Scientific Research Publishing

Open Journal of Internal Medicine, 2026, 16(2), 182-201
https://www.scirp.org/journal/ojim
ISSN Online: 2162-5980
ISSN Print: 2162-5972

Effect of Music Intervention on Fear of Cancer Recurrence and Quality of Life in Breast Cancer Patients Undergoing Postoperative Adjuvant Therapy: A Randomized Controlled Trial

Lijun Liu[1*], Xinyi Zheng[2], Huaidong Cheng[2#], Mingjun Zhang[1#]

[1]Department of Oncology, The Second Hospital of Anhui Medical University, Hefei, China
[2]Department of Oncology, Shenzhen Hospital of Southern Medical University, Shenzhen, China
Email: 15055388688@163.com, [#]chd1975ay@126.com, [#]13865952007@163.com

How to cite this paper: Liu, L.J., Zheng, X.Y., Cheng, H.D. and Zhang, M.J. (2026) Effect of Music Intervention on Fear of Cancer Recurrence and Quality of Life in Breast Cancer Patients Undergoing Postoperative Adjuvant Therapy: A Randomized Controlled Trial. *Open Journal of Internal Medicine*, **16**, 182-201.
https://doi.org/10.4236/ojim.2026.162018

Received: April 9, 2026
Accepted: May 19, 2026
Published: May 22, 2026

Copyright © 2026 by author(s) and Scientific Research Publishing Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
http://creativecommons.org/licenses/by/4.0/
Open Access

Abstract

Objective: Explore the improvement effects of music therapy on cancer recurrence fear (FCR), negative emotions, and quality of life in patients undergoing adjuvant therapy after breast cancer surgery. **Methods:** This study initially randomized 121 eligible breast cancer patients into the music therapy (MT) group and the care-as-usual (CAU) group. After follow-up, 103 participants completed all assessments and were included in the final analysis. Over a 12-week timeframe, the MT group participated in four sessions of music therapy. The primary outcome was fear of cancer recurrence (FCR), assessed by the Fear of Progression Questionnaire-Short Form (FoP-Q-SF) at the primary endpoint T4 (post-fourth intervention, 12 weeks). Secondary outcomes included quality of life (Functional Assessment of Cancer Therapy-Breast, FACT-B), anxiety/depression (Hospital Anxiety and Depression Scale, HADS), and psychological distress (Distress Thermometer, DT). Assessments were conducted at baseline (T0) and after each intervention (T1 - T4). Generalized estimating equations (GEE) were used to evaluate the intervention effects and their potential mediating effects. **Results:** GEE analysis demonstrated a significant time × group interaction effect for the primary outcome (FCR at T4, Wald χ^2 = 168.527, $p < 0.001$). Significant interaction effects were also found for quality of life (Wald χ^2 = 62.371, $p < 0.001$), anxiety (Wald χ^2 = 410.105, $p < 0.001$), depression (Wald χ^2 = 259.211, $p < 0.001$), and psychological distress (Wald χ^2 = 73.187, $p < 0.001$). From T0 to T4, quality of life improved in the MT group but declined in the CAU group; meanwhile, FCR, anxiety, depression, and psychological distress decreased over time in the MT group but increased

*First author.
[#]Co-corresponding authors.

in the CAU group. The three negative emotions significantly mediated the link between MT and FCR ($p \leq 0.001$), whereas only depression and psychological distress mediated the effect on quality of life ($p < 0.05$). **Conclusions:** Music therapy reduced FCR, improved emotional status, and enhanced quality of life in breast cancer patients receiving postoperative adjuvant therapy. Further analyses revealed that distinct negative emotional symptoms exerted differential mediating effects. Relief of these emotional symptoms serves as a key indirect pathway through which MT improves FCR and quality of life.

Keywords

Music Therapy, Breast Cancer, Fear of Cancer Recurrence, Quality of Life, Anxiety, Depression, Psychological Distress

1. Introduction

Breast cancer is the most commonly diagnosed malignancy among women worldwide and a leading cause of cancer-related death, with a rising incidence and a trend toward younger onset [1]. In recent times, progress in early diagnosis and the creation of combined treatment approaches, such as surgical procedures, chemotherapy, radiation therapy, hormone therapy, and targeted treatments, has greatly enhanced survival rates. As a result, breast cancer has increasingly been regarded as a chronic disease requiring long-term management [2] [3]. Surgery remains a cornerstone of treatment for early-stage breast cancer, achieving local control through removal of the primary tumor [4]. Earlier research has indicated that minimizing the likelihood of local recurrence is strongly linked to enhanced long-term survival rates. Additionally, adjuvant therapies, which encompass radiotherapy and essential systemic treatments, can further lower the risks of both local and distant recurrence, thus leading to a better long-term prognosis [5] [6].

In light of the extended survival rates of breast cancer patients, an increasing number of psychological issues are becoming apparent. According to studies, breast cancer survivors commonly experience anxiety, depression, and fear of recurrence of the disease [7]. The fear of developing cancer again affects the long-term physical and mental health of patients, which is one of the fears that patients have been expressing [8]. The persistent fear and worry of a cancer recurrence (FCR) or disease progression is termed FCR [9]. Elevated levels of FCR may lead to negative emotional responses and physical discomfort. This, in turn, results in impairment in daily functioning and decreased quality of life [10].

Postoperative adjuvant therapy (for example, chemotherapy and radiotherapy) subjects breast cancer patients to multiple physiological and psychological strains, and levels of FCR may further increase [11]. Some side effects of treatment (e.g., alopecia or skin toxicity and fatigue) and alterations in body image (e.g., mastectomy or changes in breast morphology) may add psychological burden to patients' lives. This psychological burden may be a higher risk for younger low-income

people or people with more extensive surgery [12] [13]. Most importantly, FCR increases tend to occur during late cumulative treatment side effects. During this period, the increasing uncertainty about the illness may worsen treatment compliance and follow-up behavior [8].

The psychological state and quality of life of breast cancer patients can be significantly improved through psychosocial interventions [14]. Music therapy (MT) has been widely used as a supportive care for patients with cancer as a non-pharmacological and non-invasive adjuvant therapy [15]. It reduces the body's stress response by modulating autonomic nervous system activity, affecting hypothalamic-pituitary-adrenal (HPA) axis function, and improving one's emotional response [15] [16]. Meta-analysis findings show that MT reduces anxiety and depression in patients with breast carcinoma [17].

While studies have largely examined the potential of MT for alleviating the short-term psychological symptoms of patients with cancer, there is limited information available on its potential for alleviating long-term psychological problems such as FCR in breast cancer patients [18] [19]. Because of the above, the study aims to determine the effect of MT on FCR and the quality of life of breast cancer patients undergoing post-surgical adjuvant therapy. Additionally, the aim is to explore if negative emotions act as a mediator in the intervention's effects, with findings anticipated to strengthen the evidence for clinical applications.

2. Materials and Methods

2.1. Study Design

This study adopted a non-blinded randomized controlled trial design. Eligible patients were recruited from the oncology ward and randomly divided into two groups. The MT group received four music therapy sessions, while the CAU group was given routine standard care. The study defined a single prespecified primary outcome: FCR, assessed at T4 (12 weeks, post-fourth intervention). All other outcome measures were classified as secondary outcomes.

2.2. Participants

In total, 121 breast cancer patients receiving postoperative adjuvant therapy were recruited from the Oncology Department of the Second Affiliated Hospital of Anhui Medical University between February 2024 and March 2025. A random number table was used to generate the random sequence for group allocation. To avoid selection bias, sequentially numbered, opaque, sealed envelopes were prepared. During allocation, research staff not involved in the intervention or outcome assessment opened the envelopes and assigned participants to the respective groups based on the envelope contents. All participants were randomly assigned to either the MT group (n = 58) or the CAU group (n = 63). This trial was not registered in a public clinical trial registry.

Inclusion criteria: 1) Breast cancer patients confirmed by pathological testing, with no prior history of psychological interventions; 2) Patients who have under-

gone surgical treatment; 3) Karnofsky Performance Status (KPS) score ≥ 80; 4) Diagnosed at 18 years of age or older, willing to participate in the study, capable of completing the required surveys independently or with assistance, and able to sign the informed consent form or provide verbal consent; 5) No significant hearing impairment, able to cooperate with the researcher to complete the MT.

Exclusion criteria: 1) Presence of severe heart, lung, or other major organ dysfunction, or in advanced cancer or cachectic states, unable to cooperate with the intervention or complete the assessments; 2) History or current diagnosis of psychiatric or neurological disorders such as schizophrenia, bipolar disorder, or severe cognitive impairment, preventing normal communication; 3) Receipt of professional psychological treatment, mindfulness, cognitive behavioral therapy, or similar psychological interventions within the past three months; 4) Presence of hearing impairment, severe speech or communication disorders, or resistance to MT, making it impossible to cooperate with listening and assessment.

2.3. Sample Size

The sample size for each group was calculated using G*Power 3.1 software, based on data from previous intervention studies [20]. A repeated measures analysis of variance (ANOVA) with interaction effects was chosen as the statistical model. Parameters were set according to standard practices in similar clinical intervention studies, with an effect size (f) of 0.2, an alpha level (α) of 0.05, a power ($1 - \beta$) of 0.8, and a correlation coefficient (Rho) of 0.5. The minimum required sample size was calculated to be 36. A total of 121 participants were recruited, exceeding the calculated minimum sample size.

2.4. Intervention Measures

The MT was conducted by a psychologist, an oncologist, and three graduate students from the Department of Oncology at the Second Affiliated Hospital of Anhui Medical University. All music therapists involved in the study received standardized, professional training and performed the interventions under the full supervision of clinical researchers. They were qualified and capable of providing standardized MT to the patients. The patients and their families were thoroughly informed about the study protocol and the MT intervention process by the researchers. Following the informed consent, the patients' eligibility was assessed, and baseline measurements were recorded. Participants who met the criteria were randomly divided into either the MT or CAU groups. Interventions were delivered every 3 weeks, consisting of 4, 30-minute MT sessions in the MT group in 12 weeks. To assess patients' music preferences, semi-structured interviews were conducted with appropriate informed consent from participants before the formal intervention. Based on these interviews, age-appropriate familiar songs were chosen, and music with sad lyrics or traumatic associations was excluded. The MT sessions were held in private rooms, thus ensuring confidentiality and enabling proper communication between the researchers and subjects. After every session,

useful questionnaire data were collected. The CAU group underwent the same evaluations after standard treatment (with the same assessment timings as the MT group). It was planned to schedule a session within a week in case the participants missed a session for medical or personal reasons.

The specific intervention methods are as follows:

Phase 1: Maintain a quiet environment and assist the patient in finding a comfortable sitting or lying position. Provide a brief guided relaxation instruction: "Next, we will listen to the music you have chosen. Please try to focus your attention on the melody, instruments, or rhythm of the music. If your mind starts to wander, don't worry; just gently bring your attention back to the music."

Phase 2: By taking into account the music preferences and interests collected, select the best personalized music for the patient. The patient may listen independently using headphones. If the patient does not express a specific preference, use slow, comfortable melodies. The music will play for approximately 30 minutes, and investigators will remain present quietly to observe the subject's responses.

Phase 3: After the music ends, allow the patient 1 - 2 minutes of quiet recovery time. Engage in brief, open-ended communication: "How do you feel?" or "Was there any moment during the listening that made you feel more comfortable?" Record the patient's brief feedback, and then guide the patient to independently complete the relevant assessment scales within 5-10 minutes. If the patient has difficulty with writing, the researcher will assist in completing the questionnaire with standardized instructions.

Phase 4: Every night before bedtime, a 10-minute individual soft music intervention was provided to help patients fall asleep. This home listening practice was arranged on a voluntary basis. Once discharged, the researchers conducted regular telephone follow-ups to encourage participants and ensure smooth study completion. During these calls, adherence to home listening was monitored via regular telephone follow-ups and self-reported daily listening logs completed by participants.

2.5. Assessment Tools

FCR: The Fear of Progression Questionnaire-Short Form (FoP-Q-SF) was used to assess patients' FCR. The scale consists of 12 items, covering aspects such as emotional responses, social and family functioning, occupation, loss of autonomy, and coping anxiety. A 5-point Likert scale was used for scoring, ranging from "Never" to "Always," with a total score range of 12 to 60. A higher score indicates a greater level of fear regarding disease progression [21]. The validated Chinese version of the FoP-Q-SF was used in this study, demonstrating good internal consistency in the domestic cancer population (Cronbach's $\alpha = 0.88$) [22].

Quality of Life: The Functional Assessment of Cancer Therapy-Breast (FACT-B) is a quality of life scale specifically designed for breast cancer patients. It includes a general scale and a breast cancer-specific subscale, comprising a total of 37 items. The scale uses a 0 - 4 scoring system, with some items negatively worded,

requiring reverse scoring. A higher score indicates better quality of life [23]. The Simplified Chinese version of the FACT-B demonstrates good reliability and validity, with Cronbach's α coefficients and test-retest reliability coefficients greater than 0.80 in most domains, making it a suitable tool for measuring quality of life in Chinese breast cancer patients [24].

Anxiety and Depression: The Hospital Anxiety and Depression Scale (HADS) is used to assess the emotional state of patients. This self-report scale consists of 14 items, divided into two subscales: anxiety (HADS-A) and depression (HADS-D), with 7 items in each subscale. It uses a 0 - 3 point four-level scoring system. The total score for each subscale ranges from 0 to 21 points. According to clinical grading standards, a score of 0 - 7 indicates no significant symptoms, 8 - 10 indicates mild symptoms, 11 - 14 indicates moderate symptoms, and 15 - 21 indicates severe symptoms. A total subscale score ≥ 11 is the screening threshold for clinically significant anxiety or depression. The internal consistency for the subscales is high, with Cronbach's α ranging from 0.68 to 0.93 for the HADS-A and from 0.67 to 0.90 for the HADS-D, and the test-retest correlations are high ($r > 0.80$) [25].

Psychological Distress: The Distress Thermometer (DT) was used to quickly screen for the level of psychological distress in individuals. This tool employs a 0-10 visual analog scale to assess the level of distress, with patients rating their average psychological distress over the past week. A score of 0 indicates no distress, and a score of 10 indicates extreme distress. Higher DT scores indicate more severe psychological distress. A DT score of ≥4 indicates significant psychological distress, warranting further assessment and intervention. The Chinese version of DT has been shown to be easily understood and accepted by patients and has high retest reliability in cancer patients ($r = 0.800$, $P < 0.01$) [26].

2.6. Statistical Analysis

Statistical evaluations were performed utilizing IBM SPSS Statistics version 27.0. To summarize the baseline demographic traits of the two groups, descriptive statistics including means, standard deviations, and frequency distributions were employed. The preliminary balance between groups was assessed through various methods, such as the independent samples t-test, chi-square test, Mann-Whitney U test, or the Fisher-Freeman-Halton exact test, chosen according to the nature and distribution of the data. The primary analysis adopted a complete-case approach. Only participants who completed all repeated measurements were included, and incomplete data from withdrawn or non-compliant participants were excluded. For repeated measures at multiple time points, Generalized Estimating Equations (GEE) were used, with model selection based on the aim of minimizing the Quasi-likelihood under the Independence model Criterion (QIC). The Bonferroni post hoc approach was utilized for within-group comparisons. Key clinical variables were balanced at baseline, so no additional sensitivity analysis was performed. A two-tailed p-value of below 0.05 was regarded as statistically significant

across all analyses.

3. Results

Figure 1 shows the research flowchart. A total of 121 participants were involved in the study, who were randomly assigned to the MT group (n = 58) and the CAU group (n = 63). After excluding lost follow-up patients, a total of 103 patients were included, with 51 in the music intervention group and 52 in the routine care group.

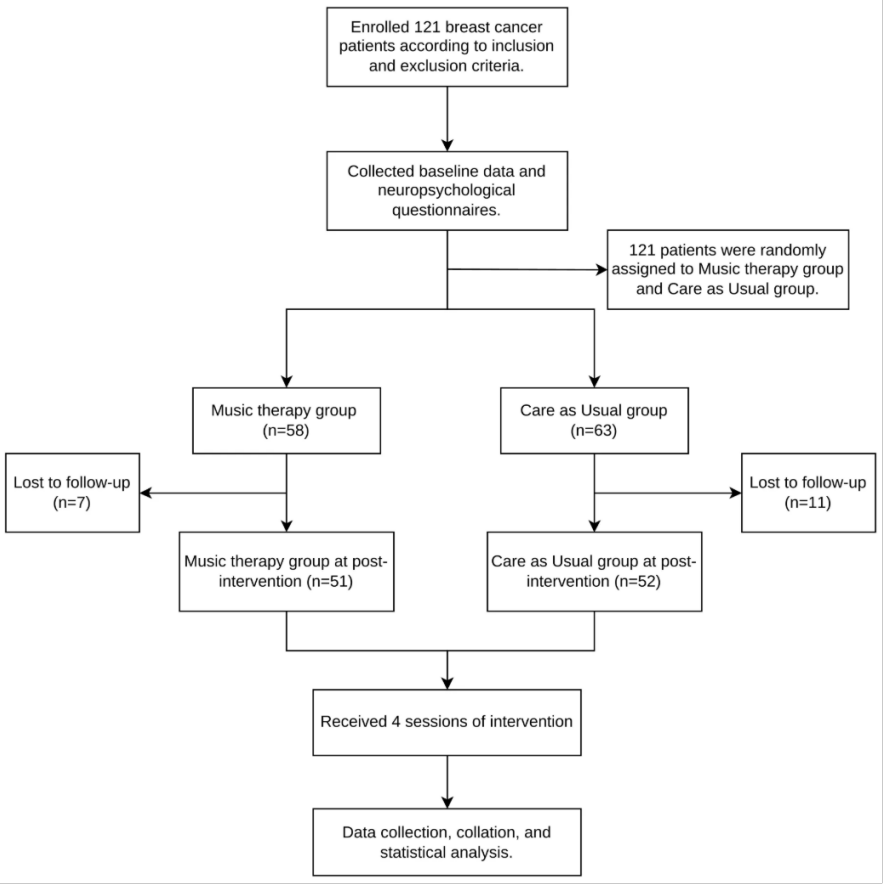

Figure 1. Research flowchart.

Table 1 presents the demographic and clinical characteristics of the patients in the MT group and the CAU group. No significant differences were observed between the two groups in demographic variables such as age, education level, and KPS score ($p > 0.05$). Additionally, there were no statistically significant differences in baseline clinical characteristics, including surgical approach, postoperative duration, cancer staging, and treatment regimens ($p > 0.05$).

3.1. Baseline Data Characteristics

Table 2 shows the baseline scores of various scales for the MT and CAU groups: quality of life ($t = 0.242$, $p = 0.810$), FCR ($t = -0.321$, $p = 0.749$), anxiety ($t = -1.373$,

p = 0.173), depression (t = −0.879, p = 0.382), and psychological distress (Z = −0.532, p = 0.595). No statistical differences were found between the two groups in baseline questionnaire data, indicating a balanced distribution.

Table 1. The clinical characteristics of participants.

Variable	MT Group (n = 51)	CAU Group (n = 52)	$t/Z/\chi^2$	p
Age (y), Mean ± SD	52.39 ± 9.63	52.10 ± 11.42	0.142[a]	0.887
Educational Level, n (%)			5.129[b]	0.163
Illiterate	3 (5.9%)	11 (21.2%)		
Primary School	13 (25.5%)	11 (21.2%)		
Middle School	24 (47.1%)	21 (40.4%)		
College or Above	11 (21.6%)	9 (17.3%)		
Surgical Type, n (%)			3.403[b]	0.182
Breast-Conserving Surgery	10 (19.6%)	5 (9.6%)		
Total Mastectomy	18 (35.3%)	15 (28.8%)		
Modified Radical Mastectomy	23 (45.1%)	32 (61.5%)		
Time after Surgery, n (%)			1.328[d]	0.549
<6 Months	41 (80.4%)	37 (71.2%)		
6 - 12 Months	9 (17.6%)	13 (25.0%)		
>12 Months	1 (2.0%)	2 (3.8%)		
Stage, n (%)			2.946[b]	0.229
I	10 (19.6%)	15 (28.8%)		
II	34 (66.7%)	26 (50.0%)		
III	7 (13.7%)	11 (21.2%)		
ER, n (%)			0.016[b]	0.900
+	32 (62.7%)	32 (61.5%)		
−	19 (37.3%)	20 (38.5%)		
PR, n (%)			0.259[b]	0.611
+	30 (58.8%)	28 (53.8%)		
−	21 (41.2%)	24 (46.2%)		
HER2, n (%)			0.306[b]	0.580
+	35 (68.6%)	33 (63.5%)		
−	16 (31.4%)	19 (36.5%)		
KPS, n (%)			−0.307[c]	0.759
80	2 (3.9%)	6 (11.5%)		
90	39 (76.5%)	34 (65.4%)		
100	10 (19.6%)	12 (23.1%)		
Treatment Method, n (%)			2.726[d]	0.899
Chemotherapy	20 (39.2%)	21 (40.4%)		

Continued

Radiotherapy	3 (5.9%)	1 (1.9%)
Targeted Therapy	9 (17.6%)	11 (21.2%)
TT + CT	8 (15.7%)	5 (9.6%)
TT + RT	1 (2.0%)	1 (1.9%)
TT + ET	9 (17.6%)	11 (21.2%)
Other	1 (2.0%)	2 (3.8%)

[a]Independent samples t-test; [b]Chi-square test; [c]Mann-Whitney U test; [d]Fisher-Freeman-Halton exact test; TT, targeted therapy; CT, chemotherapy; RT, radiotherapy; ET, endocrine therapy.

Table 2. Changes in various variables over time in the MT and CAU groups.

Variable	Time	MT Group (n = 51)	CAU Group (n = 52)	t/Z	p
FACT-B	T0	68.37 ± 7.31	68.71 ± 6.93	0.242[a]	0.810
	T1	69.51 ± 6.14	67.37 ± 5.47	−1.722[b]	0.085
	T2	70.76 ± 5.95	66.67 ± 4.94	−3.422[b]	0.002
	T3	71.63 ± 5.85	66.08 ± 5.50	−4.560[b]	<0.001
	T4	72.69 ± 6.52	65.52 ± 5.65	−5.064[a]	<0.001
FCR	T0	30.08 ± 3.91	29.85 ± 3.41	−0.321[a]	0.749
	T1	29.31 ± 3.30	31.37 ± 3.12	3.243[a]	0.002
	T2	28.12 ± 3.24	32.29 ± 3.27	6.508[a]	<0.001
	T3	27.06 ± 3.47	32.83 ± 3.00	−6.904[b]	<0.001
	T4	26.27 ± 3.29	34.12 ± 3.18	−8.008[b]	<0.001
Anxiety	T0	7.94 ± 2.89	7.17 ± 2.78	−1.373[a]	0.173
	T1	6.67 ± 2.39	8.42 ± 3.01	−2.885[b]	0.004
	T2	5.37 ± 2.40	9.56 ± 3.10	7.658[a]	<0.001
	T3	4.25 ± 2.11	10.44 ± 2.72	−8.223[b]	<0.001
	T4	3.45 ± 1.70	11.04 ± 2.30	−8.711[b]	<0.001
Depression	T0	8.16 ± 3.16	7.63 ± 2.86	−0.879[a]	0.382
	T1	6.67 ± 2.50	8.35 ± 2.51	3.398[a]	<0.001
	T2	5.43 ± 2.20	9.10 ± 2.58	7.740[a]	<0.001
	T3	4.27 ± 2.28	9.73 ± 2.92	−7.357[b]	<0.001
	T4	3.35 ± 1.68	10.35 ± 2.88	−8.278[b]	<0.001
DT	T0	4.16 ± 1.36	4.29 ± 1.26	−0.532[b]	0.595
	T1	4.04 ± 0.89	4.62 ± 1.11	−2.767[b]	0.006
	T2	3.75 ± 1.00	4.90 ± 1.05	−4.997[b]	<0.001
	T3	3.57 ± 0.98	5.15 ± 1.32	−5.788[b]	<0.001
	T4	3.04 ± 0.92	5.54 ± 1.34	−7.453[b]	<0.001

Data are expressed as mean (SD); [a]Independent samples t-test; [b]Mann-Whitney U test; T0 = baseline; T1 = post-first intervention; T2 = post-second intervention; T3 = post-third intervention; T4 = post-fourth intervention.

3.2. Intervention Outcomes

Table 2 summarizes the results for each indicator. Over time, the control group exhibited a gradual deterioration in all indicators, while the experimental group showed consistent improvement, as illustrated in Figure 2. These findings suggest that MT effectively alleviates patients' FCR, anxiety, depression, and psychological distress, while significantly improving their quality of life.

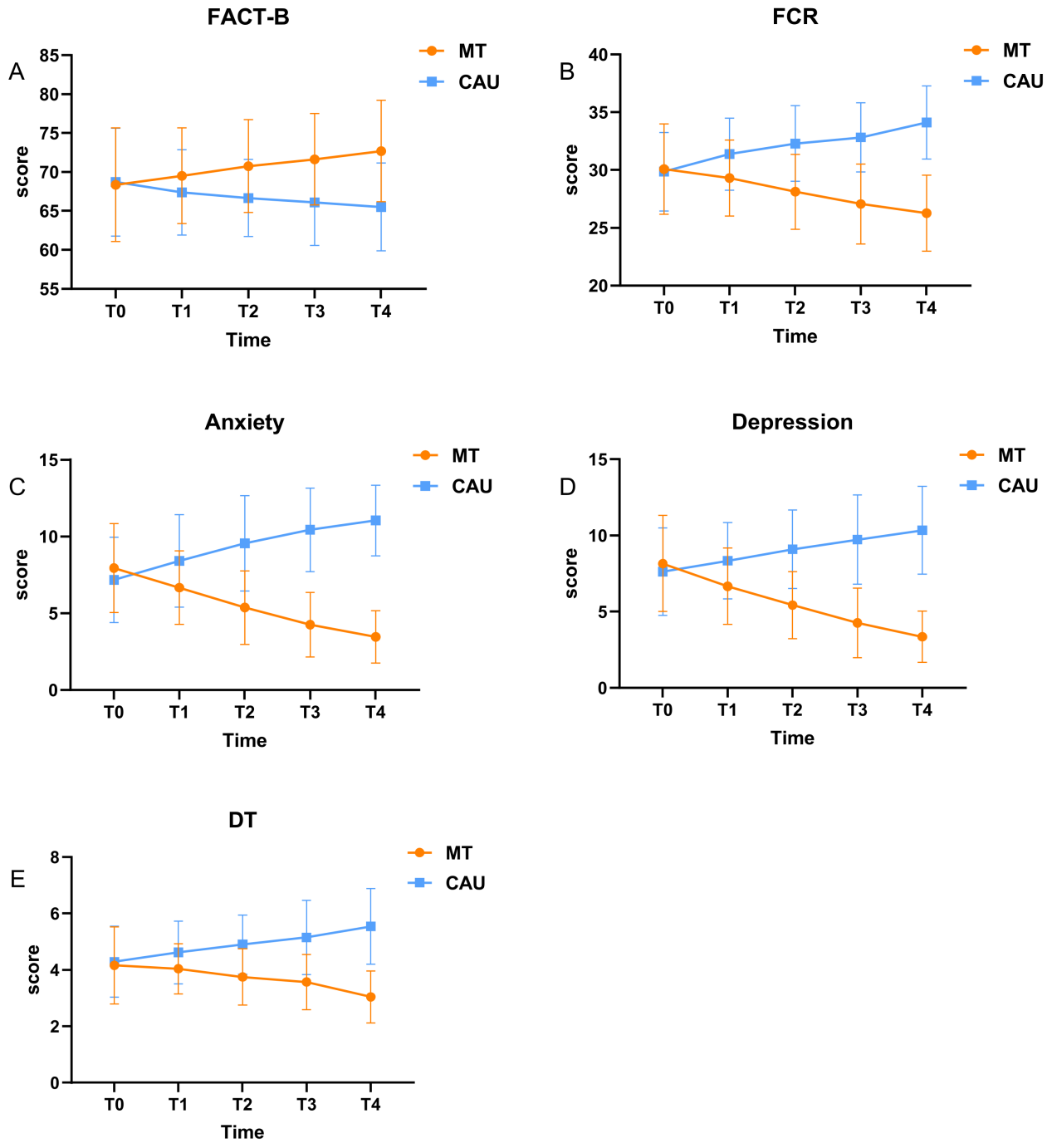

Figure 2. Changes in the mean values of patients' FCR, quality of life, depression, anxiety, and psychological distress levels.

As shown in Figure 3, prior to the intervention, FCR was negatively correlated with quality of life ($r = -0.7103$, $p < 0.0001$), and positively correlated with anxiety ($r = 0.6810$, $p < 0.0001$), depression ($r = 0.6472$, $p < 0.0001$), and psychological distress ($r = 0.6991$, $p < 0.0001$), further supporting the rationale for the intervention in this study.

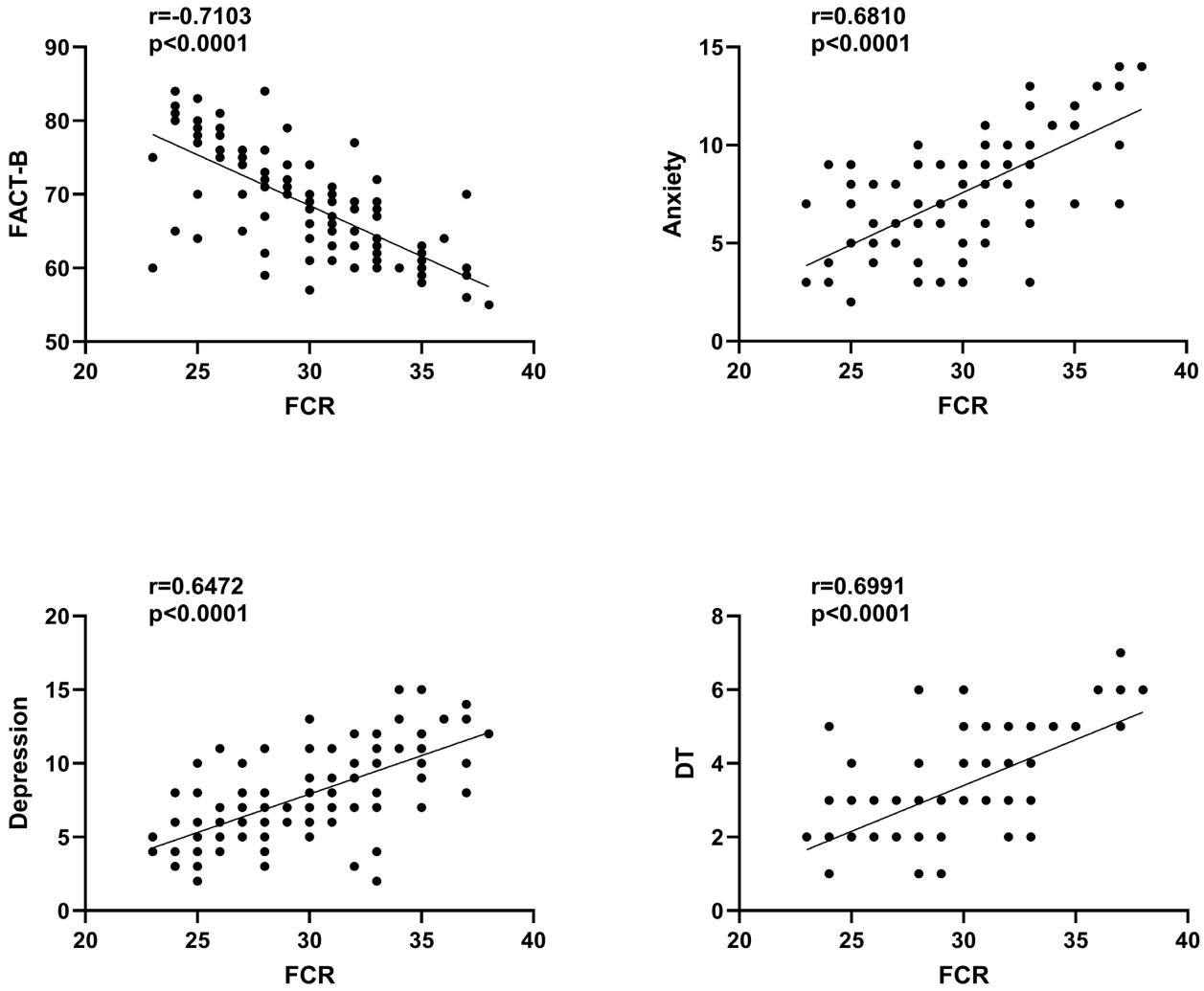

Figure 3. The correlation between FCR and the other scales.

GEE analysis was conducted to examine the effects of music intervention on various outcome measures in breast cancer patients, with intervention time (T0 - T4), group (MT group vs. CAU group), and their interaction as independent variables. The results in (Table 3) show significant time × group interaction effects for quality of life (Wald $\chi^2 = 62.371$, $p < 0.001$), FCR (Wald $\chi^2 = 168.527$, $p < 0.001$), anxiety (Wald $\chi^2 = 410.105$, $p < 0.001$), depression (Wald $\chi^2 = 259.211$, $p < 0.001$), and psychological distress (Wald $\chi^2 = 73.187$, $p < 0.001$), indicating that the improvement in these measures due to music intervention is a result of the synergistic effect with intervention time. The main group effects for all indicators

($p < 0.001$) were significant, confirming that music intervention has an independent positive effect, which is further validated in Table 4.

Table 3. GEE analysis results for the time effect, group differences, and interaction effects of scale scores.

Variables	Time		Group		Time*Group	
	Wald χ^2	p	Wald χ^2	p	Wald χ^2	p
FACT-B	4.440	0.350	15.429	<0.001	62.371	<0.001
FCR	6.066	0.194	55.598	<0.001	168.527	<0.001
Anxiety	2.737	0.603	70.474	<0.001	410.105	<0.001
Depression	18.588	<0.001	59.766	<0.001	259.211	<0.001
DT	0.882	0.927	74.137	<0.001	73.187	<0.001

Table 4 shows that, in the MT group, FCR (Wald $\chi^2 = 8.946$, $p = 0.003$), anxiety (Wald $\chi^2 = 60.728$, $p < 0.001$), and depression (Wald $\chi^2 = 44.555$, $p < 0.001$) scores began to decrease from T1 onwards. Psychological distress (Wald $\chi^2 = 10.601$, $p = 0.001$) presented a significant downward trend starting at T2, while quality of life (Wald $\chi^2 = 7.864$, $p = 0.005$) scores began to significantly increase at T2. In the CAU group, FCR (Wald $\chi^2 = 43.649$, $p < 0.001$), anxiety (Wald $\chi^2 = 32.563$, $p < 0.001$), and depression (Wald $\chi^2 = 8.116$, $p = 0.004$) scores increased gradually from T1. By contrast, quality of life (Wald $\chi^2 = 3.856$, $p = 0.050$) decreased from T2, and psychological distress (Wald $\chi^2 = 6.723$, $p = 0.010$) showed a continuous upward trend after T2. As the number of interventions increased, the trend of changes in all indicators for both groups became more pronounced, with all effects reaching a highly significant level at T4 (all $p < 0.001$).

Figure 4 shows the within-group scores at baseline (T0) and post-intervention (T4), indicating that all measures improved in the MT group, whereas the CAU group showed the opposite trend.

Table 4. GEE model parameter estimates for the effect of music intervention on outcome measures.

Variables	B	SE	[95% Cl]	Wald χ^2	p
FACT-B					
Intercept	68.71	0.95	66.846, 70.577	5213.570	<0.001
Group	−0.34	1.39	−3.064, 2.386	0.059	0.807
T1	−1.35	0.99	−3.279, 0.587	1.863	0.172
T2	−2.04	1.04	−4.073, −0.004	3.856	0.050
T3	−2.64	1.01	−4.623, −0.647	6.746	0.009
T4	−3.19	1.12	−5.382, −1.003	8.167	0.004
Group*T1	2.48	1.54	−0.542, 5.509	2.588	0.108
Group*T2	4.43	1.58	1.334, 7.527	7.864	0.005

Continued

Group*T3	5.89	1.59	2.778, 9.001	13.766	<0.001
Group*T4	7.51	1.70	4.184, 10.828	19.611	<0.001
FCR					
Intercept	29.85	0.47	28.928, 30.764	4063.477	<0.001
Group	0.23	0.72	−1.172, 1.637	0.105	0.746
T1	1.52	0.23	1.069, 1.970	43.649	<0.001
T2	2.44	0.35	1.757, 3.128	48.754	<0.001
T3	2.98	0.42	2.161, 3.800	50.795	<0.001
T4	4.27	0.42	3.443, 5.095	102.626	<0.001
Group*T1	−2.28	0.76	−3.781, −0.787	8.946	0.003
Group*T2	−4.40	0.79	−5.959, −2.848	30.782	<0.001
Group*T3	−6.00	0.84	−7.646, −4.355	51.064	<0.001
Group*T4	−8.07	0.82	−9.686, −6.460	96.211	<0.001
Anxiety					
Intercept	7.17	0.38	6.424, 7.923	351.831	<0.001
Group	0.77	0.55	−0.318, 1.855	1.920	0.166
T1	1.25	0.22	0.821, 1.679	32.563	<0.001
T2	2.39	0.24	1.916, 2.853	99.645	<0.001
T3	3.27	0.26	2.766, 3.772	162.149	<0.001
T4	3.87	0.29	3.294, 4.437	175.612	<0.001
Group*T1	−2.53	0.32	−3.159, −1.890	60.728	<0.001
Group*T2	−4.95	0.36	−5.652, −4.254	192.828	<0.001
Group*T3	−6.96	0.41	−7.755, −6.156	290.998	<0.001
Group*T4	−8.36	0.43	−9.203, −7.508	373.613	<0.001
Depression					
Intercept	7.64	0.39	6.864, 8.405	377.003	<0.001
Group	0.52	0.59	−0.633, 1.677	0.786	0.375
T1	0.71	0.25	0.222, 1.201	8.116	0.004
T2	1.46	0.27	0.938, 1.985	29.939	<0.001
T3	2.10	0.33	1.454, 2.739	40.896	<0.001
T4	2.71	0.35	2.016, 3.407	58.358	<0.001
Group*T1	−2.20	0.33	−2.848, −1.555	44.555	<0.001
Group*T2	−4.19	0.41	−4.984, −3.390	106.110	<0.001
Group*T3	−5.98	0.51	−6.969, −4.988	139.852	<0.001
Group*T4	−7.52	0.49	−8.477, −6.554	234.780	<0.001
DT					
Intercept	4.29	0.17	3.950, 4.627	616.426	<0.001
Group	−0.13	0.26	−0.633, 0.370	0.264	0.607

Continued

T1	0.33	0.23	−0.131, 0.785	1.960	0.162
T2	0.62	0.24	0.150, 1.081	6.723	0.010
T3	0.87	0.28	0.322, 1.409	9.733	0.002
T4	1.25	0.26	0.745, 1.755	23.505	<0.001
Group*T1	−0.45	0.30	−1.036, 0.147	2.168	0.141
Group*T2	−1.03	0.32	−1.645, −0.409	10.601	0.001
Group*T3	−1.45	0.37	−2.179, −0.728	15.417	<0.001
Group*T4	−2.37	0.35	−3.049, −1.686	46.406	<0.001

B = Regression coefficient; SE = Standard error; 95% CI = 95% Confidence interval. The model uses the control group and baseline (T0) as the reference. Group*Time represents the interaction term between group and time.

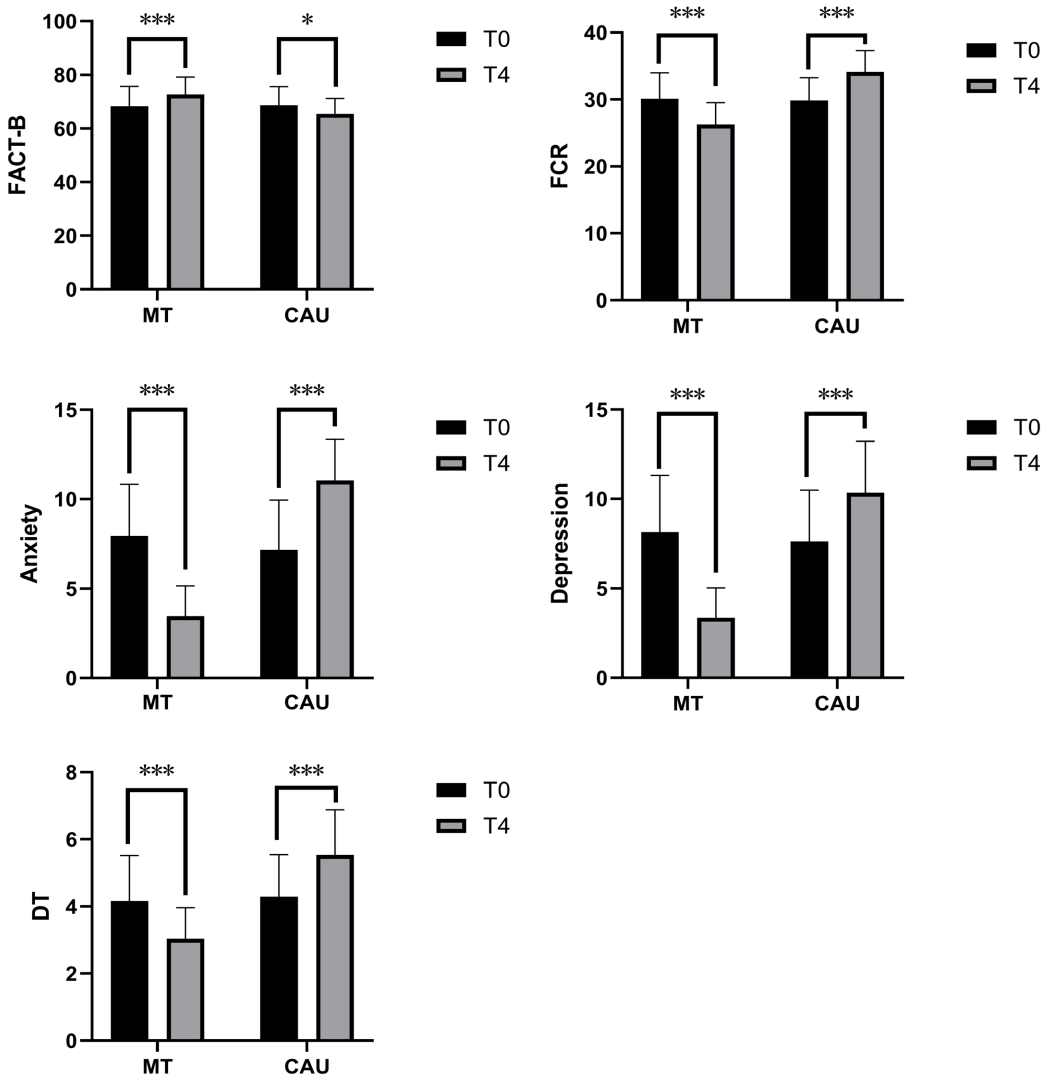

Figure 4. Comparison of scale scores between the MT and CAU groups at baseline (T0) and at the end of the intervention (T4), with * indicating $p < 0.05$ and *** indicating $p < 0.001$.

3.3. Mediation Analysis

Baron and Kenny's classic stepwise regression method was used to test the mediation effect [27]. After controlling for anxiety, depression, and psychological distress, the impact of MT on patients' FCR and quality of life was examined. The differences in the effect pathways are indicated in Table 5. When FCR was the dependent variable, the interaction effect of group and time was significant (Wald $\chi^2 = 16.466$, $p = 0.002$), suggesting a significant difference in the trend of FCR over time between the two groups. Anxiety (Wald $\chi^2 = 22.803$, $p < 0.001$), depression (Wald $\chi^2 = 10.394$, $p = 0.001$), and psychological distress (Wald $\chi^2 = 10.335$, $p = 0.001$) all had significant effects on FCR. These results suggest that MT improves FCR through two pathways: one by alleviating anxiety, depression, and psychological distress, and the other through a direct intervention effect independent of psychological factors.

In the mediation model with quality of life as the outcome variable, the interaction effect of group and time was not statistically significant (Wald $\chi^2 = 0.583$, $p = 0.965$). Depression (Wald $\chi^2 = 10.346$, $p = 0.001$) and psychological distress (Wald $\chi^2 = 23.000$, $p < 0.001$) had significant effects on quality of life, while anxiety did not reach statistical significance (Wald $\chi^2 = 2.012$, $p = 0.156$). These results suggest that depression and psychological distress play a more critical mediating role in the pathway through which MT affects quality of life.

Table 5. Results of the mediation analysis conducted using the GEE method.

Outcome	Wald χ^2	Degree of Freedom	*p*
FCR			
Time	6.639	4	0.156
Group	8.163	1	0.004
Time*Group	16.466	4	0.002
Anxiety	22.803	1	<0.001
Depression	10.394	1	0.001
DT	10.335	1	0.001
FACT-B			
Time	1.039	4	0.904
Group	0.421	1	0.516
Time*Group	0.583	4	0.965
Anxiety	2.012	1	0.156
Depression	10.346	1	0.001
DT	23.000	1	<0.001

4. Discussion

The results of this study confirm that MT significantly reduces FCR, anxiety, depression, and psychological distress levels in breast cancer patients undergoing

postoperative adjuvant therapy, while effectively improving their quality of life. This conclusion is consistent with the findings of Köhler *et al.* [28]. Further supporting the stable and reliable clinical value of MT in improving negative emotions and enhancing the quality of life in cancer patients.

Recent studies have found that the incidence of FCR in breast cancer survivors ranges from 45% to 79%, and is significantly associated with tumor molecular subtypes, treatment stages, and psychosocial factors [29]. High levels of FCR not only lead to significant anxiety and depression but can also place patients in a state of hypervigilance, where even mild physical discomfort triggers catastrophic thinking [30] [31]. Persistent anxiety, depression, and other negative emotions not only exacerbate psychological distress and reduce treatment adherence but also delay physical recovery, affecting long-term prognosis and quality of life [32]. Therefore, safe, effective, and well-tolerated non-pharmacological interventions are increasingly important.

Music therapy, as a non-invasive and easily implemented psychological intervention, has demonstrated unique advantages in improving the psychological well-being of cancer patients. The potential mechanisms include: 1) improving neuroplasticity, regulating neurotransmitters such as dopamine, serotonin, and endorphins, and integrating emotion-cognition-related brain networks; 2) balancing the autonomic nervous system and HPA axis function, reducing stress hormone levels, and regulating immune and sleep rhythms; 3) alleviating negative emotions and enhancing attention, executive function, and motor coordination; 4) strengthening social connection and sense of belonging, providing non-verbal emotional expression channels, and improving psychological coping levels [33]-[36]. These multi-pathway mechanisms collectively underpin the therapeutic effects of MT.

This study indicates that negative emotions play a significant mediating role in the impact of MT on FCR and quality of life in breast cancer patients. Previous clinical studies have shown that FCR in breast cancer patients is significantly associated with symptoms of anxiety and depression, and FCR levels can predict the severity of depression, negatively affecting emotional functioning. Furthermore, FCR is negatively correlated with overall quality of life, particularly in emotional and social functioning [37]. Anxiety involves excessive worrying about the advancement and recurrence of the disease, while psychological distress reflects the burden on the patients, which is associated with subjective suffering when confronted with a threat of the disease. Feelings of helplessness and avoidance behavior may occur from depression. The interplay of these factors can exacerbate patients' fear of recurrence and thus contribute to the persistence of FCR [8] [38] [39]. In this context, MT plays an effective role in alleviating these emotional states, such as fear of recurrence, enhancing behavioral engagement, ameliorating functional status, and improving quality of life.

In conclusion, this study's findings show that having music therapy can significantly enhance the psychological condition and rehabilitation experience faced by breast cancer patients who are undergoing postoperative adjuvant therapy.

Negative emotions serve as a crucial mediating variable, uncovering a key pathway through which music intervention exerts its effects while providing empirical evidence for understanding the mechanisms of non-drug interventions in cancer rehabilitation. Clinical practice may employ standardized music interventions in rehabilitation management in future clinical settings that may enhance emotional support and psychological counselling, thus improving patients' mental health and quality of life in a comprehensive manner and more systemically and individualized promotion of cancer psychological rehabilitation development.

5. Limitations

Firstly, the study is limited by a relatively small sample size, highlighting the need for larger, multi-center, randomized controlled trials to confirm the findings. Secondly, the intervention protocol was not sufficiently detailed. Key factors of the music therapy, including music type, frequency of sessions, and session duration, were not adjusted in a structured manner, which complicates the understanding of how these variables affect the results. Additionally, the follow-up period was short, limiting the capacity to evaluate the long-term effectiveness and persistence of the music therapy. Lastly, the outcome assessment was not exhaustive. The study primarily focused on the psychological status of patients, while objective physiological markers (e.g., cortisol levels, heart rate variability) were not included, which could have provided further validation. In this study, mediators and outcome variables were assessed at the same time point, which may limit the inference of causal temporal relationships. Further lagged longitudinal designs are needed to confirm the mediating effect in the future.

6. Conclusion

The study confirmed that MT has a significant impact on cancer-related FCR and quality of life in breast cancer patients undergoing postoperative adjuvant therapy. MT not only indirectly improves FCR and quality of life by alleviating negative emotions but also provides a direct intervention effect on FCR. As a safe, feasible, and non-pharmacological psychological rehabilitation approach, MT can be incorporated into routine postoperative rehabilitation programs for breast cancer patients, offering important clinical value in improving patients' psychological well-being and enhancing long-term quality of survival.

Acknowledgements

We would like to express our gratitude to all the patients who participated in this study for their active cooperation.

Ethical Declaration

The study has been approved by the Ethics Committee of Anhui Medical University (Ethics Approval No: 20180033).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Giaquinto, A.N., Sung, H., Newman, L.A., Freedman, R.A., Smith, R.A., Star, J., *et al.* (2024) Breast Cancer Statistics 2024. *CA*: *A Cancer Journal for Clinicians*, **74**, 477-495. https://doi.org/10.3322/caac.21863

[2] Pimentel-Parra, G.A., García-Vivar, C., Escalada-Hernández, P., San Martín-Rodríguez, L. and Soto-Ruiz, N. (2025) Systematic Review of Clinical Practice Guidelines for Long-Term Breast Cancer Survivorship: Assessment of Quality and Evidence-Based Recommendations. *British Journal of Cancer*, **133**, 178-193. https://doi.org/10.1038/s41416-025-03059-5

[3] Kim, R. and Kin, T. (2021) Clinical Perspectives in Addressing Unsolved Issues in (Neo)Adjuvant Therapy for Primary Breast Cancer. *Cancers*, **13**, Article 926. https://doi.org/10.3390/cancers13040926

[4] Wu, Y., Yao, Y., Zhang, J., Gui, H., Liu, J. and Liu, J. (2022) Tumor-Targeted Injectable Double-Network Hydrogel for Prevention of Breast Cancer Recurrence and Wound Infection via Synergistic Photothermal and Brachytherapy. *Advanced Science*, **9**, e2200681. https://doi.org/10.1002/advs.202200681

[5] Rajan, K.K., Fairhurst, K., Birkbeck, B., Novintan, S., Wilson, R., Savović, J., *et al.* (2024) Overall Survival after Mastectomy *versus* Breast-Conserving Surgery with Adjuvant Radiotherapy for Early-Stage Breast Cancer: Meta-Analysis. *BJS Open*, **8**, zrae040. https://doi.org/10.1093/bjsopen/zrae040

[6] Lavasani, S., Healy, E. and Kansal, K. (2023) Locoregional Treatment for Early-Stage Breast Cancer: Current Status and Future Perspectives. *Current Oncology*, **30**, 7520-7531. https://doi.org/10.3390/curroncol30080545

[7] Carreira, H., Williams, R., Funston, G., Stanway, S. and Bhaskaran, K. (2021) Associations between Breast Cancer Survivorship and Adverse Mental Health Outcomes: A Matched Population-Based Cohort Study in the United Kingdom. *PLOS Medicine*, **18**, e1003504. https://doi.org/10.1371/journal.pmed.1003504

[8] Simard, S., Thewes, B., Humphris, G., Dixon, M., Hayden, C., Mireskandari, S., *et al.* (2013) Fear of Cancer Recurrence in Adult Cancer Survivors: A Systematic Review of Quantitative Studies. *Journal of Cancer Survivorship*, **7**, 300-322. https://doi.org/10.1007/s11764-013-0272-z

[9] Lebel, S., Ozakinci, G., Humphris, G., Mutsaers, B., Thewes, B., Prins, J., *et al.* (2016) From Normal Response to Clinical Problem: Definition and Clinical Features of Fear of Cancer Recurrence. *Supportive Care in Cancer*, **24**, 3265-3268. https://doi.org/10.1007/s00520-016-3272-5

[10] Luigjes-Huizer, Y.L., Tauber, N.M., Humphris, G., Kasparian, N.A., Lam, W.W.T., Lebel, S., *et al.* (2022) What Is the Prevalence of Fear of Cancer Recurrence in Cancer Survivors and Patients? A Systematic Review and Individual Participant Data Meta-Analysis. *Psycho-Oncology*, **31**, 879-892. https://doi.org/10.1002/pon.5921

[11] Yang, Y., Cameron, J., Bedi, C. and Humphris, G. (2018) Fear of Cancer Recurrence Trajectory during Radiation Treatment and Follow-Up into Survivorship of Patients with Breast Cancer. *BMC Cancer*, **18**, Article No. 1002. https://doi.org/10.1186/s12885-018-4908-2

[12] Arıkan, F., Kartöz, F., Karakuş, Z., Altınışık, M., Özer, Z. and Korcum Şahin, A.F. (2024) Body Image and Social Appearance Anxiety in Patients with Cancer Under-

going Radiotherapy: A Cross-Sectional Study. *BMC Psychology*, **12**, Article No. 363. https://doi.org/10.1186/s40359-024-01856-w

[13] Wang, S., Hua, Y., Zhang, Y., Guo, D. and Tian, L. (2024) Trajectories and Influencing Factors of Social Anxiety in Postoperative Breast Cancer Patients. *BMC Psychiatry*, **24**, Article No. 357. https://doi.org/10.1186/s12888-024-05770-8

[14] Hwang, K., Lee, K., Yang, C., Lee, H. and Lee, S. (2023) Effects of Psychosocial Interventions for Patients with Breast Cancer: A Meta-Analysis. *Clinical Psychopharmacology and Neuroscience*, **21**, 118-125. https://doi.org/10.9758/cpn.2023.21.1.118

[15] Bradt, J., Dileo, C., Myers-Coffman, K. and Biondo, J. (2021) Music Interventions for Improving Psychological and Physical Outcomes in People with Cancer. *Cochrane Database of Systematic Reviews*, No. 10, CD006911. https://doi.org/10.1002/14651858.cd006911.pub4

[16] Sittler, M.C., Worschech, F., Wilz, G., Fellgiebel, A. and Wuttke-Linnemann, A. (2021) Psychobiological Mechanisms Underlying the Health-Beneficial Effects of Music in People Living with Dementia: A Systematic Review of the Literature. *Physiology & Behavior*, **233**, Article 113338. https://doi.org/10.1016/j.physbeh.2021.113338

[17] Xu, Z., Liu, C., Fan, W., Li, S. and Li, Y. (2024) Effect of Music Therapy on Anxiety and Depression in Breast Cancer Patients: Systematic Review and Meta-Analysis. *Scientific Reports*, **14**, Article 16532. https://doi.org/10.1038/s41598-024-66836-x

[18] Li, Y., Xing, X., Shi, X., Yan, P., Chen, Y., Li, M., *et al.* (2020) The Effectiveness of Music Therapy for Patients with Cancer: A Systematic Review and Meta-Analysis. *Journal of Advanced Nursing*, **76**, 1111-1123. https://doi.org/10.1111/jan.14313

[19] Zhang, J., Wang, P., Yao, J., Zhao, L., Davis, M.P., Walsh, D., *et al.* (2012) Music Interventions for Psychological and Physical Outcomes in Cancer: A Systematic Review and Meta-Analysis. *Supportive Care in Cancer*, **20**, 3043-3053. https://doi.org/10.1007/s00520-012-1606-5

[20] Lima, T.U., Moura, E.C.R., Oliveira, C.M.B.d., Leal, R.J.D.C., Nogueira Neto, J., Pereira, E.C., *et al.* (2020) Impact of a Music Intervention on Quality of Life in Breast Cancer Patients Undergoing Chemotherapy: A Randomized Clinical Trial. *Integrative Cancer Therapies*, **19**.

[21] Mehnert, A., Herschbach, P., Berg, P., Henrich, G. and Koch, U. (2006) Fear of Progression in Breast Cancer Patients—Validation of the Short Form of the Fear of Progression Questionnaire (Fop-Q-Sf). *Zeitschrift für Psychosomatische Medizin und Psychotherapie*, **52**, 274-288. https://doi.org/10.13109/zptm.2006.52.3.274

[22] Mahendran, R., Liu, J., Kuparasundram, S. and Griva, K. (2020) Validation of the English and Simplified Mandarin Versions of the Fear of Progression Questionnaire—Short Form in Chinese Cancer Survivors. *BMC Psychology*, **8**, Article No. 10. https://doi.org/10.1186/s40359-020-0374-0

[23] Brady, M.J., Cella, D.F., Mo, F., Bonomi, A.E., Tulsky, D.S., Lloyd, S.R., *et al.* (1997) Reliability and Validity of the Functional Assessment of Cancer Therapy-Breast Quality-of-Life Instrument. *Journal of Clinical Oncology*, **15**, 974-986. https://doi.org/10.1200/jco.1997.15.3.974

[24] Wan, C., Zhang, D., Yang, Z., Tu, X., Tang, W., Feng, C., *et al.* (2007) Validation of the Simplified Chinese Version of the FACT-B for Measuring Quality of Life for Patients with Breast Cancer. *Breast Cancer Research and Treatment*, **106**, 413-418. https://doi.org/10.1007/s10549-007-9511-1

[25] Beekman, E. and Verhagen, A. (2018) Clinimetrics: Hospital Anxiety and Depression Scale. *Journal of Physiotherapy*, **64**, Article 198.

https://doi.org/10.1016/j.jphys.2018.04.003

[26] Tang, L., Zhang, Y., Pang, Y., Zhang, H. and Song, L. (2011) Validation and Reliability of Distress Thermometer in Chinese Cancer Patients. *Chinese Journal of Cancer Research*, **23**, 54-58. https://doi.org/10.1007/s11670-011-0054-y

[27] Baron, R.M. and Kenny, D.A. (1986) The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, **51**, 1173-1182. https://doi.org/10.1037/0022-3514.51.6.1173

[28] Köhler, F., Martin, Z., Hertrampf, R., Gäbel, C., Kessler, J., Ditzen, B., *et al.* (2020) Music Therapy in the Psychosocial Treatment of Adult Cancer Patients: A Systematic Review and Meta-Analysis. *Frontiers in Psychology*, **11**, Article ID: 651. https://doi.org/10.3389/fpsyg.2020.00651

[29] Lambertini, M., Jackisch, C., Trédan, O., Vidal, M., Fontes-Sousa, M., Valachis, A., *et al.* (2025) Patient Perception on Risk of Recurrence and Decision-Making in the Management of HER2-Positive Early Breast Cancer: Insights from the ASKHER2 European Survey. *The Breast*, **81**, Article 104456. https://doi.org/10.1016/j.breast.2025.104456

[30] Fardell, J.E., Thewes, B., Turner, J., Gilchrist, J., Sharpe, L., Smith, A., *et al.* (2016) Fear of Cancer Recurrence: A Theoretical Review and Novel Cognitive Processing Formulation. *Journal of Cancer Survivorship*, **10**, 663-673. https://doi.org/10.1007/s11764-015-0512-5

[31] Lee-Jones, C., Humphris, G., Dixon, R. and Bebbington Hatcher, M. (1997) Fear of Cancer Recurrence—A Literature Review and Proposed Cognitive Formulation to Explain Exacerbation of Recurrence Fears. *Psycho-Oncology*, **6**, 95-105. https://doi.org/10.1002/(sici)1099-1611(199706)6:2<95::aid-pon250>3.0.co;2-b

[32] Pitman, A., Suleman, S., Hyde, N. and Hodgkiss, A. (2018) Depression and Anxiety in Patients with Cancer. *BMJ*, **361**, k1415. https://doi.org/10.1136/bmj.k1415

[33] Koelsch, S. (2014) Brain Correlates of Music-Evoked Emotions. *Nature Reviews Neuroscience*, **15**, 170-180. https://doi.org/10.1038/nrn3666

[34] Thoma, M.V., La Marca, R., Brönnimann, R., Finkel, L., Ehlert, U. and Nater, U.M. (2013) The Effect of Music on the Human Stress Response. *PLOS ONE*, **8**, e70156. https://doi.org/10.1371/journal.pone.0070156

[35] Aalbers, S., Fusar-Poli, L., Freeman, R.E., Spreen, M., Ket, J.C., Vink, A.C., *et al.* (2017) Music Therapy for Depression. *Cochrane Database of Systematic Reviews*, No. 11, CD004517. https://doi.org/10.1002/14651858.cd004517.pub3

[36] Chu, T. and Tsai, C. (2026) Music's Context-Dependent Influence on Oxytocin, Social Bonding, and Emotion Regulation: A Systematic Review. *Frontiers in Cognition*, **4**, Article ID: 1678665. https://doi.org/10.3389/fcogn.2025.1678665

[37] Tran, T.X.M., Jung, S., Lee, E., Cho, H., Kim, N.Y., Shim, S., *et al.* (2022) Fear of Cancer Recurrence and Its Negative Impact on Health-Related Quality of Life in Long-Term Breast Cancer Survivors. *Cancer Research and Treatment*, **54**, 1065-1073. https://doi.org/10.4143/crt.2021.835

[38] Almeida, S.N., Elliott, R., Silva, E.R. and Sales, C.M.D. (2019) Fear of Cancer Recurrence: A Qualitative Systematic Review and Meta-Synthesis of Patients' Experiences. *Clinical Psychology Review*, **68**, 13-24. https://doi.org/10.1016/j.cpr.2018.12.001

[39] Liu, J., Peh, C., Simard, S., Griva, K. and Mahendran, R. (2018) Beyond the Fear that Lingers: The Interaction between Fear of Cancer Recurrence and Rumination in Relation to Depression and Anxiety Symptoms. *Journal of Psychosomatic Research*, **111**, 120-126. https://doi.org/10.1016/j.jpsychores.2018.06.004