



OPEN

An examination of the effectiveness of mindfulness-integrated cognitive behavior therapy on depression, anxiety, stress and sleep quality in Iranian women with breast cancer: a randomized controlled trial

Mahboobeh Soleymani Moghadam¹, Aliakbar Parvizifard^{1✉}, Aliakbar Foroughi¹, Seyed Mojtaba Ahmadi¹ & Negin Farshchian²

Breast cancer causes numerous physical complications and mental stress that negatively impact patients' performance and quality of life. This study examined the effects of mindfulness-integrated cognitive behavior therapy (MICBT) on depression, anxiety, stress, and sleep quality in women with breast cancer. A clinical trial design with pre-tests and post-tests and a two-month follow-up were used in the current study. The target population was women with breast cancer, 30 of whom were selected through purposeful sampling. Then, 15 participants were placed in the intervention group and 15 in the control group with four random blocks. Those in the intervention group received mindfulness-integrated cognitive behavior therapy, while those in the control group received self-help (an educational book). Demographic questionnaires, the Depression, Anxiety, Stress Scale (DASS-21), and Pittsburgh Sleep Quality Index (PSQI) were used to collect data. Descriptive statistics such as frequency, mean and standard deviation, repeated measures ANOVA, and the Bonferroni test were used to analyze the data. The maximum alpha error level was considered 0.05 to test the hypotheses ($p \geq 0.05$). The results showed the effectiveness of MICBT therapy on depression, anxiety, stress, and sleep quality ($p < 0.05$). The mean scores decreased in all variables, including from 15.47 ± 1.77 in the pre-test to 11.33 ± 4.25 in the post-test for depression, from 13.20 ± 2.60 in the pre-test to 8.67 ± 4.19 in the post-test for anxiety, from 19.73 ± 1.98 in the pre-test to 14.67 ± 2.69 in the post-test for stress and from 9.20 ± 1.74 in the pre-test to 5.07 ± 2.05 in the post-test for sleep quality. Based on the results of this study, it can be concluded that MICBT therapy is effective in reducing depression, anxiety, and stress and improving sleep quality in women with breast cancer. Therefore, it is recommended that affected women use psychological treatments such as MICBT in addition to medical treatments to deal with this stressful and challenging disease. MICBT can improve mood, offer a new cognitive and behavioral system, change patients' habits and thought patterns, and improve their lifestyle.

Keywords Mindfulness-integrated cognitive behavior therapy, Breast cancer, Depression, Sleep quality

Breast cancer is the most common type of cancer in women worldwide¹, and affects more than two million women worldwide yearly². In Iran, this disease onset is a decade earlier than in developed countries³. Although the prevalence of breast cancer has increased in recent years, the mortality rate has decreased due to early detection and improved treatments⁴. However, survivors struggle with many physical and psychological problems⁵. The

¹Department of Clinical Psychology, Kermanshah University of Medical Sciences, Kermanshah, Iran. ²Department of Radiation Oncology, Faculty of Medicine, Kermanshah University of Medical Sciences, Kermanshah, Iran. ✉email: parvizia@yahoo.com

burden of these problems is significant because it affects both the mental health of the patient and the job performance, adherence to treatment, and the overall quality of life of the patient⁶. Different interventions are used for breast cancer, including surgery, chemotherapy, radiotherapy, hormone therapy, or a combination of the above interventions⁷. These interventions can cause unpleasant symptoms for patients. Chemotherapy, which some women consider to be the most uncomfortable aspect of their treatment, is associated with nausea, vomiting, fatigue, and pain. It is also associated with physiological symptoms such as night sweats and hot flashes⁸. In addition, chemotherapy disrupts the circadian rhythm and increases menopausal symptoms, which in turn affects the quantity and quality of sleep⁹. As a treatment option, surgery is also done in two ways: either it is a mastectomy in which the entire breast is removed, or it is a lumpectomy during which the breast is preserved while the tumor and surrounding tissue are removed¹⁰. Mastectomy causes the loss of symmetry and a noticeable change in the physical appearance of patients and has a profound and permanent negative effect on them. It leads to a feeling of defect and a decrease in self-worth and threatens patients' perceptions of femininity¹¹. Cancer care has five vital signs: temperature, respiration, heart rate, blood pressure, and pain. Emotional disturbance is the sixth vital sign that is added to these signs¹⁰. Despite the importance of the issue, the treatment methods used in oncology environments are primarily focused on patient's physical symptoms, and their mental distress and well-being are usually ignored¹². After women are diagnosed with breast cancer, their levels of anxiety, depression, and stress increase¹³. It has been found that continued anxiety and depression may lead to physical malfunction, which may, in turn, lead to an increased risk of death due to delay in seeing a doctor or not completing treatment as planned¹⁴. Studies have shown that approximately 7 to 46% of patients are distressed and suffer from psychological problems in the early stages of breast cancer¹⁵. Depression and anxiety are among these people's most common mental problems⁵. Anxiety related to the recurrence of the disease and its progress is one of the problems in patients that have not received proper attention and care¹⁶. According to the studies, the prevalence of depression and anxiety in these patients is 32.2 and 41.9, respectively¹⁷. Also, the side effects of cancer treatment, such as hair loss, its effect on sexual function and sex organs, and its impact on work and social roles, lead to chronic psychological stress¹⁸. People react to stress when their well-being is threatened by a threat that exceeds their coping resources. This reaction causes physical and psychological problems seen at the brain and endocrine levels¹⁹. There is a two-way relationship between stress and depression which causes short-term and long-term destructive effects in women with breast cancer and their families²⁰. It has been shown that anxiety in women with breast cancer causes fatigue and adverse treatment outcomes and affects their nervous, endocrine, and immune systems²¹. Also, depression reduces compliance with cancer treatment, and it has a negative effect on behavioral habits such as sleep, physical activity, and eating, which can decrease survival²². Both anxiety and depression affect the treatment regimen and quality of life of patients and may even increase the risk of suicide in them²¹. Sleep disorder is another common psychological symptom in people with cancer, known as a permanent problem²³. Studies have shown that 30 to 50% of cancer patients suffer from chronic sleep disorders²⁴. The prevalence of sleep problems in breast cancer patients has been found to be higher than other cancers²⁵. Sleep disorder has a profound effect on the mental, behavioral, and emotional functions of these patients, including a decrease in the quality of life, disruption in personal activities and interpersonal relationships, and memory loss. It also generally affects their health²². Even studies have shown that a decrease in sleep duration is related to an increase in breast cancer recurrence and breast cancer-specific mortality²⁶. Therefore, receiving psychological interventions and pharmaceutical and nutritional support can be part of treating women with breast cancer²⁷. Among the psychological interventions that have been used on these patients are the following: cognitive behavioral therapy, psychoeducational interventions, supportive-expressive group psychotherapy, psychosexual interventions, music therapy, and progressive muscle relaxation exercises²⁸. Interventions based on mindfulness are among the psychological interventions that are effective in alleviating cancer-related symptoms²⁹. One of these interventions is mindfulness-integrated cognitive behavior therapy, which combines mindfulness therapy with basic elements of cognitive behavioral therapy techniques³⁰. This integration aims to teach patients to learn to regulate their emotions and attention, then use these learned skills to manage their problems³¹. In the MICBT approach, patients learn to be aware of their body, for example, physical feelings, mental and emotional states, movements, behavior, and mental content³⁰. Also, MICBT reduces emotional reactions in patients³². Based on MICBT, reducing reactivity helps improve overall performance. Among other things, it helps social functioning and communication with others. As a result, it increases well-being and, in turn, prevents disease recurrence³³. During the MICBT period, patients learn to identify and change destructive thought patterns that affect their behavior³⁴. Among the exercises in MICBT are conscious breathing, body scan, loving-kindness meditation, assertiveness, and role play. MICBT treatment can be implemented as an individual and group intervention. However, treatment as an individual intervention is more appropriate for patients with severe symptoms³². The effectiveness of MICBT as a group intervention has been shown in the psychological symptoms of diseases such as multiple sclerosis^{30,34} and breast cancer³⁵. However, as far as we know, no study has investigated the effectiveness of MICBT as an individual intervention for psychological symptoms in women with breast cancer. Therefore, this study aimed to investigate the effectiveness of individual intervention MICBT on depression, anxiety, stress, and sleep quality in women with breast cancer.

Methods and materials

Method

A clinical trial design with pre-tests and post-tests and a two-month follow-up were used in the current study. The population studied in the present study included all breast cancer patients referred to Imam Reza Hospital in Kermanshah city in 2021, whom an oncologist diagnosed. A total of 30 women with breast cancer were recruited by purposive sampling, then 15 were assigned to an intervention group and 15 to a control group by quadruple-type random blocks. Quadruple blocks of intervention (A) and control (B) groups were created (AABB, ABAB,

ABBA, BBAA, BABA, BAAB). Subsequently, numbers 1–6 were assigned to cards, which were then placed into envelopes. A random selection of cards was made, forming a random string based on the chosen sequence. Participants from the intervention and control groups were assigned to the study according to this sequence. Blinding was not used in the present study. The sample size was estimated using the following formula based on previous studies³⁶. Alpha was considered as 0.05 and beta as 0.2. Since 15 and more participants were selected in most of the articles³⁷, 15 participants were considered in each group in the present study.

$$\frac{(1 - \frac{\alpha}{2} + 1 + \beta) (SD_1 + SD_2) 2}{(M_1 - M_2) 2}$$

The inclusion criteria were as follow: being between 30 and 60 years old, having the ability to read and write and participate in treatment sessions, receiving a breast cancer diagnosis more than six months ago, having informed consent to participate in the research and completing the informed consent form, not suffering from other chronic physical diseases such as diabetes and thyroid disorders, not suffering from severe mental diseases including schizophrenia spectrum disorders, bipolar type 1 and severe personality disorders, not participating in psychotherapy sessions since six months prior the treatment, no history of other cancers, no problems with hearing and vision, no history of drug use. Also, the criteria for exclusion from the research included the following: being absent for more than two intervention sessions, recurrence of the disease or metastasis in other parts of the body during the implementation of the research, unwillingness of the participants to continue the treatment process, participation in psychotherapy sessions and other support groups at the same time with the research period. The present study was conducted as an individual intervention in 8 sessions of 60 min by the first author. Table 1 provides more details of the contents of the therapy sessions. Participants in the intervention group received mindfulness-integrated cognitive behavior therapy, and participants in the control group received self-help therapy (one volume of an educational book). It should be noted that the participants completed the relevant questionnaires before receiving the interventions, and they also completed the questionnaires again immediately after the intervention and two months after the intervention (follow-up phase). The research procedure is demonstrated in the flowchart in Fig. 1.

Data analysis

The obtained data were analyzed using SPSS 26 software. The chi-square test was used to check the homogeneity of education, and Fisher’s exact test was used to check the homogeneity of the type of surgery. Background variables of age and duration of infection, were investigated with descriptive indices, and the homogeneity of the groups in terms of age and duration of the disease was investigated with the independent samples t-test. The results were analyzed using repeated measures ANOVA. The scores in the pre-test were compared to those in the post-test and follow up using Bonferroni’s post-hoc test. The maximum alpha error level to test the hypotheses was considered to be 0.05 ($p \geq 0.05$).

Ethical considerations

Before starting the study, a meeting was held to explain the project to the patients. In this meeting, ethical issues were presented, and research was explained to the patients. Then, all participants completed informed consent forms, and participants were assured that their results and identity would be kept confidential and that under no circumstances would their health information be shared with anyone except the medical staff. In this study, all health protocols related to Covid-19 were observed. Also, self-help training (receiving a training book) was used for the control group in order to comply with ethical principles. This study was approved by the Research Ethics Committee of Kermanshah University of Medical Sciences (ethical code: IR.KUMS.MED.REC.1400.088). This study has also been registered in the Iranian Registry of Clinical Trials (Clinical Trial Number: IRCT20160103025817N6 and it was registered on.

Sessions	Content
First	Introduction about meetings and rules, an overview of MICBT, the concept and principles of mindfulness and mindful breathing.
Second	Mindful breathing (continued), overview of several concepts of MICBT, (such as situation, sensory perception, evaluation, emotions and body reaction), internal causes of disturbing thoughts and their correction, part-by-part body scanning.
Third	Part-by-part body scanning (continued), explanation about body sensations, informal practice.
Forth	Body-scanning exercises (cont.), introduction of some CBT components in MICBT (such as exposure techniques), coping with unpleasant emotions using the Subjective Units of Distress Scale (SUDS) (a form used to measure exposure to target events) through Bipolar exposure (imaginary exposure to unpleasant situations)
Fifth	body scanning exercises (continued), SUDS check
Sixth	Body scanning exercises (continued), interpersonal skills, assertiveness and role playing
Seventh	Introducing the concepts of compassion and empathy, loving-kindness meditation
Eighth	Review and assessment

Table 1. Protocol of mindfulness-integrated cognitive behavior therapy (MICBT).

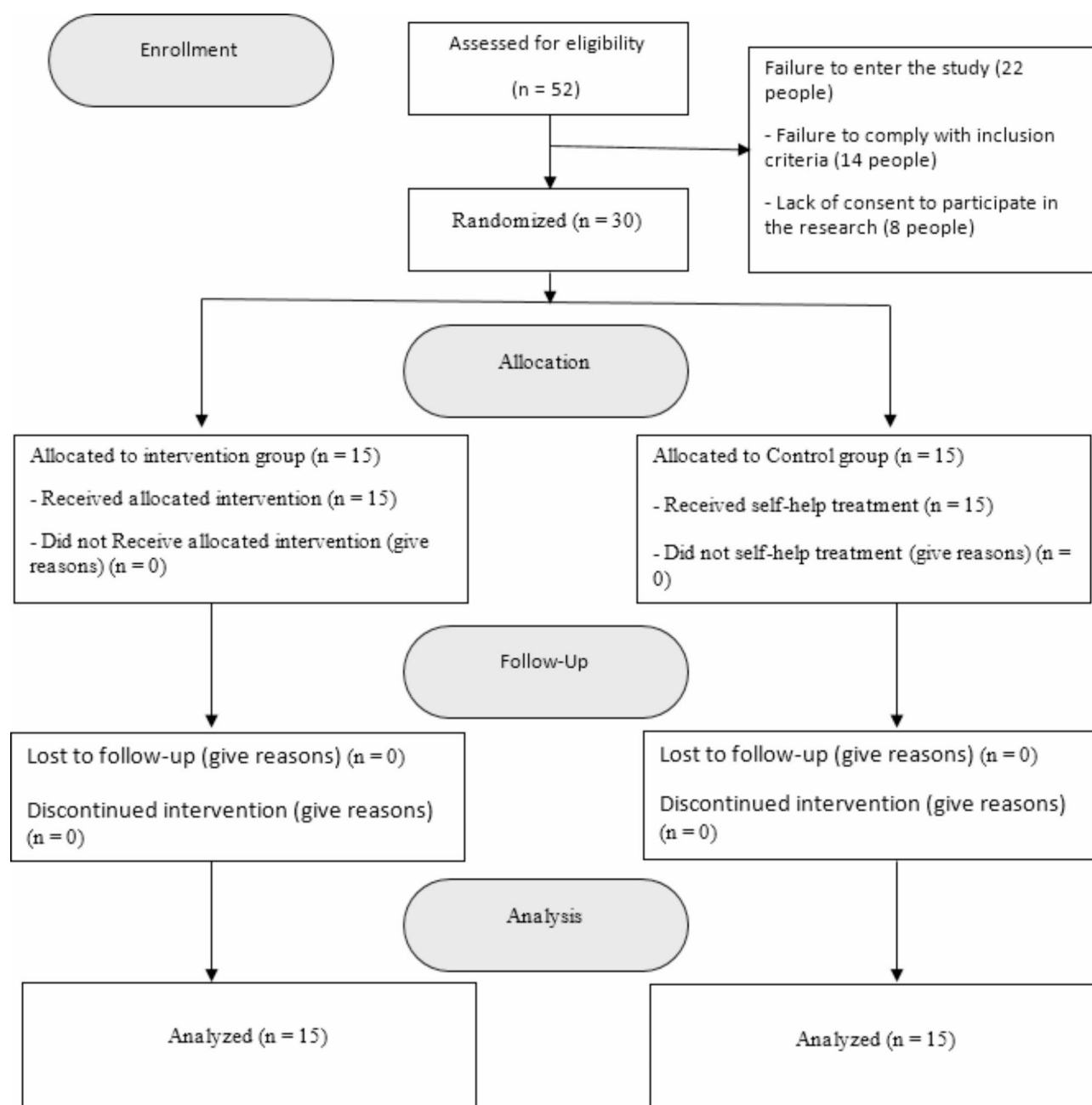


Fig. 1. Participant flow diagram.

Instruments

Demographic information questionnaire

This questionnaire was made by researchers and included age, educational level, duration of disease, and type of surgery (mastectomy, lumpectomy).

Depression, anxiety, and stress scale (DASS-21)

DASS-21 consists of 3 subscales with 7 items for each, designed to measure the emotional states of depression, anxiety, and stress³⁸. Items are scored on a Likert scale from 0 to 3. Higher scores are associated with higher levels of negative emotions. The depression subscale is interpreted as normal (0–9), mild (10–13), moderate (14–20), severe (21–27), and very severe (28+); the scores obtained from the anxiety subscale are interpreted as normal (0–7), mild (8–9), moderate (10–14), severe (15–19), and very severe (20+); and the scores in stress subscale are categorized as normal (0–14), mild (15–18), moderate (19–25), severe (26–33), and very severe (34+)³⁹.

Characteristics	Intervention group		Control group		homogeneity test	
	Frequency	Percentage	Frequency	Percentage	Statistic	P value
Educational level					a1/56	0/458
Junior high school diploma	2	13/3	4	26/7		
High School Diploma	7	46/7	4	26/7		
Undergraduate	6	40	7	46/7		
Type of surgery					b0/186	0/666
mastectomy	11	73/3	12	80		
lumpectomy	4	26/7	3	20		

Table 2. Qualitative demographic characteristics (education and type of surgery) by groups and with homogeneity test.

Variable	Intervention group				Control group				Independent t-test	
	Descriptive statistics		Kolmogorov Smirnov		Descriptive statistics		Kolmogorov Smirnov			
	Mean	Standard deviation	Statistic	P value	Mean	Standard deviation	Statistic	P value	Statistic	P value
Age	42/53	8/24	0/186	0/173	44/07	7/95	0/156	0/200	0/52	0/608
Duration of the disease	11/20	1/78	0/150	0/200	11/00	1/41	0/212	0/069	0/34	0/736

Table 3. Descriptive indices of age and duration of disease along with normality test and homogeneity of independent samples t-test.

Pittsburgh sleep quality index (PSQI)

The Pittsburgh Sleep Quality Index (PSQI) assesses subjective sleep quality over the past month. It was developed by Buysse et al. in 1988⁴⁰ and consists of 19 questions and seven components, including subjective sleep quality, sleep latency, sleep duration, normal sleep efficiency, sleep disorders, sleep medication usage, and daily functioning impairment. The overall score ranges from 0 to 21, and a score higher than 5 indicates poor sleep quality. Simply put, the higher the sleep quality score is, the worse the sleep quality is²⁶.

Results

Descriptive research findings

Table 2 describes the variables of education and type of surgery separately by groups. The chi-square test was used to check the homogeneity of education, and Fisher’s exact test was used to check the homogeneity of the type of surgery, which is a 2 × 2 variable. The sample size of each group is 15 people. The results showed that the two groups are homogeneous in terms of education and type of surgery. The significance level of the chi-square test for education and Fisher’s exact test for the type of surgery showed that there was no significant difference between the background characteristics of the two groups (p < 0.05).

In Table 3, background variables of age and duration of infection, which are quantitative variables, were investigated with descriptive indices, and the homogeneity of the groups in terms of age and duration of the disease was investigated with the independent samples t-test. The results of the Kolmogorov-Smirnov test showed that the two variables of age and duration of the disease have a normal distribution (p < 0.05). The results of the table showed that the average age in the intervention group was equal to 42.53, and in the control group was equal to 44.07. Therefore, the difference between the means was not significant and indicated the homogeneity of age in the groups (p < 0.05). The mean score for the disease duration in the intervention group was equal to 11.20, and in the control group, it was equal to 11, which indicated the equality of the two groups in terms of this underlying variable (p < 0.05).

The letter a indicates the statistic in chi-square test and the letter b indicates the statistic in Fisher’s exact test.

Table 4 describes the variables of depression, anxiety, stress, and sleep quality. Variables were described using mean and standard deviation. Also, the result of the independent samples t-test is provided in Table 4 in order to compare the mean score of each time between the two groups. Examining the mean score of depression, anxiety, and stress in the intervention group showed that the mean score of the post-test and follow-up was reduced compared to the pre-test. In other words, the mean score of depression changed from 15.47 ± 1.77 in the pre-test to 11.33 ± 4.25 in the post-test and 10.53 ± 4.10 in the follow-up. The mean score of anxiety changed from 13.20 ± 2.60 in the pre-test to 8.67 ± 4.19 in the post-test to 9.73 ± 3.99 in the follow-up. Also, the mean score of stress changed from 19.73 ± 1.98 in the pre-test to 14.67 ± 2.69 in the post-test and 16.40 ± 3.04 in the follow-up. Similarly, a decreasing trend was observed in the mean scores of sleep quality in the intervention group, and the mean score changed from 9.20 ± 1.74 in the pre-test to 5.07 ± 2.05 in the post-test and 6.20 ± 2.73 in the follow-up. Examining the independent samples t-test results showed that the mean score of all four main variables during the pre-test was not significantly different in the two groups and was almost equal. In other words, the pre-test scores of the variables were homogeneous in the two groups (p < 0.05).

Variable	Time	Intervention group		Control group		Independent t-test	
		Mean	Standard deviation	Mean	Standard deviation	Statistic	p-value
Depression	Pre-test	15/47	1/77	16/67	3/68	1/14	0/264
	Post-test	11/33	4/25	15/73	3/84	2/97	0/006**
	Follow-up	10/53	4/10	16/27	3/77	3/98	0/001>***
Anxiety	Pre-test	13/20	2/60	13/33	2/09	0/15	0/878
	Post-test	8/67	4/19	14/40	2/85	4/38	0/001>***
	Follow-up	9/73	3/99	14/13	3/16	3/35	0/002**
Stress	Pre-test	19/73	1/98	18/53	2/77	1/36	0/184
	Post-test	14/67	2/69	17/60	3/79	2/44	0/022*
	Follow-up	16/40	3/04	19/47	3/66	2/49	0/019*
Sleep quality	Pre-test	9/20	1/74	8/80	1/32	0/71	0/484
	Post-test	5/07	2/05	8/33	1/11	5/42	0/001>***
	Follow-up	6/20	2/73	7/67	2/13	1/64	0/112

Table 4. The mean and standard deviation of the main variables by type of group and time along with the independent samples t-test. ***= $p \leq 0/001$, **= $p \leq 0/01$, *= $p \leq 0/05$

Variable	Effect source	Mauchly's Test of Sphericity (<i>p</i> value)	Box's M (<i>p</i> value)	mean square	Degree of freedom	F value	P value	Effect size
Depression	group (intervention)	0/117	0/005	321/11	1	10/27	0/003	0/268
	time			106/67	1	15/86	> 0/001	0/362
	Time and group			77/07	1	11/46	0/002	0/290
Anxiety	group (intervention)	0/085	0/778	263/51	1	10/74	0/003	0/277
	time			26/67	1	6/17	0/019	0/181
	Time and group			68/27	1	15/79	> 0/001	0/361
Stress	group (intervention)	0/260	0/247	57/60	1	2/77	0/107	0/090
	time			21/60	1	4/65	0/040	0/142
	Time and group			68/27	1	14/69	0/001	0/344
Sleep quality	group (intervention)	0/272	0/152	46/94	1	10/00	0/004	0/263
	time			64/07	1	14/37	0/001	0/339
	Time and group			13/07	1	2/93	0/098	0/095

Table 5. Repeated measures ANOVA to check the effectiveness of the intervention on depression, anxiety, stress, sleep quality.

The results obtained from the intervention

The following results were obtained from the intervention: MICBT significantly reduced depression, anxiety, and stress in the intervention group compared to the control group. Also, MICBT significantly improved sleep quality in the intervention group participants compared to the control group. Repeated measures ANOVA was used to analyze the obtained results. The findings, summarized in Table 5, statistically confirmed the effect of time and group and the interaction effect on the mean score of depression, anxiety, and sleep quality ($p < 0.05$). The results showed that the effect of the group was significant, and it showed that the mean score of depression, anxiety, and sleep quality in the intervention group decreased significantly compared to the control group. This finding confirms the effectiveness of the intervention of mindfulness-integrated cognitive behavior therapy on these variables ($p < 0.05$). Also, the results showed that the effect of the group was not significant on stress. The significance level was equal to 0.107, which showed that the intervention did not have a statistically significant effect on the level of stress ($p < 0.05$). However, the time effect and the interaction effect were significant. Also, the effect of time was significant in depression, anxiety, stress, and sleep quality, which means a significant change in the mean score of all four variables in the pre-test, post-test, and follow-up ($p < 0.05$).

Table 6, shows the results of a pairwise analysis of the mean score of depression, anxiety, stress, and sleep quality separately for the two intervention and control groups. Pairwise comparisons were performed with Bonferroni's post hoc test, and scores in pre-test, post-test, and follow-up were compared. The follow-up test result showed that the mean score of depression, anxiety, stress, and sleep quality during the post-test and follow-up was significantly lower than the pre-test ($p < 0.05$). There was no significant difference in the mean score of the post-test compared to the pre-test and follow-up in the control group ($p < 0.05$).

Discussion

This study aimed to investigate the effectiveness of mindfulness-integrated cognitive behavior therapy on depression, anxiety, stress, and sleep quality in breast cancer patients. The results of the present study showed that mindfulness-integrated cognitive behavior therapy has favorable effects on the psychological symptoms of breast

Variable	Group	Comparison	Mean difference	Standard error	P value
Depression	Intervention	Pre-test with post-test	4/13	1/15	0/009
		Pre-test with follow-up	4/93	1/18	0/003
		Post-test with follow-up	0/80	0/380	0/162
	Control	Pre-test with post-test	0/93	0/547	0/331
		Pre-test with follow-up	0/40	0/623	1
		Post-test with follow-up	-0/53	0/236	0/236
Anxiety	Intervention	Pre-test with post-test	4/53	0/883	> 0/001
		Pre-test with follow-up	3/47	0/792	0/002
		Post-test with follow-up	-1/07	0/431	0/080
	Control	Pre-test with post-test	-1/07	0/613	0/311
		Pre-test with follow-up	-0/80	0/725	0/865
		Post-test with follow-up	0/27	0/473	1
Stress	Intervention	Pre-test with post-test	5/07	0/753	> 0/001
		Pre-test with follow-up	3/33	0/909	0/008
		Post-test with follow-up	-1/73	0/727	0/095
	Control	Pre-test with post-test	0/93	0/581	0/392
		Pre-test with follow-up	-0/93	0/643	0/507
		Post-test with follow-up	-1/87	0/456	0/003
Sleep quality	Intervention	Pre-test with post-test	4/13	0/487	> 0/001
		Pre-test with follow-up	3/00	0/822	0/008
		Post-test with follow-up	-1/13	0/696	0/377
	Control	Pre-test with post-test	0/47	0/376	0/706
		Pre-test with follow-up	1/13	0/716	0/408
		Post-test with follow-up	0/67	0/715	1

Table 6. Bonferroni's post hoc test to compare the mean score of depression, anxiety, stress, and sleep quality by two groups.

cancer patients and reduces the symptoms of depression, anxiety, and stress. The results of the present study are in line with the study of Piet et al.⁴¹ and the study of Chayadi et al.⁴², who showed in their meta-analysis that mindfulness-based interventions reduce depression and anxiety in cancer patients. One of the characteristics of MICBT is its meta-diagnostic approach³². It deals with processes such as metacognitive awareness, selective attention to internal and external stimuli, and avoidance³³. Mindfulness helps people deal with emotions peacefully¹⁵ and helps them realize that negative emotions may occur but are not permanent³⁵. This approach teaches people to see mental states such as anxiety and worries as transitory and not real situations³¹. MICBT has four learning stages. The first stage is the personal stage. This stage emphasizes the inner texture of the experience before dealing with every day tensions. At this stage, people learn to regulate their attention and emotions³². Attention is important in mindfulness because it helps people discover four areas of experience, including feelings, thoughts, emotions, and behavior⁴³. Exposure is the second step of MICBT treatment. In this stage, people learn to reduce the avoidance that causes anxiety and prevents them from progressing toward their goals or living according to their values³². In fact, practicing mindfulness helps people stay in touch with the experience rather than trying to avoid or control it⁴⁴. The third stage of MICBT is the interpersonal stage, during which awareness of interpersonal boundaries and assertiveness skills increase³². Assertiveness training reduces depression by improving decision-making ability, experiencing positive emotions, and increasing self-esteem³⁴. Evidence shows that assertiveness reduces distress in a wide range of situations. Finally, the last stage of Cayoun's four-step treatment is empathy. This stage includes expanding moral awareness and compassion for self and others³². By creating an attitude of compassion and accepting traumatic experiences caused by cancer, mindfulness makes patients establish a new relationship with cancer⁴³. Studies have shown a correlation between anxiety, depression, and sleep disorders. Anxiety and depression can lead to excessive functioning of the hypothalamus-pituitary-adrenal axis, an increase in sympathetic excitability, and an increase in the level of norepinephrine and cortisol in the blood, which in turn leads to the arousal of patients and problems in their sleep⁴⁵. Meditation, especially with a strong focus on breathing exercises, moderates the physiological markers of stress in people experiencing depressive symptoms. Therefore, meditation prevents mood disorders by regulating the stress response⁴⁶. Stress has different meanings for people in different situations. It can be said that stress is a condition in which a person is agitated and anxious due to an uncontrollable challenge. Stress leads to fear and anxiety⁴⁷. However, anxiety is a vague and uncomfortable feeling that is aggravated by long-term stress and the presence of multiple stressors⁴⁸. Anxiety is a state of intense apprehension, uncertainty, and excessive fear as a response to unpleasant stimuli²¹. MICBT training helps patients reduce stress, change their circumstances, and reach optimism and trust³⁴. In fact, mindfulness teaches people to have a non-judgmental attitude, accept their experiences, reduce reactivity towards them, and manage them effectively⁴⁹. MICBT can reduce depression, anxiety, and stress through mindfulness in several ways. First, mindfulness teaches patients

skills to see their mental states as fleeting, which teaches them how to deal with their thoughts and positive and negative emotions³⁰. Second, MICBT uses conscious breathing to live in the present moment, which can help the patient reduce worries about the past and worries and disturbing thoughts about the future³⁴. Third, body scanning helps to be aware and accept body feelings in everyday situations³¹. People are better able to regulate their emotions in thought and feeling when they are familiar with their bodies' basic feelings and accept them as they are³⁰. Fourth, MICBT increases people's ability to act through interpersonal skills training, including self-expression training and role-playing skills. This leads to a reduction in reluctance and unwillingness to engage in behaviors that indicate depression³⁴. Evidence suggests that assertiveness reduces distress in a wide range of situations. Therefore, lower assertiveness and poor verbal communication increase the probability of the recurrence of depression and anxiety³². Also, the present study showed that MICBT improved the quality of sleep in the intervention group. The results of the present study are in line with the results of the study of Pouyanfar et al., which showed that MICBT improved the quality of sleep in patients with multiple sclerosis³¹. Mindfulness considers several cognitive and affective processes and has been found to reduce ruminative thoughts, reduce emotional reactivity, and promote unbiased reappraisal of salient experiences, which together can improve sleep quality⁵⁰. Cultivating a non-judgmental attitude in mindfulness may be a way to reduce dysfunctional attitudes and beliefs about sleep and improve sleep. Mindfulness allows thoughts and feelings to recur without engaging in efforts to change the experience, and it helps facilitate cognitive deactivation and physiological arousal, which are essential components of the sleep experience⁵¹. Mindfulness helps improve sleep quality by changing people's psychological flexibility, which happens through awareness, that is, acceptance without judgment of the feelings that a person experiences at that moment⁵². Therefore, considering the effectiveness of MICBT treatment on the symptoms of breast cancer patients, it is suggested that psychologists and counselors use this treatment as a therapeutic strategy to reduce anxiety, depression, and stress and improve sleep in breast cancer patients.

Limitations

The current research had some limitations, including that some patients did not want to cooperate due to inappropriate psychological conditions and fatigue caused by chemotherapy. Therefore, a meeting plan was implemented based on the patients' available times to get their cooperation. Another limitation is related to the fact that the type of drug treatment used to treat the patients (chemotherapy, radiation therapy, hormone therapy) was different. This difference in the drug treatment procedure may lead to different results for the patients. Furthermore, the last limitation was using a heterogeneous sample (mastectomy or lumpectomy) due to the unavailability of a homogeneous sample. In addition, another limitation was the use of a heterogeneous sample (mastectomy or lumpectomy) due to the unavailability of a homogeneous sample. Among other research limitations, we can mention the low sample size. It is suggested that this treatment be used in larger samples with other psychological variables. Another limitation in this research can be mentioned: since breast cancer is a relational cancer and it affects the level of intimacy, emotional relationships, and sexual relations of the patients and disrupts the psychological status of the patients, it is suggested to provide MICBT treatment training to the husbands of these affected women to improve the quality of their relationships with their spouses.

Conclusion

Breast cancer is a stressful disease which involves them and their families. For this reason, women with breast cancer face many challenges. The present study provided evidence for the effectiveness of MICBT. MICBT therapy can help patients achieve acceptance through techniques such as experiencing the present, deep breathing, better understanding of thoughts, feelings, and physical states, as well as role-playing and assertiveness training. This research follows an innovative approach as it employed MICBT treatment both as an individual and a group intervention. Also, it implemented MICBT treatment as an individual intervention, which has not been performed in women with breast cancer as an individual intervention. With the increasing prevalence of breast cancer, the results of this study can be helpful in treatment programs and services for breast cancer patients to reduce anxiety and depression and improve the quality of sleep and life among them. The results show that patients can benefit from psychological treatments in addition to medical treatments, such as improving mood and increasing positive emotions, acquiring a new cognitive and behavioral system, changing old habits and thought patterns, improving lifestyle, and improving self-expression and expression of feelings by the patient.

Data availability

The dataset analysed during this study is available from the corresponding author on reasonable request.

Received: 2 July 2024; Accepted: 6 January 2025

Published online: 01 April 2025

References

- Chiesi, F. et al. Positive personal resources and psychological distress during the COVID-19 pandemic: resilience, optimism, hope, courage, trait mindfulness, and self-efficacy in breast cancer patients and survivors. *Support. Care Cancer*. **30** (8), 7005–7014 (2022).
- Sakki, S. E. et al. Mindfulness is associated with improved psychological well-being but no change in stress biomarkers in breast cancer survivors with depression: a single group clinical pilot study. *BMC Women's Health*. **22** (1), 518 (2022).
- Fouladi, N. et al. The predictors of sexual satisfaction among Iranian women with breast Cancer. *Asian Pac. J. cancer Prevention: APJCP*. **22** (2), 391 (2021).
- Shergill, Y. et al. Mindfulness-based stress reduction in breast cancer survivors with chronic neuropathic pain: a randomized controlled trial. *Pain Research and Management*. ;2022. (2022).
- Rani, R., Joseph, J. & Dhankhar, R. Brief psychological intervention among treatment-seeking cancer patients: A randomized controlled trial. (2023).

6. Yang, H. et al. Time-dependent risk of depression, anxiety, and stress-related disorders in patients with invasive and in situ breast cancer. *Int. J. Cancer*. **140** (4), 841–852 (2017).
7. Wu, T-Y. et al. Dynamic changes of body image and quality of life in breast cancer patients. *Cancer Manage. Res.* :10563–10571. (2019).
8. Jassim, G. A., Doherty, S., Whitford, D. L. & Khashan, A. S. Psychological interventions for women with non-metastatic breast cancer. *Cochrane Database of Systematic Reviews*. (1). (2023).
9. Beverly, C. M. et al. Change in longitudinal trends in sleep quality and duration following breast cancer diagnosis: results from the women's Health Initiative. *NPJ Breast Cancer*. **4** (1), 15 (2018).
10. Álvarez-Pardo, S. et al. Related factors with depression and anxiety in mastectomized women breast cancer survivors. *Int. J. Environ. Res. Public Health*. **20** (4), 2881 (2023).
11. Erturhan Türk, K. & Yilmaz, M. The effect on quality of life and body image of mastectomy among breast cancer survivors. *Eur. J. Breast Health* ;**14**. (2018).
12. Javan Biparva, A. et al. Global depression in breast cancer patients: systematic review and meta-analysis. *PLoS One*. **18** (7), e0287372 (2023).
13. Ozdemir, D. & Tas Arslan, F. An investigation of the relationship between social support and coping with stress in women with breast cancer. *Psycho-oncology* **27** (9), 2214–2219 (2018).
14. Kim, K. & Park, H. Factors affecting anxiety and depression in young breast cancer survivors undergoing radiotherapy. *Eur. J. Oncol. Nurs.* **50**, 101898 (2021).
15. Zhang, J-Y., Li, S-S., Meng, L-N. & Zhou, Y-Q. Effectiveness of a nurse-led mindfulness-based Tai Chi Chuan (MTCC) program on Posttraumatic Growth and perceived stress and anxiety of breast cancer survivors. *Eur. J. Psychotraumatology*. **13** (1), 2023314 (2022).
16. Park, S. et al. Mindfulness-based cognitive therapy for Japanese breast cancer patients—a feasibility study. *Jpn J. Clin. Oncol.* **48** (1), 68–74 (2018).
17. Kang, C. et al. The psychological effect of internet-based mindfulness-based stress reduction on the survivors of breast cancer during the COVID-19. *Front. Psychiatry*. **12**, 738579 (2021).
18. Liu, W., Liu, J., Ma, L. & Chen, J. Effect of mindfulness yoga on anxiety and depression in early breast cancer patients received adjuvant chemotherapy: a randomized clinical trial. *J. Cancer Res. Clin. Oncol.* **148** (9), 2549–2560 (2022).
19. Soria-Reyes, L. M., Cerezo, M. V., Alarcón, R. & Blanca, M. J. Psychometric properties of the perceived stress scale (pss-10) with breast cancer patients. *Stress Health*. **39** (1), 115–124 (2023).
20. Ghatak, S., Sharma, G. & STRESS IN BREAST CANCER PATIENT AND MINDFULNESS THERAPY OF BHAGWAN MAHAVEER CANCER HOSPITAL AND RESEARCH CENTER. *J. Pharm. Negat. Results* :1382–1389. (2022).
21. Ng, C. G. et al. Perceived distress and its association with depression and anxiety in breast cancer patients. *PloS One*. **12** (3), e0172975 (2017).
22. Park, H., Kim, K-E., Moon, E. & Kang, T. Psychometric properties of assessment tools for depression, anxiety, distress, and psychological problems in breast cancer patients: a systematic review. *Psychiatry Invest.* **20** (5), 395 (2023).
23. Suh, H-W. et al. The mindfulness-based stress reduction program for improving sleep quality in cancer survivors: a systematic review and meta-analysis. *Complement. Ther. Med.* **57**, 102667 (2021).
24. Hydeman, J., Ernhout, C., Attwood, K. & Hong, C-C. RCT of an online MBSR intervention with metastatic breast Cancer patients. (2022).
25. Andersen, S. R. et al. Effect of mindfulness-based stress reduction on sleep quality: results of a randomized trial among Danish breast cancer patients. *Acta Oncol.* **52** (2), 336–344 (2013).
26. Weng, Y-P. et al. Sleep quality and related factors in patients with breast cancer: a cross-sectional study in Taiwan. *Cancer Manage. Res.* :4725–4733. (2021).
27. Li, H. et al. Systematic review and meta-analysis of the efficacy and safety of psychological intervention nursing on the quality of life of breast cancer patients. *Gland Surg.* **11** (5), 882 (2022).
28. Matthews, H., Grunfeld, E. A. & Turner, A. The efficacy of interventions to improve psychosocial outcomes following surgical treatment for breast cancer: a systematic review and meta-analysis. *Psycho oncol.* **26** (5), 593–607 (2017).
29. Zhang, D., Lee, E. K., Mak, E. C., Ho, C. & Wong, S. Y. Mindfulness-based interventions: an overall review. *Br. Med. Bull.* **138** (1), 41–57 (2021).
30. Bahrani, S., Zargar, F., Yousefipour, G. & Akbari, H. The effectiveness of mindfulness-integrated cognitive behavior therapy on depression, anxiety, and stress in females with multiple sclerosis: a single blind randomized controlled trial. (2017).
31. Pouyanfard, S., Mohammadpour, M., akbar Parvizifard, A. & akbar Foroughi, A. The effectiveness of mindfulness-integrated cognitive-behavioral therapy on sleep quality, anxiety, and fatigue in patients with multiple sclerosis: a randomized clinical trial. *J. Sleep. Sci.* **4** (1–2), 1–8 (2019).
32. Cayoun, B. A., Francis, S. E. & Shires, A. G. *The Clinical Handbook of Mindfulness-integrated Cognitive Behavior Therapy: A step-by-step Guide for Therapists* (Wiley, 2018).
33. Francis, S. E., Shawyer, F., Cayoun, B., Enticott, J. & Meadows, G. N. Group mindfulness-integrated cognitive behavior therapy (MiCBT) reduces depression and anxiety and improves flourishing in a transdiagnostic primary care sample compared to treatment-as-usual: a randomized controlled trial. *Front. Psychiatry*. **13**, 815170 (2022).
34. Pouyanfard, S., Mohammadpour, M., ParviziFard, A. A. & Sadeghi, K. Effectiveness of mindfulness-integrated cognitive behavior therapy on anxiety, depression and hope in multiple sclerosis patients: a randomized clinical trial. *Trends Psychiatry Psychother.* **42** (1), 55–63 (2020).
35. Mozafari-Motlagh, M-R., Nejat, H., Tozandehjani, H. & Samari, A-A. Effect of cognitive behavior therapy integrated with mindfulness on perceived pain and pain self-efficacy in patients with breast cancer. *J. Nurs. Midwifery Sci.* **6** (2), 51–56 (2019).
36. Nabipour Gisi, S., Rafieepoor, A. & Haji Alizadeh, K. Effectiveness of mindfulness-based cognitive therapy (MBCT) on psychological symptoms in patients with cancer. *J. Res. Behav. Sci.* **16** (3), 333–343 (2019).
37. Park, S. et al. Mindfulness-based cognitive therapy for psychological distress, fear of Cancer recurrence, fatigue, spiritual Well-Being, and quality of life in patients with breast Cancer—A Randomized Controlled Trial. *J. Pain Symptom Manag.* **60** (2), 381–389 (2020).
38. De Jaeghere, E. A. et al. Mental health and quality of life among patients with cancer during the SARS-CoV-2 pandemic: results from the longitudinal ONCOVID survey study. *Cancers* **14** (4), 1093 (2022).
39. Vanni, G. et al. The effect of coronavirus (COVID-19) on breast cancer teamwork: a multicentric survey. *Vivo* **34** (3 suppl), 1685–1694 (2020).
40. Otero, P. Using a wearable device and patient reported outcome to evaluate the influence of sleep on quality of life among breast and prostate cancer patients. (2022).
41. Piet, J., Würtzen, H. & Zachariae, R. The effect of mindfulness-based therapy on symptoms of anxiety and depression in adult cancer patients and survivors: a systematic review and meta-analysis. *J. Consult. Clin. Psychol.* **80** (6), 1007 (2012).
42. Chayadi, E., Baes, N. & Kiroopoulos, L. The effects of mindfulness-based interventions on symptoms of depression, anxiety, and cancer-related fatigue in oncology patients: a systematic review and meta-analysis. *PloS One*. **17** (7), e0269519 (2022).
43. Iannopollo, L. et al. Mindfulness meditation as psychosocial support in the breast cancer experience: a case report. *Behav. Sci.* **12** (7), 216 (2022).

44. Larouche, M., Cote, G., Belisle, D. & Lorrain, D. Kind attention and non-judgment in mindfulness-based cognitive therapy applied to the treatment of insomnia: state of knowledge. *Pathol. Biol. (Paris)*. **62** (5), 284–291 (2014).
45. Zhu, W., Gao, J., Guo, J., Wang, L. & Li, W. Anxiety, depression, and sleep quality among breast cancer patients in North China: mediating roles of hope and medical social support. *Support. Care Cancer*. **31** (9), 514 (2023).
46. Pascoe, M. C., Thompson, D. R., Jenkins, Z. M. & Ski, C. F. Mindfulness mediates the physiological markers of stress: systematic review and meta-analysis. *J. Psychiatr. Res.* **95**, 156–178 (2017).
47. Fink, G. Stress, Definitions, Mechanisms, and Effects Outlined: Lessons from Anxiety. *Stress: Concepts, Cognition, Emotion, and Behavior*. 3–11 (Elsevier, 2016).
48. Turner, K. & McCarthy, V. L. Stress and anxiety among nursing students: a review of intervention strategies in literature between 2009 and 2015. *Nurse Educ. Pract.* **22**, 21–29 (2017).
49. Yazdanimehr, R., Omid, A., Sadat, Z. & Akbari, H. The effect of mindfulness-integrated cognitive behavior therapy on depression and anxiety among pregnant women: a randomized clinical trial. *J. Caring Sci.* **5** (3), 195 (2016).
50. Rusch, H. L. et al. The effect of mindfulness meditation on sleep quality: a systematic review and meta-analysis of randomized controlled trials. *Ann. N. Y. Acad. Sci.* **1445** (1), 5–16 (2019).
51. Garland, S. N., Campbell, T., Samuels, C. & Carlson, L. E. Dispositional mindfulness, insomnia, sleep quality and dysfunctional sleep beliefs in post-treatment cancer patients. *Pers. Individ. Differ.* **55** (3), 306–311 (2013).
52. Talley, G. & Shelley-Tremblay, J. The relationship between mindfulness and sleep quality is mediated by emotion regulation. *Psychiatry Int.* **1** (2), 42–66 (2020).

Acknowledgements

We would like to thank participants of this study for their contribution.

Author contributions

M. Soleymani Moghadam was responsible for the study conception, design, and, writing-original draft, and writing- review and editing. A. Parvizifard was responsible for project administration and supervision. A. Foroughi was responsible for contributing to the study conception and, design, supervision and revision of the manuscript. S. M. Ahmadi was responsible for results analysis, supervision, writing and revision of the manuscript; N. Farshchian was responsible for the editing and revision of the manuscript; All authors have read and agreed on the published version of the manuscript.

Declarations

Competing interests

The authors declare no competing interests.

Ethics approval and consent to participate

All appropriate procedures conducted in research involving human participants were in line with the ethical standards of the research Ethics Committee of Kermanshah University of Medical Sciences (ethical code: IR.KUMS.MED.REC.1400.088). therefore, it guarantees that the standards set by the Declaration of Helsinki are met. The objectives and methods of the study, the optionality of participating in the study and guaranteed anonymity were explained to the participants, and then informed consent was obtained from them.

Additional information

Correspondence and requests for materials should be addressed to A.P.

Reprints and permissions information is available at www.nature.com/reprints.

Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Open Access This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

© The Author(s) 2025