



Effectiveness of Mindfulness-Based Stress Reduction Intervention on Stress, Anxiety, Depression, And Quality of Life Among Breast Cancer Patients Undergoing Chemotherapy: A Systematic Review & Meta-Analysis

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Abstract

Background: Breast cancer patients undergoing chemotherapy frequently experience significant psychological distress, including stress, anxiety, depression, and impaired quality of life (QoL). Mindfulness-based interventions (MBIs), such as Mindfulness-Based Stress Reduction (MBSR), have been increasingly used as supportive psychosocial strategies; however, evidence regarding their effectiveness during active chemotherapy remains inconsistent.

Objective: This systematic review and meta-analysis aimed to evaluate the effectiveness of mindfulness-based interventions on stress, anxiety, depression, and quality of life among breast cancer patients receiving chemotherapy.

Methods: A systematic search of electronic databases was conducted to identify randomized controlled trials (RCTs) evaluating MBIs in breast cancer patients undergoing chemotherapy. Only RCTs published in English were included. Outcomes of interest included stress, anxiety, depression, and QoL. Meta-analyses were performed using standardized mean differences (SMDs) with 95% confidence intervals (CIs). Heterogeneity was assessed using the I^2 statistic.

Results: Nine RCTs involving 1,155 female breast cancer patients were included. Meta-analysis demonstrated that mindfulness-based interventions significantly reduced anxiety (SMD = -0.59; 95% CI: -0.80 to -0.39) and depression (SMD = -0.52; 95% CI: -0.73 to -0.30), with low heterogeneity. In contrast, pooled effects for stress and quality of life were not statistically significant, and substantial heterogeneity was observed across studies. Variability in intervention duration, delivery mode, outcome measures, and timing relative to chemotherapy likely contributed to inconsistent findings.

Conclusion: Mindfulness-based interventions are effective adjunctive approaches for reducing anxiety and depression in breast cancer patients undergoing chemotherapy. However, their effects on stress and overall quality of life remain variable. Further well-designed trials with standardized protocols and longer follow-up are needed to clarify these outcomes.

Keywords: Mindfulness-based interventions, Breast cancer, Chemotherapy, Anxiety and depression, Quality of life

Introduction

Breast cancer is among the most prevalent malignancies affecting women worldwide and has a profound impact on psychological well-being (Xu *et al.*, 2024) ^[19]. In 2020, it became the most frequently diagnosed cancer globally, surpassing lung cancer for the first time (Trapani *et al.*, 2022). Identified by the World Health Organization as the leading cause of cancer-related mortality

among women, breast cancer imposes a substantial burden on individuals, families, and healthcare systems (Wilkinson & Gathani, 2022)^[17]. As a major public health concern, breast cancer accounts for approximately 1.8 million newly diagnosed cases annually, with global incidence and mortality rates continuing to rise (Arnold *et al.*, 2022)^[2]. It is projected that by 2030, the global burden of breast cancer will rise substantially, with an estimated 2.64 million new cases and approximately 1.7 million deaths worldwide (Wang *et al.*, 2023)^[16]. According to World Health Organization reports, this upward trend is evident not only in developed countries but also across developing regions (World Health Organization, 2024). Furthermore, by 2040, the global burden of breast cancer is expected to exceed 3 million new cases and nearly 1 million deaths annually, driven primarily by population growth and aging (Arnold *et al.*, 2022)^[2]. Breast cancer patients commonly face both physical and psychological challenges. Factors such as fear of recurrence, body image disturbances, intensive treatments (chemotherapy and surgery), younger age, advanced disease, and limited social support contribute significantly to psychological distress (Mirmahmoodi *et al.*, 2020)^[10]. Psychological reactions such as stress, depression, and anxiety are closely linked to the diagnosis and treatment of the disease (Konieczny *et al.*, 2025)^[7]. Studies report wide variability in psychological morbidity among women with breast cancer, with depression affecting 26%–66%, stress 14.3%, anxiety 27%–58%, and other psychological disorders 15%–60%, all of which significantly compromise patients' quality of life. These prevalence rates are substantially higher than those observed in the general population and exceed those reported in patients with other types of cancer (Konieczny *et al.*, 2025; Zhu *et al.*, 2025)^[7, 21]. Despite notable improvements in survival outcomes due to advances in medical technology, breast cancer patients continue to experience significant psychological distress and reductions in QoL during treatment (Mokhtari-Hessari & Montazeri, 2020)^[11].

Management of breast cancer typically involves multimodal therapeutic approaches, including surgery, chemotherapy, radiotherapy, endocrine therapy, targeted therapy, and immunotherapy, requiring coordinated input from multiple clinical subspecialties (Burguin *et al.*, 2021)^[4]. Although these treatments effectively prolong survival, they are frequently associated with adverse effects such as fatigue, nausea, alopecia, and psychological disturbances, all of which substantially impair patients' quality of life (Anand *et al.*, 2023)^[1]. Psychological conditions such as anxiety, depression, and stress are particularly prevalent among breast cancer patients and may emerge during chemotherapy, persisting for years following treatment completion (W. Liu *et al.*, 2022; Naskar *et al.*, 2024)^[8, 12]. Consequently, innovative therapeutic approaches and effective disease management strategies are essential to address the complex needs of breast cancer patients, particularly those undergoing chemotherapy (J. Wang & Wu, 2023)^[16].

Psychological interventions such as cognitive-behavioral therapy (CBT), counseling, and supportive-expressive therapy are well established in oncology care and have demonstrated effectiveness in reducing stress, anxiety, depression, and enhancing quality of life (Ashton & Oney, 2024)^[3]. MBIs represent a distinct therapeutic approach (Naskar *et al.*, 2024)^[12].

Unlike CBT, which emphasizes cognitive restructuring and problem-solving, MBIs cultivate present-moment awareness, acceptance, and reduced reactivity to distressing thoughts and bodily sensations. This distinction may offer additional benefits for patients experiencing the intense psychological stress associated with chemotherapy (Xiang *et al.*, 2025)^[18]. In recent years, mindfulness-based interventions (MBIs) have emerged as promising psychosocial approaches in oncology care, demonstrating potential benefits in improving mental health outcomes and enhancing QoL among breast cancer patients (Fumero *et al.*, 2020)^[5]. MBIs are structured programs designed to cultivate present-moment awareness through systematic mindfulness training, thereby promoting psychological well-being and overall quality of life (X. Liu *et al.*, 2021)^[9]. These interventions employ techniques such as mindfulness meditation, yoga practices, group-based discussions, and daily-life mindfulness exercises to enhance awareness of present experiences (Schell *et al.*, 2019)^[14]. By encouraging patients to remain attentive to the present moment, accept unchangeable realities, and respond to experiences with a nonjudgmental and compassionate attitude, MBIs help alleviate the psychological burden associated with cancer (Xiang *et al.*, 2025)^[18]. Evidence suggests that MBIs are effective in addressing a wide range of biopsychosocial conditions, including stress, anxiety, depression, insomnia, pain, addiction, hypertension, weight regulation, cancer-related symptoms, and prosocial behaviors (Zhang *et al.*, 2021)^[20]. Current evidence further indicates that Mindfulness-Based Stress Reduction (MBSR), a structured form of MBI, can significantly improve QoL while reducing stress, anxiety, and depression among breast cancer patients (Goldberg, 2022)^[6]. However, findings across studies remain inconsistent, reflecting substantial heterogeneity in intervention design, duration, delivery methods, and patient populations (Goldberg, 2022; Reangsing *et al.*, 2023)^[6, 13]. Although existing meta-analyses provide valuable insights, many include broad eligibility criteria encompassing different cancer types or treatment stages, which may dilute the specific effects of MBIs in breast cancer patients undergoing chemotherapy (Reangsing *et al.*, 2023)^[13].

Most available meta-analyses have evaluated psychological interventions collectively or included mixed cancer populations, limiting the ability to isolate MBI-specific effects on stress, anxiety, depression, and QoL during chemotherapy (Reangsing *et al.*, 2023)^[13]. Therefore, a focused synthesis examining the effects of MBIs in breast cancer patients receiving chemotherapy is still scarced. Accordingly, this meta-analysis aims to specifically evaluate the effectiveness of mindfulness-based interventions in breast cancer patients undergoing chemotherapy, with particular emphasis on stress, anxiety, depression, and quality of life. By narrowing the scope of analysis, this review seeks to generate clearer, more clinically relevant evidence to inform practice and contribute to comprehensive, patient-centered cancer care.

1.1. Review Question

In breast cancer patients undergoing chemotherapy, does Mindfulness-based stress reduction intervention compared to usual care effect stress, anxiety, depression and quality of life?

2. Methods

A protocol of systematic review was developed and registered on PROSPERO (CRD420251011260). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed for reporting this systematic review and meta-analysis.

2.1. Eligibility Criteria

This review included interventional studies including only randomized controlled trials (RCTs) which were published between 2015 and 2025 in Peer-reviewed journals in English language. Participants in these studies were adult women (aged ≥ 18 years) diagnosed with any stage of breast cancer and undergoing chemotherapy. The review examined the effectiveness of Mindfulness-Based Stress Reduction (MBSR) as the primary intervention, delivered in various formats including group-based, individual, online, or in-person settings. Comparisons was made against usual care, comprising standard oncological and psychological support. Primary outcome of this review was depression and secondary outcomes were anxiety, stress, and quality of life. Studies were excluded involving male patients, non-chemotherapy treatments, palliative care settings, or unstructured/non-isolated MBSR interventions. Research lacking validated measures for stress, anxiety, depression, or

quality of life, or using observational, qualitative, or non-peer-reviewed designs were also excluded. Additionally, non-English studies, those outside 2015–2025, and publications without full-text or peer review were omitted.

2.2. Search Strategy

The search strategy included PubMed, CINAHL, Science Direct, Web of Science, and Cochrane Library to ensure comprehensive coverage of breast cancer, chemotherapy, and mindfulness-based interventions. Key terms include “breast cancer,” “chemotherapy,” “Mindfulness-Based Stress Reduction (MBSR),” “stress,” “anxiety,” “depression,” and “quality of life.” Boolean operators like AND, OR, NOT refine the search, e.g., (“breast cancer” OR “chemotherapy”) AND (“MBSR” OR “mindfulness”) AND (“stress” OR “anxiety” OR “depression” OR “quality of life”). Truncation (e.g., “mindful”*) further enhance retrieval. Studies from 2015–2025 were included to ensure relevance to current chemotherapy protocols and mindfulness-based interventions. The past decade had seen growing evidence on MBSR in oncology, making this period crucial for capturing the latest clinical and psychological insights. Including studies up to 2025 ensured the most recent findings inform clinical practice.

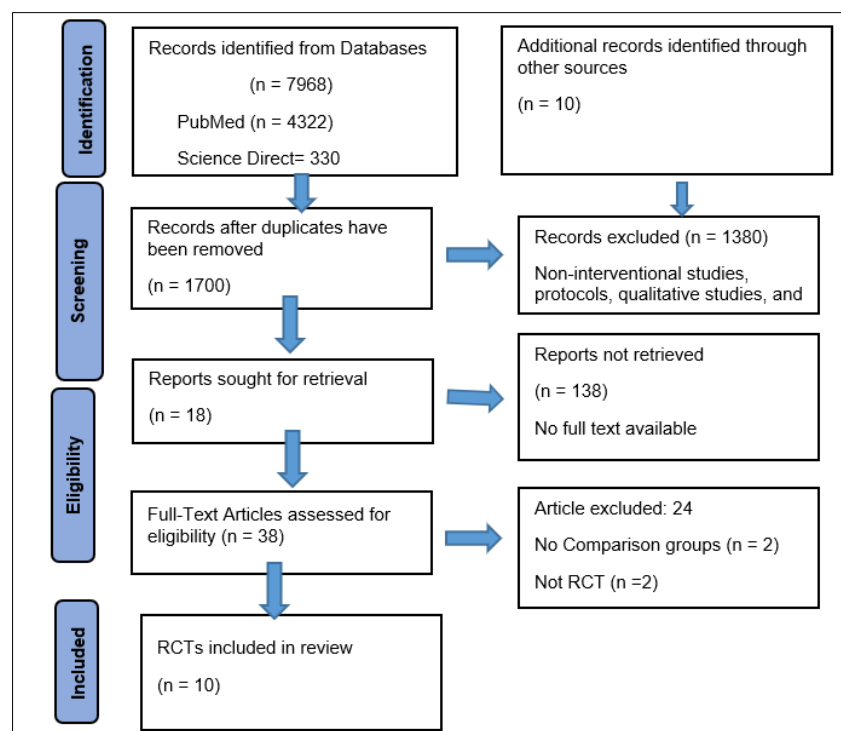


Fig 1: PRISMA flow chart for search results and selection processes

2.3. Process of Study Selection

Duplicate studies were removed by using Zotero Reference Manager. The retrieved titles and abstracts were evaluated for relevance and then relevant articles were reviewed as full text. All studies were assessed, evaluated, and finalized on the basis of inclusion and exclusion criteria before being included in the final review by the consensus of another independent reviewer to ensure the objectivity in selection process and reduce the selection bias.

2.4. Quality assessment of individual studies

All the studies were critically appraised by utilizing the Cochrane Risk of Bias tool Version 2 (RoB 2) which provides a judgment for low, some concern, or high risk. Included RCTs were assessed for quality under five domains: risk of bias in the randomization process, deviation in intended intervention, missing outcome data, measurement of outcome, and selection of the reported result.

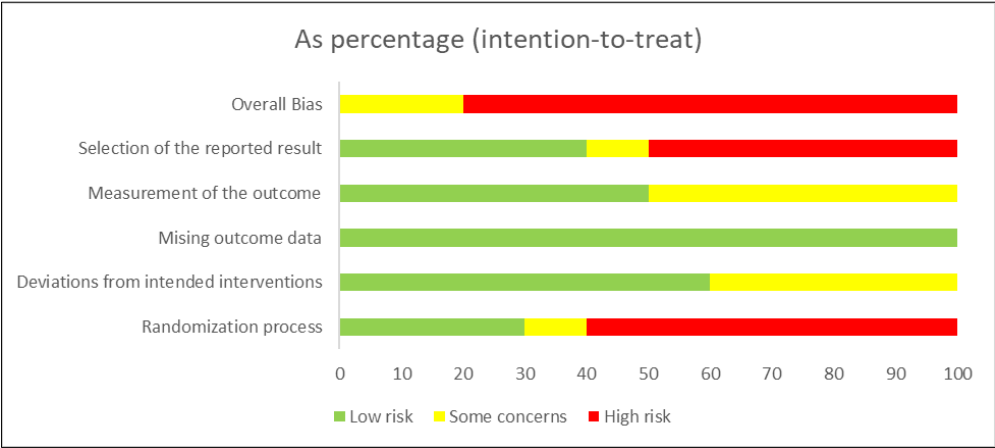


Fig 2: Risk of Bias Graph

Study ID	D1	D2	D3	D4	D5	Overall	
Liu et al 2022	+	!	+	+	+	!	+
Xu et al 2024	-	!	+	+	+	-	!
Homayoon 2021	-	!	+	+	!	-	-
Zhu et al 2023	!	!	+	+	+	!	
Mirmahmoodi et al 2020	-	+	+	+	-	-	
Khaled Younis Albahadly et al 2023	-	+	+	!	+	-	
Naskar et al 2024	-	+	+	!	-	-	
Lengacher et al 2016	+	+	+	!	-	-	
Reich et al 2017	+	+	+	!	-	-	
zhu et al 2022	-	+	+	!	-	-	

D1

D2

D3

D4

D5

Randomisation process

Deviations from the intended interventions

Missing outcome data

Measurement of the outcome

Selection of the reported result

Fig 3: Risk of Bias Summary

2.6. Data Extraction

A structured Excel sheet was used to extract information from the included studies. Accuracy and completeness of extracted data was verified by two independent researchers.

The extracted data included:

1.

Study characteristics (authors, year, country)
2.

Participant characteristics (sample size, age, gender, type of cancer)
3.

Intervention details (type, mode of delivery, duration)
Comparator details
4.

Outcome measures (Depression, stress, anxiety, quality of life)
5.

Main findings

The extracted data was compiled into evidence tables to provide a clear overview of the study characteristics and findings.

2.5. Statistical Analysis

Meta-analysis was performed using the REVMAN 5.4.1 software to calculate the magnitude of pooled effect size of MBSR intervention for stress, depression, anxiety and QOL. The random effect model was used for more than 50% heterogeneity. For effect size estimation, standardized mean differences between the experimental and control groups was calculated with 95% confidence intervals.

3. Results

3.1. Study Characteristics

This systematic review included nine randomized controlled

trials (RCTs) published between 2016 and 2024, all evaluating the effects of mindfulness-based interventions among female breast cancer patients undergoing chemotherapy. The studies were conducted across multiple countries, including China (n = 3), Iran (n = 2), United States (n = 2), Iraq (n = 1), and India (n = 1), reflecting diverse cultural and healthcare settings.

A total of 1,155 participants were included across the studies, with sample sizes ranging from 26 to 322 participants. All participants were female. The mean age of participants ranged from approximately 18 to over 60 years, with most studies reporting mean ages in the mid-40s to mid-50s. Chemotherapy was the primary treatment modality during the intervention period in all included trials.

Follow-up duration varied across studies, with most interventions assessed over an 8-week period, while two studies conducted in the United States reported 6-week interventions. One study from India implemented a short-duration intervention over five consecutive days. The included studies assessed a range of psychological and health-related outcomes, most commonly anxiety, depression, perceived stress, and quality of life, with additional outcomes such as fatigue, pain, post-traumatic stress disorder (PTSD), fear of cancer recurrence, optimism, and cognitive emotion regulation strategies

Table 1 : Characteristics of Study participants

First author	Years	Country	Type	Type of intervention		Number of cases		Sex (male/female)	Age		Follow-up time	Outcome indicator
				EP	CP	EP	CP		EP	CP		
Weimin Liu	2022	china	RCT	Mindfulness yoga	Usual care	61	63	F	18–30 2(2.94) 31–40 9 (13.24) 41–50 16 (23.53) 51–60 22 (32.35) > 60 19 (27.94)	18–30 1 (1.47) 31–40 11 (16.18) 41–50 19 (27.94) 51–60 26 (38.24) >60 11 (16.18)	8 weeks	Anxiety, Depression, Quality of Life, Pain, Fatigue
Fan Xu, MM	2024	CHINA	RCT	MBSR	Usual Care	40	40	F	(53.18 ± 14.39)	(52.88 ± 12.61)	8 weeks	Anxiety, Depression, PTSD, Cancer-related fatigue
Shariat Homayoon	2021	IRAN	RCT	MBSR	Usual Care	13	13	F	20-30 29% 31-40 42 % 41-50 19%	20-30 29% 31-40 42 % 41-50 19%	8 WEEKS	Depression, Optimism
Pingting Zhu, PhD	2023	CHINA	RCT	MBSR	Usual Care	50	51	F	47.96±8.51	49.78±7.48	8 weeks	Quality of Life, Anxiety, Depression, Cognitive Emotion Regulation Strategies
Motahareh Mirmahmoodi	2020	IRAN	RCT	MBSR	Usual Care	22	22	F	44.14 ±11.19	45.64 ±10.11	8 weeks	Anxiety, Depression, Perceived Stress
Khaled Younis Albahadly	2023	IRAQ	RCT	MBSR	Usual Care	20	20	F	48.72 ± 5.80	51.46 ± 6.10	8 weeks	Anxiety, Depression, Stress
Soumi Naskar	2024	INDIA	RCT	MBI	Usual Care	20	20	F	56.25±9.59	51.05±11.27	5 DAYS SESSIONS	Perceived Stress
Cecile A. Lengacher	2016	USA	RCT	MBSR	Usual Care	167	155	F	56.5 ± 10.2	57.6 ± 9.2	6 weeks	depression, anxiety, stress, and fear of recurrence, quality of life, fatigue, pain
Richard R. Reich, PhD	2017	USA	RCT	MBSR	Usual Care	167	155	F	56.6	56.6	6 weeks	anxiety, depression, perceived stress and QOL, emotional well-being

3.2. Intervention Characteristics

All included studies implemented mindfulness-based interventions, with the majority utilizing Mindfulness-Based Stress Reduction (MBSR) as the core intervention model. One study applied mindfulness yoga, while another employed a more general mindfulness-based intervention (MBI) framework. Control groups in all studies received usual or standard oncology care, without structured mindfulness training.

Interventions were delivered primarily in group-based formats, although individual participation was also permitted in some trials. The standard duration of interventions was 6 to 8 weeks, with session frequency and structure aligned with conventional MBSR programs. Core components across studies included mindfulness meditation, breathing awareness, body scan practices, gentle yoga or mindful movement, and group discussions aimed at enhancing emotional regulation and coping with treatment-related distress.

Most interventions were delivered face-to-face, particularly in hospital or oncology clinic settings. In several studies, participants were encouraged to engage in home practice, supported by guided instructions or written materials. Intervention delivery was facilitated by trained professionals,

including nurses, psychologists, mindfulness instructors, or multidisciplinary teams.

Outcome assessments were conducted immediately post-intervention, with limited long-term follow-up reported. Variations were observed in intervention duration, intensity, and specific mindfulness components, which may have contributed to heterogeneity in psychological outcomes across studies.

3.3. Effects of Mindfulness-Based Interventions on Psychological Outcomes in Breast Cancer Patients

3.3.1. Stress

As shown in Figure 1, three studies evaluated the effect of mindfulness-based stress reduction (MBSR) interventions on stress levels among breast cancer patients undergoing chemotherapy. The pooled analysis included a total of 62 participants in the intervention group and 62 in the control group. Individual study findings showed mixed results, with one study reporting a notable reduction in stress favoring the intervention group, while others demonstrated minimal or borderline effects. The meta-analysis revealed a pooled standardized mean difference (SMD) of -0.81 (95% CI: $-1.86, 0.23$; $p = 0.13$), indicating a non-significant reduction in stress levels in the intervention group compared with usual

care. Substantial heterogeneity was observed among the included studies ($I^2 = 87\%$), suggesting considerable variability in intervention characteristics, outcome measurement tools, and study populations. These findings indicate that while individual studies suggest potential benefits of MBSR for stress reduction, the overall pooled effect was not statistically significant.

3.3.2. Anxiety

Five studies assessed anxiety outcomes following mindfulness-based interventions, as illustrated in Figure 2. The combined sample comprised 186 participants in the intervention group and 189 in the control group. All included studies reported reductions in anxiety scores favoring the intervention group. The pooled analysis demonstrated a statistically significant reduction in anxiety, with an SMD of -0.59 (95% CI: $-0.80, -0.39$; $p < 0.00001$). No significant heterogeneity was observed ($I^2 = 0\%$), indicating consistency across studies. These results suggest that mindfulness-based interventions are effective in reducing anxiety levels among breast cancer patients receiving chemotherapy.

3.3.3. Depression

Four studies examined the effects of mindfulness-based interventions on depression, as presented in Figure 3. A total of 173 participants were included in the intervention group and 176 in the control group. All studies reported reductions in depressive symptoms among participants receiving mindfulness-based interventions. The pooled meta-analysis showed a statistically significant improvement in depression outcomes, with an SMD of -0.52 (95% CI: $-0.73, -0.30$; $p < 0.00001$). Low heterogeneity was observed ($I^2 = 0\%$), indicating homogeneity across the included studies. These findings support the effectiveness of mindfulness-based interventions in alleviating depressive symptoms in breast cancer patients during chemotherapy.

3.3.4. Quality of Life

Quality of life (QoL) was assessed in three studies included in the meta-analysis, as shown in Figure 4. The pooled sample consisted of 263 participants in the intervention group and 259 in the control group. Individual study results showed mixed effects, with some studies favoring mindfulness-based interventions and others reporting minimal differences between groups. The pooled analysis revealed an SMD of 0.25 (95% CI: $-0.08, 0.58$; $p = 0.14$), indicating no statistically significant improvement in QoL among participants receiving mindfulness-based interventions compared with usual care. Moderate heterogeneity was observed ($I^2 = 68\%$), suggesting variability in intervention duration, outcome measurement tools, and participant characteristics. These results indicate that while mindfulness-based interventions may positively influence quality of life in some contexts, the pooled evidence does not demonstrate a statistically significant overall effect.

4. Discussion

This systematic review and meta-analysis synthesized evidence from randomized controlled trials evaluating the effectiveness of mindfulness-based interventions (MBIs), including Mindfulness-Based Stress Reduction (MBSR), on psychological outcomes among breast cancer patients undergoing chemotherapy. The primary outcomes assessed were stress, anxiety, depression, and quality of life (QoL).

The principal findings indicate that MBIs produced statistically significant reductions in anxiety and depression, whereas pooled effects on stress and QoL were not statistically significant.

4.1. Stress Outcome

In contrast to anxiety and depression, the pooled effect of MBIs on stress did not reach statistical significance in the present analysis, despite some individual trials reporting moderate to large reductions. This finding partially diverges from the meta-analysis by Chayadi *et al.* (2022), which reported significant reductions in perceived stress and cancer-related fatigue across oncology populations. The discrepancy may be attributable to differences in population focus and treatment phase. While Chayadi *et al.* included patients at various stages of cancer and treatment trajectories, the present review specifically focused on breast cancer patients undergoing chemotherapy—a period characterized by fluctuating treatment-related stressors that may attenuate consistent intervention effects. Additionally, Xiang *et al.* (2022) noted variability in stress outcomes across studies, emphasizing that stress responses during chemotherapy are highly sensitive to timing, symptom burden, and contextual factors, which may explain the heterogeneous findings observed in the present review.

4.2. Anxiety and Depression

The significant reductions in anxiety and depression observed in the present review are consistent with findings from multiple prior systematic reviews and meta-analyses. Reangsing *et al.* (2023)^[13] reported that mindfulness-based interventions significantly reduced depressive symptoms in breast cancer patients, with moderate pooled effect sizes. Similarly, Xiang *et al.* (2022) demonstrated significant improvements in both anxiety and depression among breast cancer patients undergoing chemotherapy, supporting the role of mindfulness-based approaches in alleviating emotional distress during active treatment. In a broader oncology context, Chayadi *et al.* (2022) also found that mindfulness-based interventions were effective in reducing anxiety and depression across mixed cancer populations. The alignment of the present findings with these reviews strengthens the evidence base supporting MBIs as effective adjunctive interventions for emotional symptom management in breast cancer patients receiving chemotherapy.

4.3. Quality of Life

Quality of life outcomes in the current review were mixed, with the pooled analysis indicating no statistically significant overall improvement. This finding contrasts with the systematic review and meta-analysis by Wang *et al.* (2024), which reported significant improvements in QoL following MBSR interventions among breast cancer patients. However, Wang *et al.* included studies with longer intervention durations and extended follow-up periods, whereas several trials in the present review assessed QoL during or immediately after chemotherapy.

Similarly, Xiang *et al.* (2022) reported modest but significant improvements in QoL, noting that psychological improvements do not always translate into immediate gains in global quality of life, particularly during intensive treatment phases. The multidimensional nature of QoL—encompassing physical, emotional, social, and functional

domains—may further explain why physical symptoms such as fatigue, nausea, and pain during chemotherapy overshadow psychological gains, thereby limiting measurable improvements in overall QoL scores.

4.4. Heterogeneity and Methodological Considerations

Substantial heterogeneity was observed across several pooled analyses, indicating that variability in effect sizes was not due to chance alone. Comparable heterogeneity has been reported in previous reviews by Reangsing *et al.* (2023)^[13], Wang *et al.* (2024), and Xiang *et al.* (2022). Differences in mindfulness program structure, session frequency, intervention duration, delivery mode (face-to-face vs. online), outcome measurement tools, and follow-up periods likely contributed to this variability. Patient-related factors, including disease stage, baseline psychological distress, chemotherapy regimen, and cultural context, may also influence responsiveness to mindfulness-based interventions, as highlighted in earlier reviews (Chayadi *et al.*, 2022; Reangsing *et al.*, 2023)^[13].

4.5. Clinical Implications

Despite variability in stress and QoL outcomes, the present findings support the clinical utility of mindfulness-based interventions as adjunctive strategies for reducing anxiety and depression among breast cancer patients undergoing chemotherapy. These results align with existing evidence indicating that MBIs are low-risk, adaptable, and suitable for integration into supportive oncology care (Reangsing *et al.*, 2023; Xiang *et al.*, 2022)^[13]. However, the inconsistent effects on stress and quality of life highlight the need for standardized intervention protocols, consistent outcome measures, and longer follow-up periods. Future research should focus on phase-specific delivery of mindfulness interventions, standardized curricula, and subgroup analyses based on baseline distress levels to better identify patients most likely to benefit.

5. Conclusion

This systematic review and meta-analysis demonstrates that mindfulness-based interventions significantly reduce anxiety and depression among breast cancer patients undergoing chemotherapy. However, their effects on stress and overall quality of life remain inconsistent and non-significant at the pooled level. These findings support the use of mindfulness-based interventions as effective adjunctive strategies for emotional symptom management during chemotherapy, while highlighting the need for more standardized protocols and longer follow-up to clarify their impact on stress and quality of life.

6. Limitations

This systematic review and meta-analysis focused on breast cancer patients undergoing chemotherapy, the included studies varied in intervention type, duration, delivery mode, outcome measurement tools, and follow-up periods, resulting in substantial heterogeneity. The relatively small number of primary studies available for some outcomes, particularly stress and quality of life, may have limited the precision and consistency of the pooled estimates. In addition, variability in

sample characteristics, baseline psychological status, and chemotherapy regimens across studies may have influenced intervention effects. Potential risk of bias within individual studies and the possibility of publication bias may also affect the reliability and generalizability of the findings.

7. Strengths

The main strength of this systematic review and meta-analysis is the inclusion of only randomized controlled trials, which enhances methodological rigor and internal validity. Furthermore, the use of standardized mean differences (SMDs) allowed objective comparison of intervention effects across studies using different psychological assessment tools. By quantitatively synthesizing evidence on stress, anxiety, depression, and quality of life, this review provides a comprehensive evaluation of the psychological impact of mindfulness-based interventions. The findings support the clinical relevance of mindfulness-based approaches as adjunctive interventions for managing psychological distress in breast cancer patients undergoing chemotherapy.

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