

ORIGINAL ARTICLE

Effectiveness of Mindfulness-Based Art Therapy for Oncology Nurses: A Randomized Controlled Trial

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ABSTRACT

Background: Oncology nurses are frequently subjected to significant psychological stress due to the demanding nature of cancer care, which negatively impacts their mental and physical health as well as the quality of patient care. Although Mindfulness-Based Stress Reduction has been demonstrated to be effective in alleviating stress, practitioners often encounter barriers such as limited engagement and difficulty maintaining regular practice.

Aim: To enhance engagement and adherence, we integrated art elements into the Mindfulness-Based Stress Reduction framework, creating the Mindfulness-Based art therapy program, and evaluated its effectiveness among oncology nurses.

Design: A three-arm randomized controlled trial.

Methods: 90 oncology nurses participated (Mindfulness-Based Art Therapy group = 30, Mindfulness-Based Stress Reduction group = 30, waitlist controls group = 30) in an 8-week program. Stress, anxiety, depression, fatigue, and mindfulness levels were assessed at baseline, immediately after the fourth week of intervention, and immediately after the intervention concluded. Compliance and satisfaction were evaluated using attendance rates and satisfaction questionnaires. Descriptive statistics were used to analyze general data; intervention effects were compared using one-way ANOVA and generalized estimating equations, and compliance and satisfaction were compared using independent samples *t*-test.

Results: Both Mindfulness-Based Art Therapy and Mindfulness-Based Stress Reduction significantly improved stress, physiological markers, and mindfulness vs. controls. Mindfulness-Based Stress Reduction better reduced depression ($\beta = -2.980$, 95% CI: $-5.427, -0.533$, $p = 0.017$), while Mindfulness-Based Art Therapy was superior for fatigue ($\beta = -11.582$, 95% CI: $-20.615, -2.550$, $p = 0.012$). Mindfulness-Based Art Therapy had higher adherence (93.3% vs. 73.3%, $p < 0.05$) and satisfaction (3.27 ± 0.45 vs. 2.40 ± 0.52 , $p = 0.01$).

Linking Evidence to Action: For oncology nurses, Mindfulness-Based Art Therapy is as effective as Mindfulness-Based Stress Reduction for improving stress and mindfulness, while providing greater adherence, satisfaction, and more consistent fatigue reduction.

Trial Registration: Chinese Clinical Trial Registry, ChiCTR2300078124 (<http://www.chictr.org.cn>), 30/11/2023

WenMin Wu, JingYi Zhang, and Yu Ye are co-first author and contributed equally to this study.

1 | Introduction

Oncology nurses face severe occupational pressures, including heavy workloads, frequent exposure to chemotherapeutic agents (with an occupational exposure rate no less than 63% in China) (Mei et al. 2022), and the prolonged emotional labor of providing end-of-life care. These cumulative stressors significantly impact their mental health, with global data showing 30%–40% of nurses experience psychological distress. In China, 68.3% of nurses report psychological stress (Gu et al. 2019), and anxiety and depression rates reach 67.3% and 67.2%, respectively (Zhou et al. 2024)—three times higher than the general adult population (Cheung and Yip 2015). Similar issues are observed globally, with one study in South Korea noting depression and fatigue rates of 52.1% and 62% among nurses (Seo et al. 2024). Such mental health challenges contribute to burnout, reduced job satisfaction, increased turnover, and can ultimately compromise nursing quality and patient safety (Hussein et al. 2024).

Mindfulness-Based Stress Reduction (MBSR), while effective in alleviating stress and improving psychological well-being among nurses, faces significant challenges in practice adherence (Sulosaari et al. 2022). Evidence indicates that although MBSR reduces perceived stress and enhances job satisfaction, dropout rates often exceed 25%, largely due to difficulties in maintaining focus and engagement during practice (Zhang et al. 2021). Lack of immersion frequently leads to perceived ineffectiveness, thereby limiting its broader application (Van et al. 2022). In contrast, art therapy provides an alternative approach through creative expression, promoting emotional processing and stress reduction. Meta-analyses (Zhang et al. 2024) confirm that activities such as painting, collage-making, and mandala creation significantly lower stress, anxiety, and depression levels among healthcare professionals (Tjasink et al. 2023). The immersive nature of artistic tasks facilitates self-awareness and nonverbal emotional expression, with neurobiological studies suggesting that art engagement activates right-hemisphere brain functions, supporting cognitive reframing of stressors and adaptive coping (Vija and Atr-Bc 2004).

Mindfulness-Based Art Therapy (MBAT) integrates mindfulness training with artistic creation to enhance self-awareness and emotional processing through tangible creative expression. This approach has demonstrated efficacy in reducing stress in populations such as cancer patients and students, as evidenced by both self-reported measures and physiological markers like cortisol levels (Jalambadani and Borji 2019). By combining the structured awareness of MBSR with the immersive qualities of art therapy, MBAT may improve engagement and present-moment focus. However, no prior randomized controlled trials have specifically examined the efficacy of Mindfulness-Based Art Therapy for oncology nurses, leaving its effectiveness in this specific population unvalidated.

This randomized controlled trial primarily evaluates the efficacy of MBAT versus MBSR in reducing stress, fatigue, anxiety, and depression, and in enhancing mindfulness among oncology nurses. Secondarily, it compares the compliance, satisfaction, and physiological stress markers (heart rate variability and salivary cortisol) between the two interventions.

2 | Methods

2.1 | Study Design and Population

This study was a three-arm, randomized, parallel-controlled trial. Participants were randomly allocated in a 1:1:1 ratio to one of three groups: the MBAT group, the MBSR group, or the wait-list control group.

2.2 | Recruitment and Procedures

Recruitment posters were posted by researcher A across various departments of a large cancer hospital to solicit participant enrollment. Potential participants underwent screening by a general practitioner after completing the Perceived Stress Scale on “SoJump,” a questionnaire survey platform. During this phase, researcher A provided comprehensive and detailed explanations of the study, inviting queries from interested individuals. Those who met the inclusion criteria and expressed willingness to engage in the study signed an informed consent form.

2.3 | Randomization, Allocation, and Blinding

Participants were randomly allocated to one of three groups in a 1:1:1 ratio using a computer-generated sequence. The allocation was concealed via sequentially numbered, opaque, sealed envelopes. Due to the nature of the interventions, blinding of participants and instructors was not possible. However, outcome assessors were blinded to group assignment throughout the study.

2.4 | Criteria for Participation

Inclusion criteria: (a) Currently employed frontline clinical nurses; (b) score of ≥ 29 on the PSS-14 scale (indicates a high level of individual stress); (c) Voluntary participation with signed informed consent. Exclusion criteria: (a) Previous attendance at mindfulness workshops or art therapy sessions; (b) Exclusion was based on general practitioner-confirmed conditions known to influence heart rate or cortisol levels (e.g., metabolic syndrome, hypertension, Cushing’s syndrome, mental disorders, irritable bowel syndrome, and pregnancy) or current smoking.

2.5 | Sample Size

The sample size was estimated a priori using G*Power 3.1 software for a repeated-measures analysis of variance (ANOVA), with a two-sided α level of 0.05 and a power ($1-\beta$) of 0.8. The effect size estimation was grounded in prior research (Wang et al. 2023). We converted the reported standardized mean difference (SMD = 0.52) from its 95% confidence interval to a Cohen’s f value of approximately 0.26. To ensure a robust and conservative estimate, we selected a target effect size of $f = 0.3$ for our calculation. Accounting for a 20% attrition rate, a total of 90 participants (30 per group) were planned for recruitment.

2.6 | Interventions

Due to a rolling enrollment design, the participant recruitment (March–July 2024) and intervention phases (March–August 2024) overlapped. Interventions were delivered in small subgroups of approximately 10 participants, with each cohort commencing its 8-week cycle as soon as a sufficient number of members was enrolled. Sessions were offered at two time slots (12:30–13:30 or 16:00–17:00) on weekdays. The intervention schedule was mutually agreed upon by all group members. Participants who attended fewer than six sessions were classified as non-adherent and excluded from the per-protocol analysis. The home practice assignments for both groups were matched each week in terms of expected duration and thematic content.

The interventions were delivered by a primary facilitator with professional expertise in both mindfulness-based interventions and art therapy. All sessions were co-facilitated by an assistant to support consistency. The instructors communicated with participants via WeChat, providing reminders before sessions and practice guidelines afterwards. Attendance was tracked manually before each session. The reasons for withdrawal of participants during the intervention were documented in detail by researchers C&D. During the sessions, two psycho-oncology nursing specialists monitored and documented any adverse reactions.

2.6.1 | Waitlist Control Group

A waitlist control group was established as a benchmark, receiving no intervention for 8 weeks.

2.6.2 | Intervention: Mindfulness-Based Stress Reduction

MBSR course manual and teaching guide compiled by *Lyn Meleo-Meyer* from the Center for Mindfulness at the School of Public Health, Brown University was used.

2.6.3 | Intervention: Mindfulness-Based Art Therapy and Materials

The MBAT program was theoretically grounded in self-regulation theory, which posits that individuals manage stress by integrating subjective awareness with objective self-expression (Monti et al. 2006; Folkman 1984). The 8-week protocol was developed by adapting the standardized MBSR manual to incorporate evidence-based art techniques such as mandala drawing, collage, and thematic painting (Liu et al. 2020; Girija et al. 2017). Each session sequentially combined mindfulness practice (e.g., body scan, breath awareness) with non-judgmental artistic creation, using art as a tool to deepen present-moment awareness and facilitate emotional processing without evaluation. The intervention content is described in Table 1.

MBAT group received a standardized art kit (including colored pencils, markers, scissors, and glue) and an instructional booklet. MBSR group received the standard program handbook. All materials were supplied at no cost.

2.6.4 | Homework

The importance of home practice for enhancing mindfulness levels and improving mental health was explained to mindfulness practitioners to strengthen their intrinsic motivation. Clear and specific home practice goals, including the frequency and duration of practice, were collaboratively established with the participants. Participants received audio recordings of home practice instructions, recorded by the instructor based on the content of each session. A mini-program was utilized to send daily reminders for practice and to track progress. The mini-program recorded participants' practice progress, including completion status and reflections for each session.

2.7 | Fidelity

Intervention fidelity was maintained through a multi-layered approach: limited initial audio recordings for internal supervision, standardized manuals and staff training for both MBAT and MBSR programs, and unannounced on-site assessments by an independent co-investigator trained in assessment protocols and mindfulness practice.

3 | Outcome Measures



3.1 | Measurements

The primary outcome measure was assessed using the Perceived Stress Scale. Secondary outcome measures included the Short Form of the Five Facet Mindfulness Questionnaire, the Generalized Anxiety Disorder-7 scale, the Patient Health Questionnaire-9 for depressive symptoms, and two physiological indicators: salivary cortisol and heart rate variability. Data were collected at three time points: baseline (T1), immediately after the fourth session (T2), and immediately after the eighth session (T3) (as shown in Figure 1). Self-reported questionnaires were administered using the Wenjuanxing platform, while physiological indicators were collected using saliva collection tubes and the PowerLab system. Researchers C&D, who were blinded to the study group allocation, conducted the data collection.

The Perceived Stress Scale (PSS) consists of 14 items rated on a 5-point Likert scale (Cohen et al. 1983), with total scores ranging from 14 to 70. Stress levels are categorized as follows: normal range [14–28]; moderate stress requiring attention [29–42]; and significant stress suggesting the need for professional assistance [43–56]. The scale demonstrated good internal consistency, with a Cronbach's alpha of 0.78.



The Short Form of the Five Facet Mindfulness Questionnaire (SF-FFMQ) is a 24-item scale designed to measure five facets

TABLE 1 | The key themes covered in Mindfulness-Based Art Therapy group.

Weeks	Topic	Attitude	Mindfulness	Art therapy	Display
1	What is mindfulness	Beginner's Mind	Sensory Awareness	Enter a mode of conscious selection and awareness through free graffiti. Discuss the impact of inertia thinking on work	
2	Perceived stress	Acceptance	Body scan	Body mandala to express physical sensations. Share ways of coping with physical discomfort of patients	
3	Now is good	Non-judging	Breathing awareness	Life is between breaths, through life mandala, enter the mode of feeling, sensing, existing. Discuss the gain during the nursing process	
4	Accept Yourself	Trust and Non-striving	Thought detachment	Use the non-dominant hand and close your eyes to doodle, then open eyes and use another hand to supplement	
5	Stress coping	Trust and acceptance	Mindful stretching	"Man in the rain" drawing, exploring automatic stress coping strategies. Discuss how to creatively and consciously deal with challenges in daily work	
6	Strengthen communication	Patience	Mindful listening	Communication scene painting explores relationships with oneself and others around. Discuss communication difficulties at work	

(Continues)

TABLE 1 | (Continued)

Weeks	Topic	Attitude	Mindfulness	Art therapy	Display
7	Self-care	Gratitude and generosity	Loving-kindness meditation	Choose a picture that you want to color it in and give it to yourself and the patient you want to bless	
8	Embrace the future	Letting go	Mindfulness meditation	Create a collage with the theme of “on the way” and discuss how to integrate mindfulness into work	

of mindfulness (Bohlmeijer et al. 2011). Responses are recorded on a 5-point Likert scale, with higher scores indicating greater levels of mindfulness. Both the individual subscales and the total FFMQ score demonstrated good internal consistency, with Cronbach’s alpha values exceeding 0.70.

The Patient Health Questionnaire-9 (PHQ-9) is a 9-item scale (Kroenke et al. 2001). Each item is scored on a 4-point scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day), with total scores ranging from 0 to 27. The cut-off points for mild, moderate, moderately severe, and severe depression are 5, 10, 15, and 20, respectively. The scale demonstrated excellent internal consistency, with a Cronbach’s alpha of 0.89.

The Fatigue Severity Scale (FSS) is a 9-item scale utilizing a 7-point Likert scoring system (Valko et al. 2008). Participants were stratified based on the severity of fatigue, with a threshold score exceeding 36 indicating the presence of severe fatigue. The total score ranges from 7 to 63. The scale demonstrated high internal consistency, with a Cronbach’s alpha coefficient greater than 0.85.

The Generalized Anxiety Disorder (GAD) scale is a 7-item scale (Spitzer et al. 2006). Each item is scored on a 4-point scale (0 = not at all, 1 = several days, 2 = more than half the days, 3 = nearly every day), with total scores ranging from 0 to 21. The cut-off points for mild, moderate, and severe anxiety are 5, 10, and 15, respectively. The scale demonstrated excellent internal consistency, with a Cronbach’s alpha of 0.92.

Saliva samples were collected using SARSTEDT collection tubes [51.1534.500; Nümbrecht, Germany]. Salivary cortisol concentrations were measured using a high-sensitivity enzyme immunoassay kit (HA002901; Yongwin Biotechnology, China). The absorbance of the saliva samples was determined using a Tecan Spark multifunctional microplate reader, and cortisol concentrations were calculated based on a standard calibration curve. Post-experiment samples were stored at -80°C in a freezer. Salivary cortisol concentrations are expressed in nmol/L (Laudat et al. 1988). To avoid potential confounding effects of circadian rhythms, all saliva samples in this study were collected at a standardized time of 17:00.

Heart rate variability (HRV) was measured using a PowerLab multi-channel physiological recorder. Participants underwent a 5-min electrocardiogram (ECG) recording (Lead II) while lying quietly in a supine position. Among various HRV metrics, the root mean square of successive RR interval differences (RMSSD, ms) is relatively less influenced by respiratory rate (Hill and Siebenbrock 2009; Shaffer and Ginsberg 2017). Therefore, to facilitate analysis and interpretation, only RMSSD values were recorded.

3.2 | Compliance and Satisfaction

The adherence and satisfaction of oncology nurses to MBAT and MBSR were compared through attendance records and satisfaction surveys. Before each intervention session, Researcher E recorded participant attendance using a

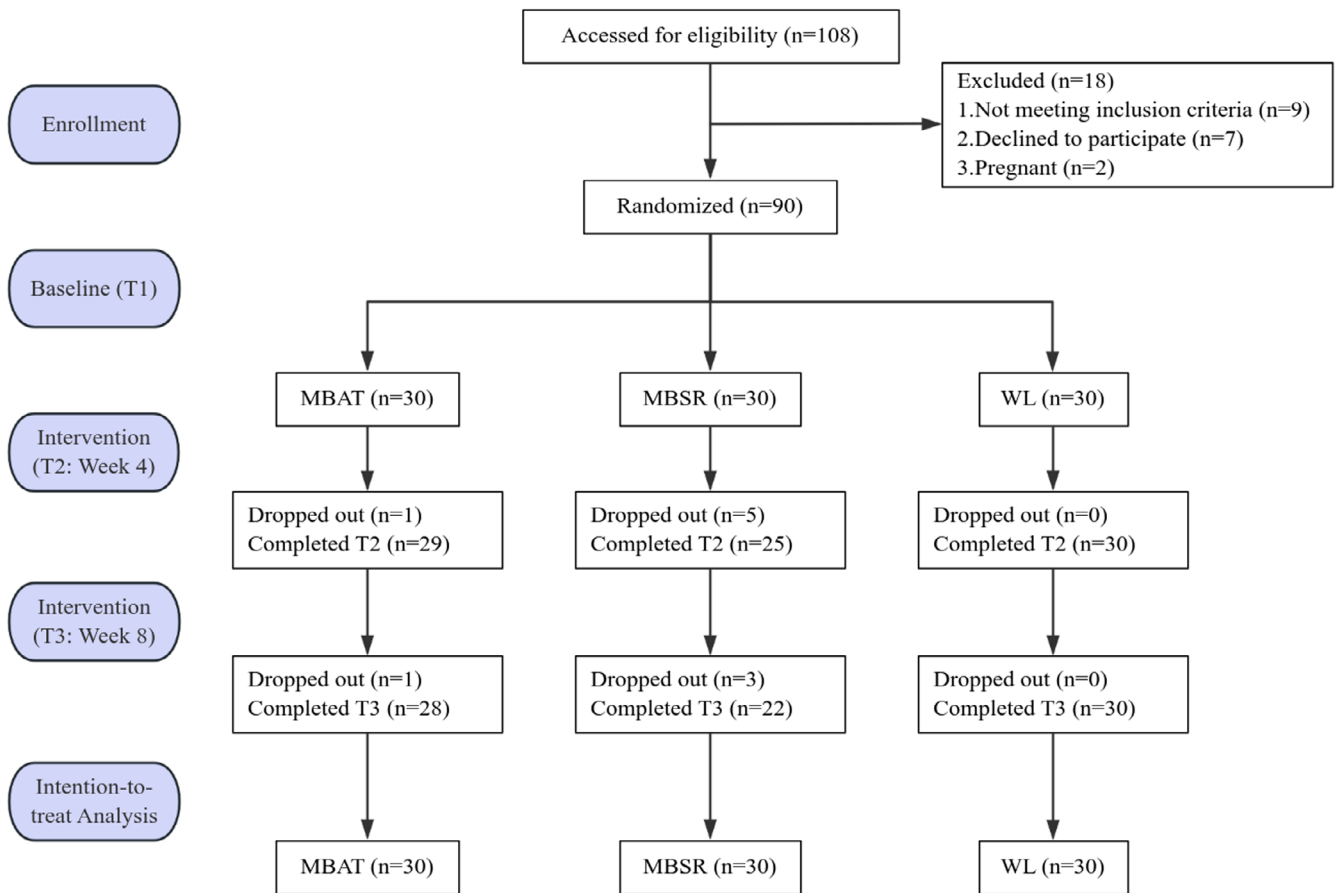


FIGURE 1 | Flow chart of data collection procedure.

paper-based sign-in sheet. Home practice was conducted on a voluntary basis, with daily reminders sent via a mini-program to encourage participation. Specific details of home practice, including frequency and personal reflections, were recorded by the mini-program's backend. Researcher E was responsible for weekly statistical analysis of attendance and home practice adherence.

To evaluate satisfaction, a self-designed satisfaction survey was administered at the end of the 8-week intervention. Participants in both the MBAT and MBSR groups were asked to rate their satisfaction with the intervention content for each of the 8 sessions on a scale from “very dissatisfied”(1) to “very satisfied”(5). Lower scores indicated lower levels of satisfaction.

3.3 | Statistical Analysis

Statistical analyses were performed using SPSS software (version 25.0). Descriptive statistics, analysis of variance (ANOVA), and the Wilcoxon signed-rank test were used to compare baseline and outcome data across the three groups. As all participants had complete data at baseline, the analysis was performed on an intention-to-treat basis, with missing data handled using multiple imputation. Generalized Estimating Equations were employed to assess changes across different time points and the interaction effects between time and group. Generalized Estimating Equations were chosen for

two reasons: it accounts for within-subject correlations in repeated measures and provides unbiased estimates even in the presence of missing data, making it suitable for both normally and non-normally distributed data. All statistical tests were two-sided, with a significance level set at 0.05. Adherence and satisfaction were compared using independent samples *t*-test and Chi-squared test. For non-normally distributed continuous data, results were expressed as “M (P25, P75)” and analyzed using the Mann–Whitney U test.

3.4 | Ethical Considerations

All procedures followed the Declaration of Helsinki. Ethical approval was obtained (No. GYZL - ZN - 2023 (032)). All participants provided written informed consent, having been informed of the study aims, their right to withdraw, and the measures to protect their privacy.

4 | Results

4.1 | Participant Characteristics

Figure 1 illustrates the participant flow. A total of 108 oncology nurses were assessed for eligibility; 90 met the inclusion criteria and were enrolled. The demographic characteristics are presented in Table 2 ($n=90$), with the majority being female ($n=84$).

TABLE 2 | Participants' characteristics ($N=90$).

Variables	Coding	Group						<i>p</i>
		MBAT ($n=30$)		MBSR ($n=30$)		WL ($n=30$)		
		Frequency	<i>N</i> (%)	Frequency	<i>N</i> (%)	Frequency	<i>N</i> (%)	
Age	1 = 20–30	5	(16.67)	9	(30.00)	10	(33.33)	0.788 ^a
	2 = 31–40	19	(63.33)	14	(46.67)	13	(43.33)	
	3 = 41–50	6	(20.00)	7	(23.33)	7	(23.33)	
Gender	1 = Male	1	(3.33)	1	(3.33)	4	(13.33)	0.357*
	2 = Female	29	(96.67)	29	(96.67)	26	(86.67)	
Marital status	1 = Never married	8	(26.67)	7	(23.33)	7	(23.33)	0.942 ^b
	2 = Ever married	22	(73.33)	23	(76.67)	23	(76.67)	
Education level	1 = Bachelor	28	(93.33)	27	(90.00)	27	(90.00)	1.000*
	2 = Master and doctoral	2	(6.67)	3	(10.00)	3	(10.00)	
Fertility circumstance	1 = Childless	9	(30.00)	10	(33.33)	10	(33.33)	0.950 ^b
	2 = Child	21	(70.00)	20	(66.67)	20	(66.67)	
Departments	1 = Internal Medicine	6	(20.00)	9	(30.00)	3	(10.00)	0.380*
	2 = Surgical department	5	(16.67)	7	(23.33)	8	(26.67)	
	3 = Radioterapia	16	(53.33)	12	(40.00)	13	(43.33)	
	4 = Other	3	(10.00)	2	(6.67)	6	(20.00)	
Job title	1 = Senior nurse	14	(46.67)	18	(60.00)	12	(40.00)	0.288 ^b
	2 = Supervisor nurse	16	(53.33)	12	(40.00)	18	(60.00)	
Service year	1 = 0–10	8	(26.67)	9	(30.00)	12	(40.00)	0.331*
	2 = 11–20	17	(56.67)	17	(56.67)	10	(33.33)	
	3 = ≥ 21	5	(16.67)	4	(13.33)	8	(26.67)	

Abbreviations: ANOVA, analysis of variance; MBAT, mindfulness-based art therapy; MBSR, mindfulness-based stress reduction; WL, waitlist controls group.

^aANOVA.

^bChi-square test.

*Fisher's exact test.

4.2 | Effects of the Program

At baseline, the MBAT, MBSR, and Waitlist control groups showed comparable PSS scores (40.30 ± 6.598 , 41.53 ± 7.176 and 40.54 ± 8.660 , Table 3), with no statistically significant differences ($p=0.798$, Table 3). At Weeks 4 and 8, PSS scores in the MBSR and MBAT groups were significantly lower than in the Waitlist control group, while no statistically significant differences were observed between the MBSR and MBAT groups ($p=0.949$, $p=0.366$, Table 4). The generalized estimating equations results indicated that the MBSR group showed interaction effects (group \times time) at both the fourth and eighth weeks ($\beta = -6.164$, 95% CI: -10.964 , -1.364 , $p=0.012$; $\beta = -10.643$, 95% CI: -16.651 , -4.634 , $p=0.001$, Table 5), whereas the MBAT group exhibited an interaction effect (group \times time) only at the eighth week ($\beta = -5.876$, 95% CI: -10.782 , -0.970 , $p=0.019$, Table 5).

At baseline, the MBAT, MBSR, and Waitlist control groups exhibited comparable salivary cortisol concentrations (8.08 ± 1.454 , 7.80 ± 1.360 and 7.87 ± 1.608 , Table 3), with no

statistically significant differences ($p=0.750$, Table 3). At Weeks 4 and 8, the salivary cortisol concentrations in the MBSR and MBAT groups were significantly lower than those in the Waitlist control group, while no statistically significant differences were found between the MBSR and MBAT groups ($p=0.305$, $p=1.000$, Table 4). The generalized estimating equations results indicated that both the MBSR and MBAT groups exhibited significant interaction effects (group \times time) at the fourth and eighth weeks ($\beta = 0.756$, 95% CI: 0.183 , 1.328 , $p=0.002$, $\beta = 0.276$, 95% CI: -0.456 , 1.008 , $p < 0.001$; $\beta = 1.821$, 95% CI: 1.134 , 2.508 , $p < 0.001$; $\beta = 2.293$, 95% CI: 1.398 , 3.189 , $p < 0.001$, Table 5).

At baseline, the MBAT, MBSR, and Waitlist control groups showed comparable RMSSD values (25.59 ± 10.821 , 22.85 ± 12.459 , 24.87 ± 12.813 , Table 3), with no statistically significant differences ($p=0.425$, Table 3). At the fourth and eighth weeks, the RMSSD values in the MBSR and MBAT groups were significantly higher than those in the Waitlist control group, while no statistically significant differences were found between the MBSR and MBAT groups ($p=1.000$, $p=1.000$, Table 4). The

TABLE 3 | Outcomes of groups at baseline, 4 and 8 weeks.

Group	Baseline			4 weeks			8 weeks					
	Mean ± SD	Median (IQR)	F/Z	p	Mean ± SD	Median (IQR)	F/Z	p	Mean ± SD	Median (IQR)	F/Z	p
<i>Perceived Stress Scale</i>												
MBAT	40.30 ± 6.598	39.5 (8.5)	0.227	0.798	38.23 ± 9.765	38.5 (11)	2.865	0.062	34.57 ± 8.257	33.0 (8.3)	9.796	<0.01
MBSR	41.53 ± 7.176	41.0 (10.5)			36.03 ± 7.365	36.0 (11.5)			31.03 ± 9.694	32.0 (15.3)		
WL	40.54 ± 8.660	38.5 (13.3)			41.20 ± 7.849	41.0 (12)			40.68 ± 7.525	40.3 (7.3)		
<i>Salivary cortisol concentrations</i>												
MBAT	8.08 ± 1.454	8.0 (2.3)	0.289	0.750	6.32 ± 1.089	6.1 (2.1)	19.488	<0.01	5.90 ± 1.131	5.5 (1.8)	38.181	<0.01
MBSR	7.80 ± 1.360	7.7 (2.4)			6.80 ± 1.213	6.7 (2.0)			5.90 ± 0.793	5.8 (1.4)		
WL	7.87 ± 1.608	8.1 (2.7)			7.93 ± 1.354	7.9 (2.2)			7.98 ± 1.321	7.9 (2.0)		
<i>The root mean square of successive RR interval differences (RMSSD)</i>												
MBAT	25.59 ± 10.821	23.0 (15.9)	1.713	0.425	34.74 ± 16.280	32.1 (21.8)	14.540	<0.01	43.88 ± 22.894	40.4 (23.1)	25.600	<0.01
MBSR	22.85 ± 12.459	19.7 (11.9)			31.68 ± 10.300	28.6 (15.3)			47.54 ± 20.192	43.5 (24.8)		
WL	24.87 ± 12.813	22.8 (14.4)			22.49 ± 8.555	21.9 (13.4)			25.30 ± 11.945	23.2 (18.8)		
<i>Fatigue Severity Scale</i>												
MBAT	41.60 ± 11.166	41.0 (18.0)	0.117	0.890	35.90 ± 12.064	33.0 (21.0)	8.246	<0.01	31.92 ± 11.011	33.0 (15.5)	6.910	<0.01
MBSR	40.40 ± 13.930	42.5 (22.3)			32.84 ± 11.646	32.8 (17.0)			34.72 ± 9.642	35.6 (14.0)		
WL	40.07 ± 13.406	42.0 (16.8)			42.27 ± 11.045	42.5 (15.8)			41.97 ± 11.672	41.0 (17.5)		
<i>Five Facet Mindfulness Questionnaire</i>												
MBAT	71.80 ± 7.194	72.5 (9.5)	0.034	0.967	75.6 ± 7.700	75.0 (9.5)	2.977	0.056	77.62 ± 9.078	75.5 (12.3)	13.669	<0.01
MBSR	72.07 ± 7.076	70.0 (11.0)			74.0 ± 6.576	74.0 (8.3)			79.96 ± 9.598	77.8 (9.5)		
WL	72.33 ± 9.382	72.5 (11.3)			71.23 ± 6.709	69.5 (8.8)			71.97 ± 6.840	72.0 (9.0)		
<i>Generalized Anxiety Disorder</i>												
MBAT	7.81 ± 3.789	7.0 (4.5)	0.362	0.697	6.71 ± 4.093	6.9 (6.3)	1.241	0.294	5.44 ± 2.777	6.0 (3.3)	2.672	0.075
MBSR	7.20 ± 3.357	7.0 (4.5)			8.32 ± 3.794	8.3 (5.0)			6.53 ± 3.171	6.0 (3.3)		
WL	7.97 ± 3.899	7.0 (4.3)			7.30 ± 4.095	7.0 (4.5)			7.21 ± 3.022	7.0 (5.0)		

(Continues)

TABLE 3 | (Continued)

Group	Baseline			4 weeks			8 weeks					
	Mean \pm SD	Median (IQR)	F/Z	p	Mean \pm SD	Median (IQR)	F/Z	p	Mean \pm SD	Median (IQR)	F/Z	p
<i>Patient Health Questionnaire</i>												
MBAT	8.90 \pm 4.063	9.0 (5.5)	0.035	0.983	7.23 \pm 3.683	8.0 (5.3)	1.068	0.348	6.87 \pm 3.330	7.04 (6.0)	3.674	<0.05
MBSR	8.73 \pm 4.479	9.0 (6.0)			7.63 \pm 3.819	8.0 (3.5)			6.02 \pm 3.172	6.53 (5.0)		
WL	8.37 \pm 4.560	9.0 (4.8)			8.67 \pm 4.237	9.0 (5.5)			8.63 \pm 4.731	9.5 (7.3)		

Note: Bold data indicates $p < 0.05$.

Abbreviations: MBAT, mindfulness-based art therapy; MBSR, mindfulness-based stress reduction; WL, waitlist controls group.

generalized estimating equations results indicated that both the MBSR and MBAT groups exhibited significant interaction effects (group \times time) at the fourth and eighth weeks (MBSR: $\beta = 11.210$, 95% CI: 4.167, 18.253, $p = 0.002$; $\beta = 24.249$, 95% CI: 15.949, 32.548, $p < 0.001$; MBAT: $\beta = 11.520$, 95% CI: 4.251, 18.789, $p = 0.002$; $\beta = 17.852$, 95% CI: 8.562, 27.142, $p < 0.001$, Table 5).

At baseline, the MBAT, MBSR, and Waitlist control groups showed comparable mindfulness (71.80 \pm 7.194, 75.6 \pm 7.700, 77.62 \pm 9.078, Table 3), with no statistically significant differences ($p = 0.967$, Table 3). At Weeks 4 and 8, the Five Facet Mindfulness Questionnaire scores in the MBSR and MBAT groups were significantly higher than those in the Waitlist control group, while no statistically significant differences were found between the MBSR and MBAT groups. The generalized estimating equations results indicated that the MBSR group exhibited an interaction effect (group \times time) at the eighth week ($\beta = 8.264$, 95% CI: 2.748, 13.780, $p = 0.003$, Table 5), whereas the MBAT group showed interaction effects (group \times time) at both the fourth and eighth weeks ($\beta = 4.900$, 95% CI: 0.788, 9.012, $p = 0.020$; $\beta = 6.185$, 95% CI: 1.597, 10.773, $p = 0.008$, Table 5).

At baseline, the MBAT, MBSR, and Waitlist control groups showed comparable fatigue scale scores (41.60 \pm 11.166, 40.40 \pm 13.930, 40.07 \pm 13.406, Table 3), with no statistically significant differences ($p = 0.890$, Table 3). At Weeks 4 and 8, the fatigue scale scores in the MBSR and MBAT groups were significantly lower than those in the Waitlist control group, while no statistically significant differences were found between the MBSR and MBAT groups ($p = 0.928$, $p = 0.858$, Table 4). The generalized estimating equations results indicated that the MBAT group exhibited interaction effects (group \times time) at both the fourth and eighth weeks ($\beta = -7.897$, 95% CI: -15.687, -0.107, $p = 0.047$; $\beta = -11.582$, 95% CI: -20.615, -2.550, $p = 0.012$, Table 5).

At baseline, the MBAT, MBSR, and Waitlist control groups showed comparable anxiety scale scores (7.81 \pm 3.789, 7.20 \pm 3.357, 7.97 \pm 3.899, Table 3), with no statistically significant differences ($p = 0.697$, Table 3). At Weeks 4 and 8, there were still no statistically significant differences in anxiety scale scores among the MBAT, MBSR, and Waitlist control groups ($p = 0.294$, $p = 0.075$, Table 3). However, the anxiety scale scores in the MBAT and MBSR groups at Week 8 showed a decrease compared to both baseline and the Waitlist control group.

At baseline, the MBAT, MBSR, and Waitlist control groups showed comparable depression scale scores (8.90 \pm 4.063, 8.73 \pm 4.479, 8.37 \pm 4.560, Table 3), with no statistically significant differences ($p = 0.983$, Table 3). At Weeks 4 and 8, the depression scale scores in the MBSR and MBAT groups were significantly lower than those in the Waitlist control group, while no statistically significant differences were found between the MBSR and MBAT groups ($p = 1.000$, $p = 0.908$, Table 4). The generalized estimating equations results indicated that the MBSR group exhibited a significant interaction effect at the eighth week ($\beta = -2.980$, 95% CI: -5.427, -0.533, $p = 0.017$, Table 5).

TABLE 4 | Comparisons between groups.

Outcome by group		4 weeks		8 weeks	
		Difference between groups (95% CI)	<i>p</i>	Difference between groups (95% CI)	<i>p</i>
<i>Perceived Stress Scale</i>					
MBAT	MBSR	2.20 ± 2.196 (−3.06, 7.46)	0.949	3.53 ± 2.286 (−1.94, 9.01)	0.366
MBAT	WL	−2.97 ± 2.249 (−8.35, 2.42)	0.561	−6.11 ± 2.010 (−10.91, −1.31)	< 0.01
MBSR	WL	−5.17 ± 1.932 (−9.79, −0.54)	0.022	−9.65 ± 2.202 (−14.92, −4.37)	< 0.01
<i>Salivary cortisol concentrations</i>					
MBAT	MBSR	−0.48 ± 0.293 (−1.18, 0.22)	0.305	0.00 ± 0.248 (−0.59, 0.59)	1.000
MBAT	WL	−1.61 ± 0.312 (−2.35, −0.86)	< 0.01	−2.08 ± 0.312 (−2.83, −1.33)	< 0.01
MBSR	WL	−1.13 ± 0.326 (−1.91, −0.35)	< 0.01	−2.08 ± 0.277 (−2.74, −1.42)	< 0.01
<i>The root mean square of successive RR interval differences (RMSSD)</i>					
MBAT	MBSR	3.05 ± 3.458 (−5.22, 11.33)	1.000	−3.66 ± 5.480 (−16.77, 9.46)	1.000
MBAT	WL	12.24 ± 3.301 (4.34, 20.15)	< 0.01	18.58 ± 4.635 (7.48, 29.67)	< 0.01
MBSR	WL	9.19 ± 2.403 (3.44, 14.95)	< 0.01	22.23 ± 4.211 (12.15, 32.31)	< 0.01
<i>Five Facet Mindfulness Questionnaire</i>					
MBAT	MBSR	1.60 ± 1.818 (−2.75, 5.95)	1.000	−2.35 ± 2.371 (−8.02, 3.33)	0.968
MBAT	WL	4.37 ± 1.833 (−2.02, 8.76)	0.052	5.65 ± 2.040 (0.77, 10.54)	0.017
MBSR	WL	2.77 ± 1.686 (−1.27, 6.80)	0.303	8.00 ± 2.116 (2.93, 13.06)	< 0.01
<i>Fatigue Severity Scale</i>					
MBAT	MBSR	3.06 ± 3.010 (−4.15, 10.27)	0.928	−2.80 ± 2.627 (−9.09, 3.49)	0.858
MBAT	WL	−6.37 ± 2.936 (−13.40, 0.66)	0.090	−10.05 ± 2.880 (−16.95, −3.16)	< 0.01
MBSR	WL	−9.43 ± 2.881 (−16.32, −2.53)	< 0.01	−7.25 ± 2.718 (−13.75, −0.74)	0.023
<i>Patient Health Questionnaire</i>					
MBAT	MBSR	−0.40 ± 0.952 (−2.68, 1.88)	1.000	0.85 ± 0.826 (−1.13, 2.83)	0.908
MBAT	WL	−1.43 ± 1.008 (−3.85, 0.98)	0.465	−1.76 ± 1.038 (−4.25, 0.72)	0.269
MBSR	WL	−1.03 ± 1.024 (−3.48, 1.42)	0.939	−2.61 ± 1.022 (−5.06, −0.17)	0.032

Note: Bold data indicates $p < 0.05$.

Abbreviations: MBAT, mindfulness-based art therapy; MBSR, mindfulness-based stress reduction; WL, waitlist controls group.

4.3 | Compliance and Satisfaction

During the intervention period, 28, 22 and 30 participants from the MBAT, MBSR, and Waitlist control groups, respectively, completed the final assessment. In the MBAT group, 2 participants dropped out, both due to time conflicts ($n = 2$). In the MBSR group, 8 participants dropped out, with reasons including time conflicts ($n = 2$), lack of interest ($n = 5$), and perceived ineffectiveness ($n = 1$). The 8-week activity participation rate for the MBAT group was 93.3% (28/30, number of participants who completed the study/number of participants enrolled in the study $\times 100\%$), while the MBSR group also had an 8-week activity participation rate of 73.3% (22/30), with a significant difference observed between the two groups ($p < 0.05$). Satisfaction questionnaire results indicated that the average score in the MBAT group was higher than that in the MBSR group (3.267 ± 0.45

VS 2.400 ± 0.52 , $p = 0.010$). Additionally, in terms of weekly homework participation rates, the MBAT group had a homework participation rate of 100% (number of participants who completed at least one homework exercise/total number of participants $\times 100\%$), with 21 participants achieving a homework practice frequency (number of exercises actually completed/number of exercises planned $\times 100\%$) of 80% or higher. In contrast, the MBSR group had a homework participation rate of 86.67%, with 16 participants achieving a homework practice frequency of 80% or higher.

5 | Discussion

This study demonstrates that both MBAT and MBSR effectively reduced stress and fatigue while enhancing mindfulness in

TABLE 5 | Changes in primary and secondary outcomes at 4-week (T2) and 8-week (T3) in control and intervention groups compared to baseline (T1) based on Generalized Estimating Equations models.

Effect	B	95% CI		p	B	95% CI		p	
		Lower limits	Upper limits			Lower limits	Upper limits		
<i>Perceived Stress Scale</i>					<i>Fatigue Severity Scale</i>				
MBAT	-0.236	-4.066	3.594	0.904	MBAT	1.531	-4.608	7.669	0.625
MBSR	0.997	-2.960	4.954	0.621	MBSR	0.333	-6.468	7.135	0.923
T3	0.143	-4.310	4.596	0.950	T3	1.900	-4.977	8.777	0.588
T2	0.664	-3.855	5.183	0.773	T2	2.200	-3.794	8.194	0.472
MBAT*T3	-5.876	-10.782	-0.970	<0.05	MBAT*T3	-11.582	-20.615	-2.550	<0.05
MBAT*T2	-2.731	-7.965	2.503	0.307	MBAT*T2	-7.897	-15.687	-0.107	<0.05
MBSR*T3	-10.643	-16.651	-4.634	<0.01	MBSR*T3	-7.581	-17.442	2.279	0.132
MBSR*T2	-6.164	-10.964	-1.364	<0.05	MBSR*T2	-9.760	-19.576	0.056	0.051
<i>Salivary cortisol concentrations</i>					<i>Five Facet Mindfulness Questionnaire</i>				
MBAT	-0.214	-0.976	0.549	0.583	MBAT	-0.533	-4.693	3.626	0.802
MBSR	-0.276	-0.977	0.424	0.439	MBSR	-0.267	-4.401	3.868	0.899
T3	-2.181	-2.704	-1.659	<0.01	T3	-0.367	2.043	-4.371	0.858
T2	-1.759	-2.185	-1.334	<0.01	T2	-1.100	1.918	-4.859	0.566
MBAT*T3	2.293	1.398	3.189	<0.01	MBAT*T3	6.185	1.597	10.773	<0.01
MBAT*T2	1.821	1.134	2.508	<0.01	MBAT*T2	4.900	0.788	9.012	0.02
MBSR*T3	0.276	-0.456	1.008	0.460	MBSR*T3	8.264	2.748	13.780	<0.01
MBSR*T2	0.756	0.183	1.328	0.01	MBSR*T2	3.033	-1.765	7.832	0.215
<i>The root mean square of successive RR interval differences</i>					<i>Patient Health Questionnaire</i>				
MBAT	0.724	-5.177	6.625	0.810	MBAT	-0.888	-2.099	0.324	0.151
MBSR	-2.018	-8.306	4.270	0.529	MBSR	-1.093	-2.696	0.509	0.181
T3	0.435	-4.866	5.735	0.872	T3	-1.492	-2.582	-0.402	<0.01
T2	-2.379	-7.626	2.867	0.374	T2	-0.822	-1.844	0.200	0.115
MBAT*T3	17.852	8.562	27.142	<0.01	MBAT*T3	-2.296	-5.252	0.660	0.128
MBAT*T2	11.520	4.251	18.789	<0.01	MBAT*T2	-1.967	-4.864	0.931	0.183
MBSR*T3	24.249	15.949	32.548	<0.01	MBSR*T3	-2.980	-5.427	-0.533	<0.05
MBSR*T2	11.210	4.167	18.253	<0.01	MBSR*T2	-1.400	-3.593	0.793	0.211

Note: Bold data indicates $p < 0.05$.

Abbreviations: 95% CI, 95% confidence interval values; MBAT, mindfulness-based art therapy; MBSR, mindfulness-based stress reduction; SD, standard deviation; T1, baseline; T2, mid-intervention stage; T3, immediately after the intervention; WL, waitlist controls group.

oncology nurses compared to waitlist controls. The two interventions showed similar efficacy, but MBAT proved more favorable in implementation, evidenced by higher participation, adherence, and satisfaction.

Both MBAT and MBSR significantly reduced perceived stress (Monti et al. 2012), with no statistically significant differences between them. This comparable efficacy may stem from their shared foundation, as MBAT is derived from the MBSR framework, suggesting overlapping therapeutic mechanisms. Physiological evidence (Beerse, Van Lith, Pickett, and Stanwood 2020; Beerse, Van Lith, and Stanwood 2020) supports these findings: increased RMSSD values indicated enhanced

parasympathetic activity, while decreased cortisol levels reflected attenuated stress responses. Neuroimaging studies further reveal that MBAT modulates key neural circuits involved in stress regulation, including increased activation in the insular cortex, amygdala, hippocampus, and striatum, alongside reduced cingulate cortex activity. These convergent subjective and objective measures underscore the robust stress-reduction capabilities of both interventions.

Both MBAT and MBSR significantly enhanced mindfulness levels as measured by the FFMQ, with no statistically significant differences between interventions. This equivalent efficacy suggests that mindfulness improvement depends

primarily on core principles—present-moment awareness, acceptance, and non-judgmental observation—rather than specific practice modalities (Creswell 2017). The shared group-based format, which fostered self-awareness and self-regulation through structured exercises, likely contributed to these convergent outcomes, indicating that both approaches effectively cultivate fundamental mindfulness skills in nursing professionals.

The results of the fatigue self-assessment scale in this study indicate that both interventions significantly alleviate fatigue levels. However, the patterns of change differed: MBAT was associated with sustained improvements, while MBSR showed a slight rebound during the T2–T3 period. MBAT integrates multisensory experiences involving vision, touch, and kinesthesia, activating the right brain (associated with creativity) and reducing the overactivity of the left brain (associated with logic and analysis) (Demarin et al. 2016). In contrast, MBSR requires sustained focus on breathing or bodily sensations, which may impose an additional burden on nurses already experiencing left-brain overload. The observed data suggest that MBAT may demonstrate more stable effects in alleviating fatigue compared to MBSR (Zhang et al. 2021).

MBAT and MBSR showed equivalent effectiveness in reducing mild anxiety symptoms, potentially due to a floor effect limiting differential detection. Existing evidence suggests both modalities engage distinct mechanisms (e.g., MBAT modulates limbic regions) (Beerse, Van Lith, Pickett, and Stanwood 2020; Beerse, Van Lith, and Stanwood 2020). Our findings indicate both are viable for mild symptoms, but future research should examine efficacy across severity levels to guide personalized treatment.

The study found that the MBAT group demonstrated higher participation rates, greater adherence, and superior satisfaction over the 8-week intervention compared to the MBSR group. Adherence to mindfulness interventions is closely associated with treatment outcomes, as adherence behaviors directly influence individual benefits (Creswell 2017). Previous research has shown that MBAT offers unique advantages over MBSR in integrating artistic elements, enhancing emotional resonance, promoting self-discovery and growth, providing flexibility and personalization, and utilizing non-verbal communication methods (Garland et al. 2007). MBAT distinguishes itself by attracting and sustaining participant engagement through stimulating activities, thereby improving adherence and treatment efficacy (C, 2013). This positions it as an innovative direction for mindfulness-based interventions (Rappaport 2014).

5.1 | Limitations

While this study has limitations including lack of participant blinding, potential instructor bias, and possible intergroup contamination in single-site recruitment, it demonstrates strengths through its randomized controlled design, multimodal assessment combining self-report and physiological measures, high retention rates particularly in the MBAT group, and rigorous fidelity monitoring throughout the intervention period.

5.2 | Linking Evidence to Action

Implement MBAT as an evidence-based alternative to MBSR for oncology nurses, achieving comparable reductions in stress and enhancements in mindfulness.

Prioritize MBAT to significantly improve program adherence and participant satisfaction, addressing key challenges in sustainability of mindfulness interventions.

Adopt MBAT for more stable and consistent fatigue reduction, offering a distinct advantage in managing this prevalent symptom among nurses.

Consider MBAT as a more accessible and engaging entry point into mindfulness practice, particularly for beginners who may find traditional methods challenging.

6 | Conclusion

The MBAT program for oncology nurses demonstrated significant benefits in reducing stress and fatigue and enhancing mindfulness, comparable to MBSR across multiple domains. MBAT showed distinctive advantages in adherence, satisfaction, and more sustained fatigue reduction, positioning it as a valuable alternative—particularly for those drawn to creative, expressive approaches.

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Ethics Statement

All methods were carried out according to the relevant guidelines and principles of the Declaration of Helsinki (DoH-Oct 2008). The required formal approval and permission to perform the study were obtained from the Research Ethics Committee of the Affiliated cancer Hospital of Guangzhou Medical University, China (approval number: GYZL-ZN-2023(032), 13/10/2023). Nurses were informed about the purpose of the study, and they provided signed informed consent. The right to refuse or withdraw from the study at any time was assured. Furthermore, they were informed that their privacy and confidentiality were maintained.

Consent

Informed consent was obtained from all individual participants included in the study. The consent form was provided in the participants' native language (Chinese) and approved by the Ethics Committee. An English-translated version of the consent form is available from the corresponding author upon request and for editorial review.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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