3.75*	54.87 ± 8.00*
	t		−3.426	−3.419	−2.303	−3.736
	P		.001	.001	.024	<.001

Compared with the same group before treatment.

IES-R = impact of event scale-revised.

*$P < .05$.

Table 4

Comparison of CFS dimension scores and total scores before and after intervention in the 2 groups ($\bar{x} \pm s$).

Time	Group	n	Somatic fatigue	Emotional fatigue	Cognitive fatigue	CFS
Before intervention	Study group	40	11.97 ± 2.04	10.48 ± 1.92	7.75 ± 2.21	30.27 ± 5.03
	Control group	40	11.60 ± 2.26	10.40 ± 2.09	7.65 ± 2.27	29.98 ± 5.12
	t		0.778	0.167	0.199	0.264
	P		.439	.868	.843	.792
After intervention	Study group	40	9.60 ± 2.09*	8.10 ± 2.24*	5.37 ± 2.37*	23.07 ± 5.27*
	Control group	40	10.80 ± 2.25*	9.60 ± 2.21*	6.85 ± 2.33*	27.25 ± 5.45*
	t		−2.464	−3.144	−2.801	−3.456
	P		.016	.002	.006	.001

Compared with the same group before treatment.

CFS = cancer fatigue scale.

*$P < .05$.

4. Discussion

4.1. MBCR helps alleviate anxiety, depression in chemotherapy-stage breast neoplasm patients

Depression and anxiety are common psychological disorders in breast neoplasm patients. In clinical work, patients' anxiety and depression are easily overlooked because symptoms of psychological disorders usually overlap with fatigue and physical pain and are difficult to distinguish. Relevant studies have pointed out that depression and anxiety not only reduce the quality of life of breast neoplasm patients during cancer treatment, but also significantly increase the mortality rate of patients.[21] Cancer patients with a total HADS score of 13 or more were considered to be in need of psychosocial intervention support,[22] and HADS-A and HDAS-D scores > 7 were considered to have anxiety and depressive symptoms.[23,24] The results of this study showed that before the intervention, patients in both groups had a total HADS score of > 13 and HADS-A and HADS-D scores of > 7. This may be due to the fact that heavy blows such as the diagnosis of cancer, chemotherapy and uncertainty about the disease cause patients to develop a negative stress response and emotional disorders such as anxiety and depression; After the intervention ended, the HADS-A and HADS-D scores of the intervention group were significantly lower than those of the control group, indicating that MBCR can improve anxiety and depression in breast neoplasm patients in the chemotherapy stage, which is similar to the results of the study group by Meagan et al.[25] The analysis of the reasons concluded that the 8-week MBCR course conducted in this study was centered on improving patients' mindfulness ability, and added targeted course contents such as emotion regulation and stress coping in the course in combination with the characteristics of patients in the chemotherapy period, which helped to alleviate the chemotherapy period by guiding the patients to be aware of the life events with a calm mind, increasing their perception of emotions, and improving their ability to emotionally regulate their emotions and stress management ability, breast neoplasm patients from clinical level to subclinical level of psychological distress, thus reducing the level of anxiety and depression of patients.

4.2. MBCR reduces PTSD in chemotherapy-stage breast neoplasm patients

Clinical psychology recognizes cancer as a stressorigenic event that can cause PTSD.[26] In recent years, the assessment and prevention of PTSD has become an important component of care for cancer survivors.[27] It has been shown that the diagnosis and treatment process of breast neoplasm can cause patients to develop different degrees of PTSD,[28] especially with the change of social roles and lifestyle changes, breast cancer patients not only need to bear the pain caused by the disease, but also suffer from the mental pressure from the society and the family, which will directly or indirectly lead to the aggravation of the individual's psychological stress response.[29] In addition to affecting patients' mental health, it can lead to adverse consequences such as decreasing patients' medication adherence, increasing the risk of patient suicide, and affecting patients' quality of life.[30] The results of this study showed that after the intervention, the scores of IES-R dimensions and total scores of the intervention group were significantly lower than those of the control group, indicating that MBCR can improve the level of PTSD in breast neoplasm patients undergoing chemotherapy. Previous studies have also confirmed that breast neoplasm patients who receive mindfulness interventions exhibit fewer mood swings and stress symptoms,[31] and significantly higher levels of post-traumatic growth.[32] MBCR is designed to enhance the brain's ability to help cancer patients embrace the present moment as it is, accepting rather than avoiding the negative emotions that arise in the mind, viewing personal experiences non-judgmentally, and

contributing to emotional regulation and cognitive change.[14] In this study, through exercises such as mindfulness of breathing, meditation, and acceptance and avoidance, we awakened intrinsic focus within the individual, instructed patients to focus on things with new eyes, and channeled fears and other negative emotions, thus positively affecting the mental status and health behaviors of breast neoplasm patients. In addition, the participation of breast cancer patients in practical activities with their wardmates can enhance their confidence, help each other, vent their negative emotions and face the disease optimistically, reducing their PTSD.

4.3. MBCR helps alleviate CRF in chemotherapy-stage breast neoplasm patients

Currently, chemotherapy is an important treatment for breast neoplasm, but on the basis of achieving control of the disease progression, it will bring the patient digestive symptoms such as nausea, vomiting and other symptoms of physical discomfort such as fatigue and numbness. Studies have shown that CRF is one of the most common long-term complications affecting patients with breast neoplasm, with rates ranging from 14.03% to 99%.[33–35] ESMO guidelines recommend incorporating the prevention and treatment of CRF into the daily care of oncology patients.[36] The results of this study showed that after the intervention, the CFS scores on all dimensions and the total scores of the intervention group were lower than those of the control group, which is consistent with the findings of the Carlson team, the developers of the MBCR program.[32] This is probably because the MBCR program used in this study was based on mindfulness and helped the patients develop a series of emotion regulation and stress management strategies, which enabled the patients to increase their awareness and perception of their emotions and experiences, eliminate their tensions and fears, and reestablish a sense of control over their lives; Second, relaxation training, yoga, and mindfulness walking were integrated into the MBCR program of this study, which enhanced neuroplasticity by balancing sympathetic and parasympathetic responses, improved the patients' self-regulation ability, alleviated the negative effects of fatigue on the brain, and promoted physical and mental relaxation to stimulate their physical vitality, which further resulted in the improvement of fatigue; Meanwhile, somatic symptom management was also included in this intervention program, which effectively alleviated CRF by instructing patients to apply mindfulness to improve somatic symptoms such as sleep, fatigue, pain, and nausea.

This study had some limitations. First, this study used a quasi-randomized controlled trial to set up an intervention group and a control group for assessment and comparison, but the intervention time of the control group in this study was different from that of the experimental group, which did not effectively control the time factor; Secondly, due to the limitation of human and material resources, only one hospital was selected as the study site in this study, with a small sample size, and only the short-term effects of chemotherapy-stage breast neoplasm patients were evaluated. This limitation may bias the results of the study, and more high-quality clinical trials are still needed to study the long-term effects of MBCR training in the future.

5. Conclusion

In summary, MBCR training can reduce anxiety, depression, PTSD, and CRF in breast cancer patients in chemotherapy stage, and promote patients' physical and mental health, which is worth to be promoted in the clinic.

Author contributions

Conceptualization: Fan Xu, Jiquan Zhang.
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