Post-print of an Umbrella Review of the Effectiveness of Mindfulness-Based Stress Reduction Therapy in Breast Cancer Patients

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Date: 2022-09-13T00:00:00+00:00

Abstract

Background: Breast cancer has become the most prevalent cancer globally, and its treatment and rehabilitation processes often inflict severe psychological distress on patients. Numerous systematic reviews (SRs) have identified certain effects of Mindfulness-Based Stress Reduction (MBSR) in psychological care for breast cancer patients; however, substantial variations exist among different SRs regarding the quality of included primary studies, levels of evidence, and outcome measures, resulting in significant discrepancies in outcome indicators.

Objective: To conduct an overview of systematic reviews evaluating the effectiveness of MBSR in breast cancer patients, thereby providing decision-making references for psychological care in this population.

Methods: Systematic searches were conducted across PubMed, Embase, the Cochrane Library, Web of Science, CINAHL, PsycINFO, JBI, CNKI, Wanfang Medical Database, and Chinese Biomedical Literature Database for SRs on MBSR interventions in breast cancer patients, with the search period extending to July 2022. Two researchers independently screened literature and extracted study information. The Assessment of Multiple Systematic Reviews-2 (AMSTAR 2), Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), and Grading of Recommendations Assessment, Development and Evaluation (GRADE) were employed to assess methodological quality, reporting standards, and evidence quality, respectively.

Results: Fourteen SRs were included in the overview analysis. AMSTAR 2 assessment revealed suboptimal overall methodological quality, with only one high-quality study and severe information deficiency in two critical items. PRISMA statement evaluation indicated that reporting quality deficiencies primarily concerned study protocol registration, risk of bias assessment across studies, and

funding sources. The 14 SRs encompassed 15 outcome indicators and 73 evidence bodies. GRADE assessment demonstrated 2 high-quality, 48 moderate-quality, and 23 low-quality evidence bodies. MBSR could ameliorate anxiety, depression, fatigue, and stress in breast cancer patients to varying degrees, with significant short-term efficacy, though long-term efficacy remains uncertain.

Conclusion: The current evidence quality of SRs regarding MBSR effectiveness in breast cancer patients is generally low. Both methodological quality and reporting standardization require further improvement. While MBSR demonstrates considerable efficacy in improving psychological status and related indicators among breast cancer patients, additional high-quality, large-scale studies are warranted for further validation.

Full Text

Efficacy of Mindfulness-based Stress Reduction in Breast Cancer Patients: An Overview of Systematic Reviews

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Abstract

Background: Breast cancer has become the most prevalent cancer worldwide, and its treatment and recovery process often causes severe psychological distress to patients. Numerous systematic reviews (SRs) have found Mindfulness-based Stress Reduction (MBSR) to be effective in the psychological care of breast cancer patients. However, the quality of original studies included in these SRs, the level of evidence, and the observed indicators vary considerably, resulting in significant differences in outcome measures.

Objective: To re-evaluate SRs on the efficacy of MBSR in breast cancer patients and provide decision-making references for the application of MBSR in psychological care for this population.

Methods: PubMed, Embase, The Cochrane Library, Web of Science, CINAHL, PsycINFO, JBI, China National Knowledge Infrastructure (CNKI), WanFang Data, and China BioMedical Literature Database (CBM) were systematically searched for SRs and meta-analyses of MBSR interventions in breast cancer patients, with a search cutoff date of July 2022. Two investigators screened

literature based on inclusion and exclusion criteria and extracted relevant information. Methodological quality, reporting completeness, and evidence quality were assessed using A Measurement Tool to Assess Systematic Reviews 2 (AMSTAR 2), Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA), and Grading of Recommendations, Assessment, Development and Evaluations (GRADE), respectively.

Results: A total of 14 SRs were included. AMSTAR 2 assessment showed that only 1 SR was of high quality, while 2 critical items had serious missing information. The PRISMA statement revealed that reporting quality deficiencies were mainly in study protocol registration, risk of bias assessment across studies, and funding sources. The 14 SRs included 15 outcome indicators with 73 bodies of evidence. GRADE assessment showed that 2 were of high quality, 48 were of moderate quality, and 23 were of low quality. MBSR could improve anxiety, depression, fatigue, and stress in breast cancer patients to varying degrees, with significant short-term effects, though long-term efficacy remains uncertain.

Conclusion: The overall quality of evidence from SRs on MBSR interventions in breast cancer patients is not yet high, and both methodological quality and reporting standards need further improvement. MBSR demonstrates promising improvements in psychological status and other indicators among breast cancer patients, but more high-quality, large-sample studies are needed for further validation.

Keywords: Breast cancer; Mindfulness-based stress reduction; Overview of systematic reviews; AMSTAR 2; PRISMA; GRADE; CERQual

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According to the 2020 global cancer burden data reported by the International Agency for Research on Cancer (IARC), breast cancer has replaced lung cancer as the most common cancer worldwide, with 2.26 million new cases [1]. Data from the National Cancer Center also show that breast cancer is the most common cancer among Chinese women, with incidence and mortality rates of 45.37/100,000 and 10.62/100,000, respectively [2, 3]. During diagnosis and subsequent treatment and rehabilitation, most breast cancer patients experience varying degrees of negative emotions such as anxiety and depression [4], which not only directly affect quality of life, social functioning, and treatment adherence, but are also associated with poor prognostic outcomes including tumor recurrence and shortened survival time. Therefore, screening and intervention for psychological status in breast cancer patients have received increasing attention [5, 6].

In recent years, numerous studies have shown that appropriate psychological interventions can effectively alleviate psychological distress and significantly improve quality of life and treatment adherence in breast cancer patients. Among these, Mindfulness-based Stress Reduction (MBSR) has been widely applied in clinical practice for psychological intervention in breast cancer patients due to its operational simplicity and broad applicability [5]. MBSR is a cognitive

functional training program that integrates meditation, relaxation, controlled breathing, body stretching, and social interaction as protective psychological factors [7, 8], with its core principle being stress reduction through mindfulness to better facilitate disease coping. Currently, many systematic reviews (SRs) have explored the application effects of MBSR in breast cancer patients. However, due to substantial differences in the quality of original studies, evidence levels, and observed indicators included in different SRs, the outcome measures show significant variation [9, 10]. To further reduce clinical research design bias and provide reliable evidence-based medical evidence for clinical practice, this study aims to conduct an overview of SRs on the application effects of MBSR in breast cancer patients. Through comprehensive, systematic, and scientific evaluation of existing relevant SRs, we seek to provide decision-making references for the application of MBSR in psychological care for breast cancer patients in China.

1.1 Inclusion and Exclusion Criteria

1.1.1 Inclusion Criteria: (1) Study population: Breast cancer patients, with no restrictions on age, disease stage, ethnicity, or outpatient/inpatient status. (2) Intervention measures: Intervention group: MBSR, with no restrictions on whether combined with other interventions; Control group: Non-MBSR interventions, with no restrictions on specific types. (3) Outcome indicators: Anxiety, depression, fatigue, stress, quality of life, sleep quality, and pain, among others. (4) Study type: SRs based on clinical studies, including meta-analyses.

1.1.2 Exclusion Criteria: Studies were excluded if they met any of the following criteria: Research protocols or proposals; Conference abstracts; Studies where full text was unavailable; Duplicate publications or studies including completely identical research data; SRs that included clinical trials without control groups; Literature not in Chinese or English.

1.2 Search Strategy

A systematic computer search was conducted in English databases/platforms including PubMed, Embase, The Cochrane Library, Web of Science, CINAHL, PsycINFO, and JBI, as well as Chinese databases including CNKI, WanFang Medical Database, and CBM. SRs on the application effects of MBSR in breast cancer patients were searched from database inception to July 25, 2022, with language limited to English or Chinese. The search combined subject headings and free-text terms, with strategies adjusted for different databases. English search terms included mindfulness, mindfulness-based, MBSR, meditation, breast cancer, breast neoplasms, meta-analysis, systematic review, and systematic studies. Chinese search terms included: 正念 (mindfulness), 乳腺癌 (breast cancer), 系统评价 (systematic review), 系统综述 (systematic review), Meta 分析 (meta-analysis), and 荟萃分析 (meta-analysis). Additionally, references of included studies were traced to supplement relevant research. The specific search strategy for PubMed is shown in Table 1.

Table 1 Search Strategy (PubMed)

Search Step	Search Expression
#1	"Mindfulness" [MeSH Terms] OR "Meditation" [Mesh Terms]
#2	"Mindfulness" [Title/Abstract] OR "Meditation" [Title/Abstract] OR "mindfulness-based" [Title/Abstract] OR "MBSR" [Title/Abstract]
#3	#1 OR #2
#4	"Breast Neoplasms" [Mesh Terms]
#5	"Breast Neoplasm" *[Title/Abstract] OR "Breast Tumor*" [Title/Abstract] OR "Breast Cancer" *[Title/Abstract] OR "Breast Carcinoma*" [Title/Abstract] OR "Mammary Cancer" *[Title/Abstract] OR "Mammary Carcinoma*" [Title/Abstract] OR "Mammary Neoplasm" *[Title/Abstract] OR "Mammary Tumor*" [Title/Abstract] OR "Malignant Neoplasm of Breast" [Title/Abstract] OR "Breast Malignant Neoplasm" *[Title/Abstract] OR "Breast Malignant Tumor*" [Title/Abstract] OR "Malignant Tumor of Breast" [Title/Abstract] OR "Cancer of Breast" [Title/Abstract] OR "Cancer of the Breast" [Title/Abstract] OR "metastasis in breast" [Title/Abstract] OR "phyllodes tumor" [Title/Abstract] OR "breast angiosarcoma" [Title/Abstract] OR "breast carcinogenesis" [Title/Abstract]
#6	#4 OR #5
#7	"Meta-Analysis as Topic" [Mesh Terms] OR "Meta-Analysis" [Publication Type] OR "Network Meta-Analysis" [Mesh Terms] OR "Systematic Reviews as Topic" [Mesh Terms] OR "Systematic Review" [Publication Type]

Search Step	Search Expression
#8	"systematic review" [Title/Abstract] OR "systematic reviews" [Title/Abstract] OR "systematic study" [Title/Abstract] OR "systematic studies" [Title/Abstract] OR "meta analysis" [Title/Abstract] OR "meta analyses" [Title/Abstract] OR "meta-analysis" [Title/Abstract] OR "meta-analyses" [Title/Abstract] OR "meta-study" *[Title/Abstract] OR " meta study*" [Title/Abstract] OR "data pooling" *[Title/Abstract] OR " clinical trial overview*" [Title/Abstract]
#9	#7 OR #8
#10	#3 AND #6 AND #9
#11	#10 AND (English[Filter])

1.3 Literature Screening and Data Extraction

Two researchers independently screened literature, extracted data, and cross-checked results. Any disagreements were resolved through discussion. Researchers first imported retrieved literature into Rayyan for deduplication, then excluded studies that did not meet inclusion criteria by reading titles and abstracts, and finally read full texts to determine studies for inclusion. A predesigned data form was used to extract: Basic literature information including first author, first author' s country, publication year, etc.; Study design information including countries of original studies, number of studies, study types, sample sizes, interventions in experimental and control groups, etc.; Risk of bias assessment tools; Evidence quality assessment tools; Relevant outcome indicators and main conclusions.

1.4 Assessment Methods

All assessments were conducted independently by two researchers using corresponding tools, with cross-checking after completion. Disagreements were resolved through discussion.

1.4.1 Methodological Quality Assessment: The A Measurement Tool to Assess Systematic Reviews 2 (AMSTAR 2) was used to evaluate methodological quality [11]. AMSTAR 2 contains 16 items, with critical items being 2, 4, 7, 9, 11, 13, and 15. Based on these, reporting quality was classified into four levels: High quality: no or only one non-critical item not met; Moderate quality: more than one non-critical item not met; Low quality: one critical item not met with or without non-critical items not met; Critically low quality: more than one critical item not met.

1.4.2 Reporting Quality Assessment: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement was used to evaluate reporting quality, with a total of 27 items. Each item was scored based on actual reporting: fully reported (1 point), partially reported (0.5 points), or not reported (0 points). A total score $ $22 indicated relatively complete reporting, $ $15 indicated serious information gaps, and intermediate scores indicated some reporting deficiencies.

1.4.3 Evidence Quality Assessment: The Grading of Recommendations, Assessment, Development and Evaluations (GRADE) system was used to assess evidence quality [12]. For qualitatively described SRs, the CERQual (Confidence in the Evidence from Reviews of Qualitative research) tool was used, which systematically evaluates non-quantitative SRs from four aspects: methodological limitations, relevance, coherence of results, and adequacy of data. Final evidence quality was presented as high (0 points, no downgrade), moderate (-1 point, downgrade one level), low (-2 points, downgrade two levels), or very low (-3 points, downgrade three levels) [13]. Disagreements were resolved through discussion.

1.5 Statistical Analysis: Excel 2019 was used for data statistics and analysis. Literature quality assessment results were described using frequency distribution and percentages, with GRADE/CERQual scores presented in bubble charts.

2.1 Literature Screening

A total of 430 relevant studies were retrieved. After deduplication, 280 studies remained. Through layered screening, 14 SRs were finally included. The literature screening process and results are shown in Figure 1.

Figure 1 [Figure 1: see original paper] Literature screening flow chart

2.2 Basic Characteristics of Included Studies

The 14 SRs were published between 2013 and 2021, including 6 Chinese studies [14-19] and 8 English studies [9, 10, 20-25]. All SRs included randomized controlled trials (RCTs), and some SRs [9, 10, 14, 20, 23, 25] also included non-randomized study designs such as controlled clinical trials (CCTs) and case-control studies (CCS). Twelve SRs used assessment tools such as RoB (Cochrane collaboration' s tool for assessing risk of bias in randomized trials), Jadad, and NOS (The Newcastle-Ottawa Scale), while 2 SRs [22, 25] did not report methodological assessment tools. Only 1 SR [24] used the GRADE system to evaluate the credibility of the evidence body. The included studies reported 15 outcome indicators including anxiety, depression, and fatigue. The vast majority of studies affirmed the beneficial effects of MBSR on psychological status and quality of life in breast cancer patients, as detailed in Table 2.

Table 2 Basic characteristics of the included systematic reviews

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Zainal NZ (2013, Malaysia)	USA (6); Canada (3)	(6/8 weeks)	Standard treatment + follow-up	NR		MBSR has significant effects on improving psychological status (stress and depression) in breast cancer patients
Cramer H (2013, Germany)	USA (3); UK (1); Denmark (1)	(6 weeks/partial with retreat)	UC	Jadad	NR	Compared with conventional care or nutritional support, MBSR has positive significance in managing negative emotions (anxiety and depression) and improving quality of life

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Yang LM (2015, China)	USA (3); Denmark (1); Canada (3); Thailand (1)	(6/8 weeks)	UC	Jadad	NR	MBSR significantly improves anxiety and depression, and also has positive effects on stress relief and quality of life improvement
Huang HP (2015, China)	USA (3); Canada (3); China (1); Korea (1)	(6/8 weeks)	UC	Jadad	NR	MBSR is significantly superior to conventional care in reducing perceived stress and alleviating depression, but shows no significant difference in anxiety

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Zeng YL (2017, China)	USA (7); Denmark (3); Canada (2); China (1); UK (1)	(6/8 weeks)	UC	Jadad	NR	MBSR has some effect on improving quality of life, sleep, and anxiety/depression, but long-term effects (>12 months) are not significant

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Haller H (2017, Germany)	USA (5); Denmark (2); UK (1); Iran (1); Sweden (1)	(6/8 weeks)	UC/NE	RoB	C/PES	NR	MBSR can effectively relieve anxiety and depression, improve fatigue symptoms and quality of life; effects on stress, fear of recurrence, and sleep improvement remain unclear

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Zhang QY (2018, China)	USA (4); Iran (1);	(6/8 weeks)	UC	RoB	NR	MBSR has some effect on improving physiology, cognition, fatigue, mental health, anxiety/depression, and stress levels; effects on sleep quality and pain remain uncertain
Zhang QX (2019, China)	Korea (1); Netherlands (1); UK (1); Thailand (1); Canada (3); China (2)	(6/8 weeks)	UC	RoB	GRADE	MBSR has some effect on improving fatigue and may be a promising intervention

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Castanhel FD (2018, Brazil)	USA (3); Iran (2); UK (1); Sweden (1)	/	NEP/OP	PEDro	NR	MBSR can effectively relieve anxiety and depression, but short-term and long-term effects on quality of life are not significant
Liu Y (2019, China)	USA (4); China (7); Korea (1)	(6/8 weeks)	UC	NR		MBSR can effectively relieve post-intervention and long-term stress and anxiety, but only shows immediate effects on depression

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Schell LK (2019, USA)	USA (6); Denmark (1); China (1); UK (1); Sweden (1)	UC (anti-tumor treatment)	RoB	GRADE	MBSR can improve quality of life, anxiety/depression, sleep quality, and fatigue to some extent, but long-term effects (>6 months) are minimal	
Yang H (2020, China)	China (10); USA (5); UK (1); Netherlands (1)	(6/7/8/9 weeks)	OC/NEP	JPT	MCT	MBSR can effectively relieve cancer-related fatigue and negative emotions, and improve sleep quality

Study (Year, Country)	Study Distribution (Number of Studies)	Intervention Duration	Control Group	Quality Assessment Tool	Evidence Quality Assessment Tool	Main Results/Conclusions
Shen XY (2020, China)	China (3); USA (2); Denmark (1)	(6/8 weeks)	UC	NR		MBSR can improve sleep in breast cancer patients, but needs validation by large-sample, high-quality RCTs
Chang YC (2021, China)	USA (15); Denmark (2); Iran (1); Sweden (1)	(6/8 weeks)	UC	RoB	NR	Mindfulness-based interventions are very beneficial for reducing short-term depression, fatigue, and stress in breast cancer patients, but long-term effects remain uncertain

Note: RCT = randomized controlled trial; nRCT = non-randomized controlled trial; CCT = controlled clinical trial; CCS = case-control study; MBSR = mindfulness-based stress reduction; UC = usual care; NEP = nutritional education program; SET = supportive-expressive therapy; OC = other interventions besides mindfulness; PES = psychological education and support; MCT = mindfulness-based cognitive therapy; RoB = Cochrane collaboration' s tool for assessing risk of bias in randomized trials; NOS = The Newcastle-Ottawa Scale; NR = Not Reported; GRADE = Grading of Recommendations Assessment, Development and Evaluation; Depression; Anxiety; Stress; Spirituality; Quality of life; Fatigue; Pain; Fear of recurrence; Concentration; Sleep quality; Emotional well-being; Grief; Physical function; Cognitive function; Mental health

2.3 Methodological Quality Assessment

AMSTAR 2 was used to assess the methodological quality of the 14 included SRs. Overall quality was not high, with only 1 study [24] rated as high quality, 6 studies [9, 10, 14, 17, 22, 23] as low quality, and 7 studies [15, 16, 18-21, 25] as critically low quality. Missing information in critical items mainly came from item 2 (78.6% "No"), item 10 (71.4% "No"), item 15 (42.9% "No"), and item 16 (64.3% "No"). Specific scoring for each item is shown in Table 3.

Table 3 AMSTAR 2 evaluations of included systematic reviews

Note: # = critical item; Y = Yes; N = No; PY = Partial Yes; Item 1: Whether the research question and inclusion criteria for the review include PICO components; Item 2: Whether an explicit statement was made that the review methods were established prior to conduct of the review and whether any deviations were reported; Item 3: Whether the authors explained their selection of study designs; Item 4: Whether a comprehensive literature search strategy was used; Item 5: Whether study selection was performed in duplicate; Item 6: Whether data extraction was performed in duplicate; Item 7: Whether a list of excluded studies with reasons was provided; Item 8: Whether included studies were described in adequate detail; Item 9: Whether the tool used to assess risk of bias was appropriate; Item 10: Whether funding sources for included studies were reported; Item 11: Whether appropriate statistical methods were used for meta-analysis; Item 12: Whether the impact of risk of bias in individual studies on meta-analysis results was assessed; Item 13: Whether risk of bias in included studies was considered when interpreting results; Item 14: Whether heterogeneity was satisfactorily investigated and discussed; Item 15: Whether publication bias was adequately investigated and its impact discussed; Item 16: Whether potential sources of conflict of interest were reported

2.4 Reporting Quality Assessment

The PRISMA-based reporting quality scores for the 14 SRs are shown in Table 2. Only 2 studies [9, 24] had relatively comprehensive reporting ($ $22 points),

while the remaining 12 SRs had some degree of reporting deficiencies. Table 4 shows the completeness of specific reporting items among the 27 items. Eleven studies (78.6%) did not register their protocols, 7 studies (50%) did not report bias assessment in methods, and 9 studies (64.3%) did not report funding or other support sources.

Table 4 Report quality assessment of the included SRs (PRISMA statement)

Section Structure	Specific Item	Fully Reported (n, %)	Partially Reported (n, %)	Not Reported (n, %)
Title	Title	13 (92.9)	1 (7.1)	0 (0)
Abstract	Structured abstract	14 (100.0)	0 (0)	0 (0)
Introduction	Rationale	13 (92.9)	1 (7.1)	0 (0)
Methods	Protocol and registration	3 (21.4)	0 (0)	11 (78.6)
	Search strategy	14 (100.0)	0 (0)	0 (0)
	Study selection	10 (71.4)	4 (28.6)	0 (0)
	Data collection process	10 (71.4)	4 (28.6)	0 (0)
	Risk of bias in individual studies	13 (92.9)	1 (7.1)	0 (0)
	Summary measures	14 (100.0)	0 (0)	0 (0)
	Synthesis of results	6 (42.9)	8 (57.1)	0 (0)
	Risk of bias across studies	7 (50.0)	0 (0)	7 (50.0)
	Additional analyses	1 (7.1)	0 (0)	13 (92.9)
Results	Study selection	14 (100.0)	0 (0)	0 (0)
	Study characteristics	13 (92.9)	1 (7.1)	0 (0)

Section Structure	Specific Item	Fully Reported (n, %)	Partially Reported (n, %)	Not Reported (n, %)
	Risk of bias within studies	14 (100.0)	0 (0)	0 (0)
	Results of individual studies	14 (100.0)	0 (0)	0 (0)
	Synthesis of results	6 (42.9)	8 (57.1)	0 (0)
	Risk of bias across studies	10 (71.4)	0 (0)	4 (28.6)
	Additional analyses	1 (7.1)	0 (0)	13 (92.9)
Discussion	Summary of evidence	14 (100.0)	0 (0)	0 (0)
	Limitations	8 (57.1)	6 (42.9)	0 (0)
	Conclusions	14 (100.0)	0 (0)	0 (0)
Other	Funding or other support	5 (35.7)	0 (0)	9 (64.3)

2.5 Evidence Quality Assessment

Analysis of 15 outcome indicators from the 14 SRs yielded 73 bodies of evidence graded using GRADE and CERQual systems. Two bodies of evidence were high quality, 48 were moderate quality, 23 were low quality, and none were very low quality. These are presented in bubble chart form in Figure 2 [Figure 2: see original paper], where each bubble represents a body of evidence, bubble size represents the number of included studies, and different colors represent different evidence grades. Red and black number labels represent GRADE and CERQual evaluation results, respectively.

Figure 2 [Figure 2: see original paper] GRADE/CERQual quality of evidence grading for key outcome indicators

2.5.1 Anxiety Twelve SRs [9, 10, 14, 15, 17-19, 21-25] reported the effect of MBSR on anxiety in breast cancer patients. Assessment tools were diverse, mainly including the Modified Symptom Checklist, Quality of Life Scale for

Cancer Survivors, Profile of Mood States, Courtauld Emotional Control Scale, Hospital Anxiety and Depression Scale, State-Trait Anxiety Inventory, Generalized Anxiety Disorder Scale, Self-Rating Anxiety Scale, and Beck Anxiety Inventory. Only Chang YC [21] reported no significant difference between MBSR and non-mindfulness interventions in relieving anxiety (moderate quality evidence), while the remaining 11 SRs showed that MBSR could significantly alleviate anxiety in breast cancer patients (low to moderate quality evidence). Three SRs [9, 15, 24] demonstrated that short-term effects of MBSR on anxiety were more pronounced than long-term follow-up effects (>12 months) (moderate quality evidence) (Figure 3a [Figure 3: see original paper]).

2.5.2 Depression Twelve SRs [9, 10, 14, 15, 17-19, 21-25] reported the effect of MBSR on depression in breast cancer patients. Main assessment tools included the Center for Epidemiologic Studies Depression Scale, Profile of Mood States, Modified Symptom Checklist, Hospital Anxiety and Depression Scale, Self-Rating Depression Scale, and Beck Depression Inventory. All studies showed that MBSR could significantly relieve depression in breast cancer patients compared with conventional care (low to moderate quality evidence), particularly in short-term evaluations ($ $3 months post-intervention) (moderate quality evidence) (Figure 3b). Meanwhile, 4 SRs [9, 15, 21, 24] showed that long-term effects of MBSR on depression were not significant (moderate quality evidence).

2.5.3 Fatigue Seven SRs [9, 10, 17, 19-21, 24] reported the effect of MBSR on fatigue in breast cancer patients. Assessment tools included the Fatigue Symptom Inventory, Profile of Mood States, MD Anderson Symptom Inventory, Piper Fatigue Scale, Self-Report Checklist Personal Strength–Fatigue Subscale, Fatigue Severity Scale, Brief Fatigue Inventory, and Modified Symptom Checklist. Five SRs [10, 17, 19, 20, 24] showed that MBSR could significantly improve fatigue symptoms compared with conventional care or anti-cancer treatment alone (low to high quality evidence) (Figure 3c). However, meta-analyses by Haller H [9] and Castanhel FD [20] found no significant fatigue relief effect from MBSR (low to moderate quality evidence). Additionally, 3 SRs [17, 21, 24] showed no significant long-term effects of MBSR on fatigue improvement (moderate to high quality evidence).

2.5.4 Stress Eight SRs [9, 10, 14, 15, 19, 21, 23-25] reported the stress-relieving effects of MBSR (Figure 3d). Assessment tools included the Perceived Stress Scale, Stress Symptom Score, Perceived Stress Scale (Chinese version), and Brief Occupational Stress Inventory. Seven SRs [9, 10, 14, 15, 21, 23-25] showed that MBSR could significantly reduce stress levels (low to moderate quality evidence). Zhang QY' s meta-analysis [19] did not show significant efficacy of MBSR compared with conventional care and non-mindfulness interventions in relieving stress, but the included sample size was relatively small (low quality evidence).

2.5.5 Quality of Life Seven SRs [9, 10, 15, 19, 21, 23, 24] reported the intervention effects of MBSR on quality of life in breast cancer patients. Assessment tools were relatively uniform, including the Quality of Life Questionnaire, Quality of Life Scale for Adult Cancer Survivors, and Quality of Life Inventory. Only 2 SRs [19, 23] showed that MBSR courses significantly improved quality of life (low quality evidence) (Figure 3e).

2.5.6 Sleep Quality Seven SRs [9, 10, 16, 17, 19, 21, 24] reported the intervention effects of MBSR on sleep quality. Assessment tools were diverse, including MOS-SS Sleep Scale, Pittsburgh Sleep Quality Index, MD Anderson Symptom Inventory, Insomnia Severity Index, subjective and objective sleep measures, sleep diary cards, and sleep recorders. Only 3 SRs [9, 16, 17] showed that MBSR significantly improved sleep quality compared with conventional care (moderate quality evidence) (Figure 3f). Haller H [9] reported that sleep quality significantly improved at 2-month measurement after 6-8 weeks of MBSR training compared with controls, but the improvement was not significant at 6-month follow-up (moderate quality evidence).

2.5.7 Pain Three SRs [10, 17, 21] evaluated the intervention effects of MBSR on pain in breast cancer patients. Main assessment tools included the Wisconsin Brief Pain Questionnaire. Studies showed that MBSR courses did not significantly improve pain compared with conventional care, nutritional support, or psychological education (low to moderate quality evidence) (Figure 3g).

2.5.8 Other Outcomes Zhang QX [10] reported that MBSR training had significant improvement effects on grief, cognitive function, physical function, mental health, and concentration in breast cancer patients (all moderate quality evidence). Yang LM [18] found that MBSR training could significantly improve emotional well-being (moderate quality evidence). Meanwhile, 3 SRs [18, 19, 22] showed no significant effects of MBSR courses on spirituality (low to moderate quality evidence) and fear of recurrence (low to high quality evidence) (Figure 3h).

Figure 3 [Figure 3: see original paper] Summary results of Meta-analysis of the efficacy of MBSR in breast cancer patients

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3 Discussion

With the transformation of medical models, screening and intervention research on psychological status of cancer patients has attracted increasing attention in recent years. This overview included 14 SRs and applied AMSTAR 2, PRISMA, and GRADE to evaluate the methodological quality, reporting quality, and evidence quality of these SRs, respectively, while summarizing the main conclusions.

3.1 Inconsistent Implementation Protocols of MBSR Although the intervention in all included SRs was MBSR, details of the protocol still varied across studies. There were differences in MBSR course settings, implementation, and follow-up durations [10], which may contribute to substantial differences in intervention effects between study groups. The standard MBSR training course consists of 8 weeks, including one 2.5-hour group session per week and 45 minutes of individual practice 6 days per week. This relatively cumbersome course setting creates certain barriers for participant engagement and practice. In recent years, to improve feasibility, convenience, and reduce participant burden, researchers have developed various novel MBSR formats and explored them in non-cancer populations with promising results and application prospects, such as changing group face-to-face learning to one-on-one video or audio-guided teaching, and shortening the 8-week duration to 2 or 4 weeks [26-29]. A meta-analysis by Kriakous et al. [30] including 15 studies showed that a simplified 4-week MBSR training program was equally effective as the standard 8-week program in improving psychological function among healthcare professionals. Therefore, future researchers should conduct high-quality, large-sample prospective RCTs in cancer patient populations to further explore, validate, and promote these alternative formats.

3.2 Quality Assessment of Included Systematic Reviews 3.2.1 Methodological Quality Assessment: The methodological quality of SRs on MBSR effects in breast cancer patients was generally low. AMSTAR 2 results showed that only 1 (7.1%) was high quality, 11 (78.6%) did not publish or announce their research protocol in advance (potentially affecting transparency and increasing bias risk), 10 (71.4%) did not report funding information, 9 (64.3%) did not declare potential conflicts of interest, and nearly half did not consider potential publication bias—all factors that further affect the credibility of SR results. Additionally, assessment tools varied considerably among the original RCTs included in the analysis, preventing data pooling in some SRs and resulting in less convincing qualitative descriptions.

3.2.2 Reporting Quality Assessment: PRISMA assessment showed that only 2 studies (14.3%) had relatively comprehensive reporting, while most studies needed improvement in reporting standardization. Main deficiencies were in protocol registration, risk of bias assessment, and description of funding sources and other support, raising doubts about study completeness and reducing result credibility. Additionally, reporting standardization in introduction and discussion sections of included SRs also needed improvement.

3.2.3 Evidence Quality Assessment: GRADE and CERQual evaluation showed that high-quality evidence accounted for only 2.7%, with the remainder being moderate- or low-quality evidence. Main reasons for downgrading were that blinding is difficult to achieve in MBSR intervention studies, allocation concealment protocols were not reported, and heterogeneity among assessment tools led to significant heterogeneity in pooled results. Additionally, as MBSR is

a special intervention requiring long-term implementation and follow-up, study sample sizes are often small and difficult to conduct on a large scale. Therefore, included studies were downgraded multiple times in the evidence quality evaluation system, resulting in generally low overall levels.

3.3 Significant Effects of MBSR on Overall Psychological Status and Quality of Life, but Long-term Efficacy Requires Further Investigation The included SRs contained a total of 50 clinical trials, including 40 RCTs, covering multiple stages after breast cancer diagnosis such as anti-tumor treatment phases (e.g., chemotherapy), post-treatment survivorship, and terminal stages. Overall results from included SRs consistently indicated that MBSR could significantly improve anxiety, depression, and fatigue in breast cancer patients, with significant short-term effects but uncertain long-term efficacy. Originating from religious practices, MBSR therapy primarily combines meditation, mindfulness yoga, and mindful eating to guide patients in exposing inner emotions, helping them re-examine their self-state [19], reduce rumination on negative emotions (anxiety and depression), improve tolerance to fatigue and stress states, and ultimately enhance quality of life [31]. Additionally, multiple studies reported that MBSR may regulate psychological status by triggering brain regions related to emotional experience and modulating the sympathetic nervous system, cortisol, immunoglobulins, and cytokines [26, 32, 33]. The lack of significant long-term effects on psychological status may be because anxiety, depression, fatigue, stress, and pain are normal temporary reactions to life events that are volatile and influenced by multiple factors, while standard MBSR only includes 8 weeks of learning without subsequent maintenance training. Therefore, MBSR is currently recommended for treating temporary and fluctuating symptoms in breast cancer patients, or patients should be guided to engage in long-term persistent follow-up training to promote subsequent physical and mental recovery. Previous SRs have not reached consensus on whether MBSR can improve sleep and quality of life [9, 24], possibly because different studies included different literature and assessment tools varied considerably, preventing unified definitions and follow-up observation methods. Thus, whether MBSR training can improve sleep and quality of life requires more high-quality original studies with consistent standards.

3.4 Limitations of This Study

(1) Some SRs included original studies with substantial heterogeneity in study design, assessment tools, and core outcome indicators, preventing quantitative pooling; (2) SRs published in languages other than English and Chinese were not included, which may cause some bias; (3) Among original studies included in the analyzed SRs, few strictly adhered to RCT execution principles.

Conclusion

Currently, the overall quality of SRs on MBSR interventions in breast cancer patients is not high. Researchers should further standardize and unify assessment methods and outcome indicators in MBSR-related clinical trials, ensure complete reporting when publishing conclusions, and strictly follow SR reporting processes and standards to provide more rigorous and effective reference recommendations for MBSR application in breast cancer patients. Meanwhile, this overview comprehensively summarizes the current status and prospects of MBSR application in breast cancer patients from an effectiveness perspective. MBSR demonstrates certain short-term improvement effects on anxiety, depression, fatigue, and stress in breast cancer patients, but more high-quality, large-sample RCTs are needed to draw more definitive conclusions.

Author Contributions: Zheng Qingyong and Yang Min proposed the research direction and were responsible for conceptualization, design, analysis, and reporting. Zhao Liang and Wei Wei were responsible for data collation and figure/table preparation. Ren Xuejun, Wang Chao, Sun Rui, and Cong Minghua were responsible for literature screening, data extraction, and quality assessment. Zheng Qingyong drafted the initial manuscript. Yu Lei provided statistical guidance and language polishing. Yang Min was responsible for quality control and final review, taking overall responsibility for the article. All authors critically reviewed and revised the manuscript.

Conflict of Interest: The authors declare no conflict of interest.

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Note: Figure translations are in progress. See original paper for figures.