Impact of Mindfulness-Based Stress Reduction on Female Sexual Function and Mental Health in Patients with Breast Cancer

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Research Article

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Abstract

Purpose

There have been few studies using mindfulness-based stress reduction (MBSR) to improve sexual function in Asian women with breast cancer. This study aimed to evaluate the impact of mindfulness intervention on female sexual function, mental health and quality of life in patients with breast cancer.

Methods

Fifty-one women with breast cancer were allocated into 6-week MBSR (n=26) session or usual care (n=25), without differences in group characteristics. The research tools included the Female Sexual Function Index (FSFI), the Depression Anxiety Stress Scales-21 (DASS-21), and the EuroQol instrument (EQ-5D). The Greene Climacteric Scale (GCS) was used to verify the foregoing scale. The effects of MBSR were evaluated by the differences between the post- and pre-intervention score in each scale. Statistical analyses consisted of descriptive dataset and Mann-Whitney ranked-pairs test.

Results

Although MBSR did not significantly improve sexual desire and depression in patients with breast cancer, MBSR could improve parts of female sexual function [i.e. Δ arousal: 5.73 vs. -5.96, Δ lubrication: 3.35 vs. -3.48, and Δ satisfaction: 8.48 vs. 1.76; all $p < .005$] assessed by the FSFI, and mental health [Δ anxiety: -10.92 vs. 11.36 and Δ stress: -10.96 vs. 11.40; both $p < .001$] assessed by the DASS-21.

Conclusion

Our study revealed that MBSR can improve female sexual function and mental health except sexual desire and depression in women with breast cancer. Medical staffs can incorporate MBSR into clinical health education for patients with breast cancer to promote their overall quality of life.

Introduction

Among cancers, breast cancer is the most prevalent among women and has the second-highest mortality rate in Taiwan [1]. The vast majority of patients with breast cancer receive surgery and adjuvant treatment, and iatrogenic menopause or estrogen deprivation therapy in the treatment of female breast cancer can adversely affect sexual function [2]. The literature show that female patients with breast cancer are subject to changes in sexual function, body image, sexual activity, and intimacy after treatment [3]. After experiencing menopausal symptoms and changes in sexual function, patients with breast cancer can feel distressed, frustrated, helpless, and psychologically burdened [4].

There are only five related studies related to "mindfulness" and "sexual function". The research participants included patients undergoing fallopian tube and ovarian resection [5], having menopause-related symptoms [6, 7], having multiple sclerosis [8], and having interstitial cystitis [9]. The research

results have indicated that mindfulness intervention improves menopausal symptoms [7] and hot flashes [5] and also increases sexual function and satisfaction [8]. Few studies have focused on women with breast cancer in Asia and on how mindfulness intervention can improve their sexual function and alleviate their menopausal symptoms.

Most studies have used mindfulness-based intervention to monitor symptom clusters pertaining to, for example, the physiology, psychology, and activity response of patients with cancer. In a meta-analysis of 11 papers, Chang et al. (2020) reported that at the end of mindfulness-based stress reduction (MBSR) intervention, depression (standardized mean difference, -1.32 ; 95% confidence interval [CI], -2.18 to -0.46 ; $I^2 = 97\%$) and fatigue symptoms (mean difference [MD], -0.47 ; 95% CI, -0.59 to -0.34 ; $I^2 = 0\%$) were significantly reduced. In addition, the patients' stress (MD, -0.79 ; 95% CI, -1.34 to -0.24 ; $I^2 = 0\%$) was significantly decreased within 3 months from the initial date. The quality of life did not reach statistical significance at either the end of the intervention or within 3 months after baseline [10]. Lengacher et al. (2018) implemented a single-group study with a pre- and posttest design, with a 6-week, 2-h weekly MBSR intervention. Participants were required to use an iPad app to practice mindfulness for 15–45 min daily and to record how long they practiced. After 6 weeks, the patients with breast cancer exhibited improvements in depression, anxiety, stress, fear of cancer recurrence, sleep quality, fatigue, and life span [11]. Bisseling et al. (2017) employed a mixed-method design for an 8-consecutive-week, 2.5-h-weekly mindfulness-based stress reduction (MBSR) intervention to improve patients' physical and emotional quality of life, well-being, mindfulness skills, and self-compassion. Among these factors, only rumination and global quality of life did not significantly improve. This may be attributable to the deterioration of mindfulness skills after treatment; when time as a moderating variable was added to the analysis, emotional functioning and well-being became nonsignificant [12]. In the qualitative interview stage, the following three themes were determined to comprise one overarching theme: participation during anticancer treatment, participation after anticancer treatment, and participation in relation to emotional processing [12]. Reich et al. (2017) also reported that MBSR resulted in improvements in symptom clusters, such as anxiety, depression, perceived stress, quality of life, and fatigue, especially in the sixth week of treatment when psychological and fatigue symptoms affected patients most severely [13]. Therefore, the outcomes hypothesized that "mindfulness intervention" can improve the degree of "female sexual function" and "mental health".

Methods

Participant inclusion and exclusion criteria

This study used purposive and snowball sampling. Specifically, prospective participants who visited clinics, groups, or websites on breast cancer were recruited. Patients were included only if they had a diagnosis of breast cancer within the previous 2 years at stage 0–IV; were over 20 years old; were able to communicate in Mandarin; had received at least one instance of adjuvant therapy; and had a score of ≤ 1 on the Eastern Cooperative Oncology Group (ECOG) performance status scale [14]. Patients were

excluded if they had a been diagnosed with mental illness. This study was conducted over 6 consecutive weeks and had pre- and posttests, participants were required to participate in the course for at least 5 weeks; if they were absent for more longer, they were excluded from the analysis. In cases of absence, we contacted the participants by phone and sent them a questionnaire to complete.

Procedure

Study Design. This study adopted a quasi-experimental design where groups were compared with respect to MBSR. The control group received routine treatment but did not receive MBSR. The MBSR sessions included (1) 6 consecutive weeks of 2 h-sessions and (2) home-based practice using a CD with meditation instruction. Specifically, the participants undertook home-based practice at least 10–15 min daily, 5–6 times per week, and they participants recorded their personal experience on a sheet.

Ethics. All appropriate procedures conducted in research involving human participants were in line with the ethical standards of the institutional research committee in Taiwan.

Data Collection. During the orientation, all participants gave their written informed consent. The two time points at which measurements of the variables were taken were when the pre- or posttest occurred. (1) Pretest: This time point was no later than the second week of the course. The baseline values were determined by responses to questions that were based on the scale in its entirety. (2) Posttest: This time point was after the end of the sixth week of the course, and a comprehensive questionnaire was completed within one week. Participants were incentivized with NT\$100 and NT\$200 gift cards for completing the preintervention and postintervention questionnaires, respectively. Participants in the experimental group also received a yoga mat.

Female sexual function, mental health, and quality of life measures

Main research tools

Female Sexual Function. The Female Sexual Function Index (FSFI) comprising 19 items scored on a 5-point Likert-type scale was used to measure female sexual function [15]. Scores ranged from 2 to 36, with higher FSFI scores indicating better sexual function and scores below 26.55 indicating a risk of sexual dysfunction. The FSFI was divided into six domains, namely desire, arousal, lubrication, orgasm, satisfaction, and pain. Each of the individual domains had good test–retest reliability ($r = .79-.86$) [15].

Depression, Anxiety, and Stress. The Depression, Anxiety, and Stress Scale (DASS-21) was divided into 21 items under the 3 axes of depression, anxiety, and stress; the scale measured the mental health of the participants over the past week on a 3-point Likert-type scale from 0 (*never*) to 3 (*almost always*) [16]. The DASS Anxiety and Depression scales had a 0.81 and 0.74 correlation coefficient with the Beck Anxiety Inventory, respectively [16].

Quality of Life. The EQ-5D tool was developed and is widely used in Europe to assess general quality of life. It covers the five areas of mobility, self-care, everyday activity, pain or discomfort, and anxiety and depression. The EQ-5D tool includes a Visual Analog Scale; patients draw a line directly on the scale and the corresponding score represents their daily health status, scored from 0 to 100 with lower scores indicating worse health status [17]. For the test–retest reliability of items in the EQ-5D, their Kappa coefficients ranged from 0.49 to 1 ($p < .001$) [18].

Basic Demographic Questionnaire. Data on age, time since diagnosis (months), education level, marital status, menopause status, and employment status were collected through a self-reported questionnaire. The participants' medical records confirmed their staging and treatment of cancer.

Research tools for validation

Climacteric Symptoms. The Greene Climacteric Scale (GCS) is a 21-item tool that evaluates the following four domains: mental health (items 1–11), physical health (items 12–18), vasomotor function (items 19 and 20), and loss of interest in sex (item 21) on a Likert-type scale ranging from 0 (*not at all*) to 3 (*extremely*) [19, 20]. A higher score indicated more severe menopausal symptoms. The factor loadings were greater than .35, and the internal consistency was indicated by a Cronbach's alpha of .83–.87 [20].

Fidelity

A 6-week intervention by a qualified mindfulness facilitator who have received over 9 years of MBSR system training and supervised every week by a co-investigator (co-PI) who records the length of the patient's practice. In order to enhance fidelity, the 2-hour introduction meeting which reminded participants to follow the training manual and the first author contacted the participants through a mobile LINE APP every week, reminding patients to practice, participate in the next course, motivate participants and answer any questions they may encounter as much as possible.

Sample size

The study determined the difference in outcomes between the intervention and control groups at a statistical power of 80%, accounting for a potential dropout rate of approximately 20%. Therefore, the total number of participants had to be at least 40.

Statistical analysis

The data analysis was conducted using SPSS for Windows 22.0 (IBM, Chicago, IL, USA). The collected questionnaires were coded, and the accuracy of the data were verified repeatedly after being input. Descriptive statistics were used to summarize the demographic and clinical characteristic of the patients. This study had a small sample, and the Kolmogorov–Smirnov test determined that the data were not normally distributed. Therefore, the differences in absolute values and in the changes in values before and after the intervention between the two groups were tested using nonparametric statistical methods. Within-subject changes in the levels of climacteric symptoms, female sexual function, anxiety, depression, stress, and quality of life at pre- and postintervention were analyzed using the Mann–Whitney

U Test for continuous variables; a Chi-square test was used for the categorical variables. In all analyses, statistical significance was defined by a two-sided p value less than .05.

Results

Patient characteristics

A total of 51 patients were recruited; 26 and 25 people were assigned to the experimental and control groups, respectively. The demographic and clinical characteristics of the patients are listed in Table 1. All participants were women and the majority were adults (age: 47.77 ± 9.29 years old). Most had university education (20, 39.2%), followed by junior college education (12, 23.5%). The majority of participants were married (33, 67.4%), and 10 were unmarried (19.6%). With regard to employment, most were retired (13, 25.5%), nine were working in secondary industry or commerce, and nine were working in occupations classified under *other* (both 17.6%). A total of 23 (45.1%) patients answered *yes* for the option regarding menopause, and 28 (54.9%) answered *no*. The average duration since breast cancer diagnosis was 19.28 ± 15.78 months, and 25 patients (54.9%) were diagnosed as having stage II cancer. At the time of the study, the main form of treatment was hormone therapy (26, 51.0%). No significant difference in the data on basic characteristics of the experimental and control group was noted.

Table 1
The demographic and clinical characteristic of patients with breast cancer

characteristic	Total (n = 51) ^a	MBSR (n = 26) ^a	UC (n = 25) ^a	p-value
Age,years (SD)	47.77(9.29)	50.19(11.25)	45.24 (5.90)	.17
Time since diagnosis, months(SD)	19.28(15.78)	24.81(19.13)	13.52(8.37)	.09
Educational, n(%)				.08
Elementary	3(5.9)	3(11.5)	0(0.0)	
Junior	2(3.9)	0(0.0)	2(8.0)	
Senior High	9(17.6)	2(7.7)	7(28.0)	
Junior college	12(23.5)	6(23.1)	6(24.0)	
University	20(39.2)	13(50.0)	7(28.0)	
Graduate institute	5(9.8)	2(7.7)	3(12.0)	
Marital status, n(%)				.06
Unmarried	10(19.6)	8(30.8)	2(8.0)	
Married	33(64.7)	15(57.7)	16(64.0)	
Divorced	5(9.8)	0	5(20.0)	
Cohabitation	2(3.9)	2(7.7)	1(4.0)	
Separation	1(2.0)	1(3.8)	1(4.0)	
Employment status, n(%)				.27
Retired	13(25.5)	9(34.6)	4(16.0)	
Government employees	5(9.8)	1(3.8)	4(16.0)	
Industry/commerce	9(17.6)	3(11.5)	6(24.0)	
House Keeper	8(15.7)	3(11.5)	5(20.0)	
Service industry	7(13.7)	4(15.4)	3(12.0)	

^a Categorical variable were presented as frequencies and percentages, continuous variables were presented as median and interquartile range (IQR). Continuous variables were used Mann-Whitney U Test; categorical variables were used Chi-square test

MBSR Mindfulness-Based Stress Reduction;*UC* Usual care

SD, Standard Deviation

characteristic	Total (n = 51) ^a	MBSR (n = 26) ^a	UC (n = 25) ^a	<i>p</i> -value
Other	9(17.6)	6(23.1)	3(12.0)	
Menopause, n(%)				.07
Yes	23(45.1)	15(57.7)	8(32.0)	
No	28(54.9)	11(42.3)	17(68.0)	
Cancer staging, n(%)				.13
Stage 0	4(7.8)	4(15.4)	1(4.0)	
Stage I	6(11.8)	5(19.2)	3(12.0)	
Stage II	25(54.9)	10(38.5)	12(48.0)	
Stage III	7(13.7)	1(3.8)	6(24.0)	
Stage IV	9(11.8)	6(23.1)	3(12.0)	
Treatment, n(%)				.43
Chemotherapy	13(25.5)	9(34.6)	4(16.0)	
Radiotherapy	4(7.8)	2(7.7)	2(8.0)	
Targeted therapy	3(5.9)	2(7.7)	1(4.0)	
Hormone therapy	26(51.0)	10(38.5)	16(64.0)	
Other	5(9.8)	3(11.5)	2(8.0)	
^a Categorical variable were presented as frequencies and percentages, continuous variables were presented as median and interquartile range (IQR). Continuous variables were used Mann-Whitney U Test; categorical variables were used Chi-square test				
<i>MBSR</i> Mindfulness-Based Stress Reduction; <i>UC</i> Usual care				
SD, Standard Deviation				

Effects of MBSR

The FSFI results indicated significantly improved arousal (Δ arousal: 5.73 vs. -5.96, $p \leq .001$), lubrication (Δ lubrication: 3.35 vs. -3.48, $p \leq .001$), orgasm (Δ orgasm: 1.6 vs. -1.66, $p = .002$), satisfaction (Δ satisfaction: 8.48 vs. 1.76, $p = .007$), and pain (Δ pain: 1.92 vs. -1.84, $p = .012$). With respect to satisfaction, the most effective improvements were noted in the participants' sexual relationship (postintervention: 26.79 vs. 16.31, $p = .005$) and overall sexual satisfaction (postintervention: 27.52 vs. 16.82, $p = .005$). Six consecutive weeks of MBSR sessions improved some aspects of female sexual function in patients with breast cancer (Table 2). The patients' psychological problems were measured

using the DASS-21, and the scores of the three components of depression, anxiety, and stress were not significantly reduced in preintervention. Anxiety (Δ anxiety: -10.92 vs. 11.36, $p \leq .001$) and stress (Δ stress: -10.96 vs. 11.40, $p \leq .001$) but not depression (Δ depression: -2.33 vs. 2.42, $p = .96$) significantly improved at the posttest (Table 3). Quality of life was measured using the EQ-5D, and it did not significantly differ between the preintervention and postintervention. Nonetheless, the intervention significantly improved the participants' conduct of usual activities (Δ usual activities: -1.94 vs. 2.02, $p = .048$) (Table 4). Typically, 6 weeks of MBSR sessions can only mildly improve the quality of life in patients with breast cancer. The GCS was used to verify the front scales and ascertain whether patients with breast cancer had improvements in their psychological and physical symptoms following 6 consecutive weeks of MBSR. The findings demonstrated that vasomotor function (postintervention: 21.87 vs. 30.30, $p = .035$), and mental health (Δ psychological: -4.37 vs. 4.54, $p = .045$) significantly improved at the posttest (Table 5), which was consistent with the results of the FSFI and DASS-21.

Table 2
Female sexual function index

Measure FSFI	Group	Preintervention		Postintervention		Effect of intervention		
		Mean rank	<i>p</i> -value	Mean rank	<i>p</i> -value	ΔMean rank	Z	Δ <i>p</i> -value
Desire	UC	28.56	0.17	24.06	0.33	-4.5	-1.61	0.11
	MBSR	23.54		27.87		4.33		
often of sexual desire	UC	27.30	0.46	24.76	0.51	-2.54		
	MBSR	24.75		27.19		2.44		
level of sexual desire	UC	28.76	0.13	24.26	0.37	-4.5		
	MBSR	23.35		27.67		4.32		
Arousal	UC	30.60	.027*	24.64	0.51	-5.96	-3.91	.000**
	MBSR	21.58		27.31		5.73		
often of sexually aroused	UC	30.64	.022*	23.54	0.22	-7.1		
	MBSR	21.54		28.37		6.83		
level of sexual arousal	UC	30.70	.022*	24.96	0.61	-5.74		
	MBSR	21.48		27.00		5.52		
confident of sexual activity	UC	29.16	0.12	25.68	0.87	-3.48		
	MBSR	22.96		26.31		3.35		
often satisfied with arousal	UC	29.60	0.05	26.52	0.79	-3.08		
	MBSR	22.54		25.50		2.96		
Lubrication	UC	29.22	0.09	25.74	0.90	-3.48	-4.05	.000**
	MBSR	22.90		26.25		3.35		
often of lubricated	UC	29.30	0.08	26.06	0.98	-3.24		
	MBSR	22.83		25.94		3.11		
difficult of lubricated	UC	29.66	.049*	25.80	0.92	-3.86		
	MBSR	22.48		26.19		3.71		
maintain of lubricated	UC	28.92	0.12	27.14	0.56	-1.78		
	MBSR	23.19		24.90		1.71		

* $p \leq .05$; ** $p \leq .001$ Δpost-test minus pre-test scores □ *FSFI* Female Sexual Function Index □ *MBSR* Mindfulness-Based Stress Reduction □ *UC* Usual care

difficult of lubricated	UC	29.04	0.10	26.32	0.87	-2.72		
	MBSR	23.08		25.69		2.61		
Orgasm	UC	28.72	0.15	27.06	0.59	-1.66	-3.10	.002*
	MBSR	23.38		24.98		1.6		
often of orgasm	UC	28.60	0.16	27.06	0.59	-1.54		
	MBSR	23.50		24.98		1.48		
difficult of orgasm	UC	28.80	0.13	27.18	0.54	-1.62		
	MBSR	23.31		24.87		1.56		
satisfied of orgasm	UC	29.14	0.09	27.70	0.37	-1.44		
	MBSR	22.98		24.37		1.39		
Satisfaction	UC	19.66	0.15	21.42	0.64	1.76	-2.70	.007*
	MBSR	14.77		23.25		8.48		
emotional closeness	UC	29.12	0.09	27.96	0.30	-1.16		
	MBSR	23.00		24.12		1.12		
Sexual relationship	UC	19.45	0.17	16.31	.005*	-3.14		
	MBSR	15.03		26.79		11.76		
overall sexual	UC	20.43	0.20	16.82	.005*	-3.61		
	MBSR	16.09		27.52		11.43		
Pain	UC	28.30	0.13	26.46	0.63	-1.84	-2.52	.012*
	MBSR	22.70		24.62		1.92		
during vaginal penetration	UC	28.54	0.10	26.13	0.75	-2.41		
	MBSR	22.46		24.92		2.46		
following vaginal penetration	UC	27.80	0.21	26.44	0.64	-1.36		
	MBSR	23.20		24.63		1.43		
level of pain during or following	UC	28.86	0.06	26.85	0.50	-2.01		
	MBSR	22.14		24.25		2.11		

* $p \leq .05$; ** $p \leq .001$ Δpost-test minus pre-test scores □ *FSFI* Female Sexual Function Index □ *MBSR* Mindfulness-Based Stress Reduction □ *UC* Usual care

Table 3
Mental health of patients

Measure DASS-21	Group	Preintervention		Postintervention		Effect intervention		
		Mean rank	<i>p</i> -value	Mean rank	<i>p</i> -value	ΔMean rank	Z	Δ <i>p</i> -value
Depression	UC	23.70	0.28	26.12	0.96	2.42	-1.81	.07
	MBSR	28.21		25.88		-2.33		
Anxiety	UC	23.36	0.21	34.72	.000**	11.36	-4.67	.000**
	MBSR	28.54		17.62		-10.92		
Stress	UC	22.60	0.11	34.00	.000**	11.40	-4.32	.000**
	MBSR	29.27		18.31		-10.96		
* $p \leq .05$; ** $p \leq .001$ Δpost-test minus pre-test scores □ DASS-21 Depression Anxiety Stress Scales-21 □ MBSR Mindfulness-Based Stress Reduction □ UC Usual care								

Table 4
Quality of life

Measure EQ-5D	Group	Preintervention		Postintervention		Effect of intervention		
		Mean rank	<i>p</i> -value	Mean rank	<i>p</i> -value	ΔMean rank	Z	Δ <i>p</i> -value
Mobility	UC	26.02	0.98	26.54	0.53	0.52	-0.58	0.56
	MBSR	25.98		25.48		-0.5		
Self-care	UC	24.50	0.08	26.02	0.98	1.52	-1.71	0.09
	MBSR	27.44		25.98		-1.46		
Usual activities	UC	24.52	0.18	26.54	0.53	2.02	-1.98	.048*
	MBSR	27.42		25.48		-1.94		
Pain/Discomfort	UC	25.96	0.98	24.88	0.53	-1.08	-0.84	0.40
	MBSR	26.04		27.08		1.04		
Anxiety /Depression	UC	24.84	0.51	27.20	0.50	2.36	-1.25	0.21
	MBSR	27.12		24.85		-2.27		
Health state	UC	27.34	0.52	25.00	0.64	-2.34	-0.61	0.54
	MBSR	24.71		26.96		2.25		
* $p \leq .05$; Δpost-test minus pre-test scores □ EQ-5D EuroQol instrument □ MBSR Mindfulness-Based Stress Reduction □ UC Usual care								

Table 5
Validations tool of GCS

Measure GCS	Group	Preintervention		Postintervention		Effect of intervention		
		Mean rank	<i>p</i> -value	Mean rank	<i>p</i> -value	ΔMean rank	Z	Δ <i>p</i> -value
Psychological	UC	22.50	0.10	27.04	0.62	4.54	-2.01	.045*
	MBSR	29.37		25.00		-4.37		
Physical	UC	22.34	0.08	26.34	0.87	4.00	-1.44	0.15
	MBSR	29.52		25.67		-3.85		
Vasomotor	UC	27.94	0.33	30.30	.035*	2.36	-1.06	0.29
	MBSR	24.13		21.87		-2.26		
Loss of interest in sex	UC	25.54	0.82	28.44	0.22	2.90	-1.87	0.06
	MBSR	26.44		23.65		-2.79		
* <i>p</i> ≤ .05; Δpost-test minus pre-test scores; GCS The Greene climacteric scale; MBSR Mindfulness-Based Stress Reduction; UC Usual care								

Discussion

The study determined the efficacy of MBSR in improving female sexual function, anxiety, stress, everyday activity, and vasomotor function among women with breast cancer. However, MBSR yielded no improvement with respect to depression.

Approximately 50%-75% of women diagnosed with breast cancer experience sexual difficulties; of those treated with aromatase inhibitors, as many as 79% develop new sexual problems, and nearly 25% stop sexual activity [21–23]. In addition, patients with breast cancer can experience a reduced quality of life because of side effects or psychological problems after treatment. Therefore, we hypothesized an immediate increase in the level of female sexual function from pre- to post-MBSR intervention. Our finding indicated that MBSR intervention improves female sexual function, especially in their relationship with their partner and in their overall sexual satisfaction. Previous study analyzed data from three databases (EBSCO, PubMed, and ResearchGate) and the findings of 15 original research articles; the results demonstrated that MBSR can be effectively used to treat female sexual dysfunction, especially with regard to sexual arousal and satisfaction, and to reduce sexual dysfunction related to anxiety and negative cognitive patterns [24]. Studies have determined that MBSR can improve anxiety and stress, self-esteem, sexual relationships, and sexual satisfaction in women [25], which is consistent with the present study's findings.

Because no significant improvement in depression was noted, a long-term intervention for depression is likely warranted. Nonetheless the MBSR intervention was unlikely to be effective in all aspects over the

short duration of 6 weeks. Würtzen conducted a study with 336 women (stages I–III) who had undergone breast cancer surgery, randomly assigning them to a routine care or mindfulness intervention group and using intention-to-treat analysis. Patients participated in 6 consecutive weeks of mindfulness intervention; depression did not significantly improve during the posttest ($p = .07$) but did at the 6 months ($p = .01$) and 12 months ($p = .03$) of follow-up [26]. Following MBSR intervention, improvement was noted only in everyday activity and not in the other four items of the EQ-5D. Kanter et al. (2016) determined no difference in the quality of life between an MBSR group and a control group [9], which may be attributable to the short follow-up period of the study or to the small sample size. The EQ-5D questionnaire must be administered to patients with serious diseases and who face restrictions in their activity to ensure more meaningful results.

Traditional MBSR courses last for 8 weeks and can effectively improve quality of life [27–29] and anxiety [26]. However, some studies have indicated that 6 weeks of intervention can also improve quality of life and reduce depression [13]. Demarzo et al. (2017) compared an 8-week mindfulness-based intervention with its 4-week counterpart. The intervention was demonstrated to be effective relative to the control, and the effect sizes of the 4- and 8-week courses were similar findings [30]. Braden et al. (2016) analyzed the effectiveness of a 4-weeks MBSR intervention ($n = 12$) against a control that involved only reading as a means to reduce stress ($n = 11$). Studies have shown that 4-week MBSR treatment can alleviate symptoms of low back pain and improve emotional awareness in the frontal lobe and that its 8-week counterpart can yield improvements in depression, anxiety, and cognition. Therefore, improvements in perceived pain are achievable with short-term MBSR intervention, but depression and anxiety may require long-term MBSR [31]. Our study limited the intervention to 6 weeks to better ensure that the study did not inconvenience the participants and to thus encourage their continued participation. Nonetheless, 6 weeks may have been overly short for the intervention to yield improvements in all aspects. Future studies should investigate the effects of course duration or adopt an intervention with a longer duration.

MBSR can improve the mental health of patients with breast cancer, as indicated by the GCS. Climacteric syndrome in patients with breast cancer is usually caused by chemotherapy and hormone therapy [32]. Up to 85% of women with climacteric syndrome have vasomotor symptoms (i.e., hot flashes and night sweats), 60% report vaginal discomfort (i.e., vaginal dryness and dyspareunia), and 86.5% report sexual dysfunction (such as a lack of libido and difficulty in reaching orgasm) [33, 34]. Among the patients in this study, 13 (21.7%) received chemotherapy and 26 received hormonal therapy (43.3%). An improvement in overall climacteric symptoms in the vasomotor domain was noted following MBSR intervention. This finding is consistent with those of a study involving a randomized trial of 110 postmenopausal and early postmenopausal women who experienced an average of ≥ 5 moderate or severe hot flashes (including night sweats) per day. Additionally, in the vasomotor domain of the GCS scale, the total scores were lower for the MBSR group than the routine care group; this may be because the postmenopausal stage and transition to menopause can induce vasomotor symptoms in younger women [35].

The quantitative results were consistent with the findings of the qualitative interviews. For example, one patient who participated in this course narrated their experience as follows: *“I have symptoms such as hot flashes, night sweats, and frequent urination after taking hormonal drugs. I also feel particularly tired the next day. After doing an MBSR session, I felt an unprecedented peace of mind. When I do mindful breathing and body scanning, I can fall asleep quickly, and I can even sleep until dawn.”* As indicated in the statistical analysis and the qualitative responses in the questionnaires, patients with breast cancer were prone to having trouble sleeping and experiencing pain after receiving treatment; sleep and pain can thus be measured independently in future studies. Data from both subjective (e.g., self-reports) and objective (e.g., wearable devices, functional magnetic resonance imaging) sources can be used to establish more specific patterns of how patients sleep and experience pain.

In general, MBSR alleviated the serious problems this study’s participants faced with their physical and mental health. Thus, MBSR can be incorporated into alternative therapies.

Studies have rarely discussed the improvement of female sexual function in breast cancer patients through MBSR intervention and have predominantly considered sexual function to be an unimportant aspect of an individual’s quality of life. The main strengths of our study were that female sexual function was regarded as a vital part of quality of life, and that MBSR intervention was demonstrated to improve sexual function and mental health. MBSR is a nonpharmacologic therapy, and it is safe, accessible, and simple to practice for patients with breast cancer. In the future, MBSR intervention can be used in clinical care and established as part of standard care procedures. However, the limitations of our study must also be acknowledged. Further studies should use random assignment for more robust findings. Mindfulness can be implemented anytime and anywhere and becomes more beneficial with practice; therefore, research tools can incorporate a mobile app to build courses, record information, and provide mindfulness videos to encourage participants to keep up their mindfulness practice. This study was conducted during the COVID-19 pandemic, and patients wore protective facemasks during every session. Should other public health crises occur in the future, research interventions can employ distance learning methods. Because of the ease and convenience of course participation, a larger sample can be used in future studies to ensure greater representativeness.

Declarations

Authors' contributions Y. C. Chang was responsible for the study conception, design and writing of the manuscript; G. M. Lin was responsible for results analysis, writing and revision of the manuscript; T. L. Yeh was responsible for results analysis and revision of the manuscript; Y. M. Chang was responsible for study conception and revision of the manuscript; C. Y. Yeh was responsible for revision of the manuscript; W. Y. Hu was responsible for contributed to the study conception, design and revision of the manuscript. All authors read and approved the final manuscript.

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Ethics approval All appropriate procedures conducted in research involving human participants were in line with the ethical standards of the institutional research committee in Taiwan.

Consent to participate All participants signed an informed consent form before participating in the study.

Consent for publication The manuscript has been seen and approved by all authors, and the material was not previously published.

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