

The Effects of Music Intervention on Quality of Life, Anxiety, and Fatigue Among Patients With Breast Cancer: A Randomized Controlled Trial

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OBJECTIVES: To determine the effects of music intervention on quality of life, anxiety, and fatigue among patients with breast cancer.

SAMPLE & SETTING: 170 individuals from the general surgery unit of Kaohsiung Chang Gung Memorial Hospital in Taiwan.

METHODS & VARIABLES: Individuals who had received a mastectomy were randomly assigned to a treatment group or control group. In the treatment group, participants received music intervention for an hour each week, totaling 12 hours during 12 consecutive weeks. The primary variable was quality of life, and secondary variables were anxiety and fatigue.

RESULTS: Greater quality of life was seen in the treatment group at 12 weeks. In the treatment group, participants showed significant improvement in State-Trait Anxiety Inventory (trait), which was most significant at eight weeks. No statistically significant difference was observed in fatigue levels after 4, 8, and 12 weeks of music intervention.

IMPLICATIONS FOR NURSING: Music intervention may improve anxiety and quality of life of patients with breast cancer. Music intervention could be established following mastectomy and continued throughout recovery.

KEYWORDS quality of life; anxiety; fatigue; breast cancer; mastectomy; music intervention

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Breast cancer is the most commonly diagnosed cancer in women (Co et al., 2022) and affects 1.38 million people worldwide (12.5%) per year (Wu et al., 2022). In addition, the worldwide annual total of breast cancer cases increased each year between 2012 and 2019 (Siegel et al., 2023). With an average of 685,000 deaths and about 2.3 million new occurrences of breast cancer per year worldwide (Arnold et al., 2022), breast cancer is a common disease and the second highest cause of cancer deaths worldwide (Giaquinto et al., 2022).

Numerous studies have explored the impact of music intervention on pain management in individuals with breast cancer. However, the results regarding improvements in quality of life, anxiety, and fatigue among these patients remain inconsistent. Therefore, the current study investigated the effects of music intervention on quality of life, anxiety, and fatigue in patients with breast cancer.

Quality of Life

Breast cancer events can significantly affect a person's quality of life (Ulrich et al., 2022). Patients often experience a decline in quality of life during the breast cancer period (Hanson et al., 2022). If not properly managed, breast cancer can result in prolonged hospital stays and reduced quality of life (Smail et al., 2022).

A study by Lima et al. (2020) indicated that being diagnosed with cancer can decrease quality of life and affect a patient's mental health; therefore, a goal of therapy for breast cancer is to maintain quality of life (Heidary et al., 2023). Another study found lower quality of life in postmastectomy patients with breast cancer (Silverstein et al., 2023). The study indicated

that quality of life may change during the first year after mastectomy for women with breast cancer (Silverstein et al., 2023).

After receiving breast surgery, patients should be closely observed regarding their quality of life (Kang et al., 2022). A collaborative intervention is essential for patients to achieve high quality of life (El Masri & Phadke, 2022). A study focused on the trajectories of quality of life in patients with breast cancer showed that patients should be provided with further complementary care (Di Meglio et al., 2022). Arnaud et al. (2021) found that individualized care planning and quality-of-life management may lead to better breast cancer outcomes. Research has determined that nurses should provide appropriate complementary care to help patients enhance their resilience and seek effective support to improve their quality of life after breast cancer (Hanson et al., 2022).

Anxiety

A cancer diagnosis is one of the most serious and feared life events that causes stress in individuals, and for many individuals, the diagnosis of breast cancer may also cause the development of stress and anxiety. Psychiatric disorders such as anxiety are common among patients with breast cancer (Guo et al., 2023). A 2023 study by Ruiz-González and Guil determined that anxiety occurred in nearly 27% of patients after breast cancer was detected. Patients who choose surgery as their first treatment are typically more anxious (Kugbey, 2022). Because of disease progression or adverse surgical effects, some individuals experience severe anxiety (Al-Alawi et al., 2022); therefore, anxiety is considered an unfavorable condition in patients with breast cancer (Grocott et al., 2023). Qualitative interviews have indicated that some patients with breast cancer with body image problems following surgery prefer to choose alternative approaches to reduce anxiety (Grocott et al., 2023).

A cross-sectional study confirmed that anxiety problems are related to higher levels of stress (Soqia et al., 2022). Increased anxiety and stress often lead to a negative outlook on the future in patients with breast cancer. Those who have undergone a mastectomy tend to experience heightened anxiety, particularly concerning their interpersonal and social relationships (Hanson et al., 2022). In a study by Álvarez-Pardo et al. (2023), patients expressed their initial anxiety about cancer treatment and felt some sense of uncertainty about the future. The more anxious the patients with breast cancer, the worse their quality of life. In a study by Williams et al. (2021), a

patient's anxiety and fatigue were exacerbated by the diagnosis of breast cancer.

Fatigue

Fatigue was another common symptom (60%) among patients with breast cancer (Kaur et al., 2022). Fatigue is a self-perceived phenomenon and is subjective in nature. It often seriously affects patients' quality of life (Alsharif et al., 2022). Patients with breast cancer describe sensitivity to increased fatigue, which may occur following breast surgery (Schmidt et al., 2023); however, little is known about fatigue in patients with breast cancer (Huifang et al., 2022). Studies have reported that about one in four patients with breast cancer experience severe fatigue (Alcântara-Silva et al., 2018; Wu et al., 2019). A study by Lacourt et al. (2022) demonstrated that patients with breast cancer show signs of fatigue. Fatigue is caused by physical and mental stress in patients with breast cancer (Schaab et al., 2023). Psychological symptoms of fatigue were also commonly reported by patients with breast cancer (Kaur et al., 2022). A study by Amarsheda and Bhise (2022) found that fatigue is a major predictor of diminished employment for patients with breast cancer.

Alternative interventions may reduce persistent fatigue in breast cancer survivors (Jun & Lee, 2024). Emotional factors are highly associated with severe fatigue (Jun & Lee, 2024). Although fatigued individuals show evidence of increased inflammation, the physiologic mechanisms driving provocative dynamic inflammation have not been resolute (Getu et al., 2022). Fatigue is a high priority for breast cancer survivors with chronic health problems (Getu et al., 2022; Svendsen et al., 2023).

Intervention

Some findings support the use of complementary interventions for fatigue in patients with breast cancer (Schaab et al., 2023). Music intervention is one complementary therapy for patients with breast cancer (Viola et al., 2023). Music intervention is the use of music to help achieve a specific change in behavior, feeling, or physiology (Hennenberg et al., 2023). Music intervention is effective in treating many chronic pains, which often induce stress and anxiety (Tervaniemi, 2023). Music intervention encompasses a variety of activities that may soothe the mind, going beyond listening to music to involve acting, composing, reading, and writing (Trigueros-Murillo et al., 2023). Music treatment benefits may depend on participants' characteristics, and one study suggested

that patient-favored music reduces anxiety in patients with cancer (Chirico et al., 2020). A literature review showed limited evidence regarding the effects of music intervention on anxiety (Duman et al., 2022).

Only a small number of researchers have discussed complementary and alternative medicine for the stress and anxiety caused by breast cancer (Chirico et al., 2020). Few studies have addressed how music reduces radiation therapy-induced fatigue (Alcântara-Silva et al., 2018) and psychological distress (Grocott et al., 2023) and increases length of life (Trigueros-Murillo et al., 2023), which shows that rigorously designed randomized controlled trials with adequate quality and size are still lacking.

Research has shown that music could reduce the overall fatigue of patients with breast cancer (Hsieh et al., 2019). A mixed-methods study advocated the use of music in cancer care (Grau-Sánchez et al., 2022). Music intervention has been reported to improve mood, social interaction, and stress among patients with breast cancer; therefore, the use of music has become popular among individuals with breast cancer worldwide (Semeniuk et al., 2023).

Because of a lack of research results and insufficient data to perform comparative analysis, including the frequency and average duration of music sessions, music intervention is not a uniformly regulated form of care among hospitalized patients with cancer. The American Society of Clinical Oncology published a guideline for the use of music after breast cancer treatment (Liou et al., 2023; Semeniuk et al., 2023). Because music intervention may be physically and spiritually healing, it has become a frontier branch of nursing science (Braun Janzen et al., 2021).

The neural mechanisms under the circumstance of music intervention are unknown (Jiang et al., 2023). One study endeavored to interpret the therapeutic effects of music based on enhanced neuroplasticity (Chen et al., 2022), which is one of the pivotal components following changes in memory function (Martínez-Molina et al., 2022), and it was assumed that music acts as a distractor, meaning that it can shift a person's attention away from noxious provocations (Bonomo et al., 2022). Further trials regarding the underlying therapeutic effects of music intervention are needed for better understanding (Jiang et al., 2023). Currently, music intervention is mostly focused on postoperative pain management (Liou et al., 2023).

Research has shown that music intervention may have an affirmative impact on anxiety in people with cancer (Trigueros-Murillo et al., 2023). A randomized clinical trial revealed that music therapy could relieve

the anxiety of people with breast cancer (Deng et al., 2022). In addition, music intervention may alleviate fatigue after cancer surgery (Alcântara-Silva et al., 2018).

Music is an art that strongly affects individuals and can elicit many different emotions (Szewczyk et al., 2023). Music is one of the suggested nursing interventions for various health problems. One study indicated that music therapy was more effective in reducing anxiety than improving quality of life (Gramaglia et al., 2019) and should be offered in various treatment phases (Köhler et al., 2020). According to Lorek et al. (2023), the creativity of neuroscience and music improvisation is an interesting issue, and one with powerful implications for music intervention (Vincenzi et al., 2022). Previous studies have suggested that music could shut down neurologic receptors; therefore, the entrances of the nervous system also close in the face of malicious stimulus (Bradt et al., 2021), which could be attributed to the mechanism that diverts attention away from fears that lead to anxiety. In addition, music could initiate happiness among individuals with feelings of melancholy (Riby, 2023).

Evidence illustrates the usefulness of music for enhancing the quality of life among patients with cancer (Porter et al., 2018). A randomized controlled trial by Henneghan et al. (2022) pointed out that music intervention may enhance the happiness of individuals with breast cancer. Music intervention produces small neurobehavioral enhancements in auditory and linguistic processing (Neves et al., 2022). Participants who heard happy-sounding music exhibited larger improvements in arousal and mood (Vincenzi et al., 2022). A study suggested that increased knowledge regarding music intervention is required to build a better foundation for use in nursing care (Chen et al., 2022).

Music stimulates the brain and is noninvasive, making it ideal for treating numerous conditions (Kwekkeboom, 2003). However, clinical research on the mechanisms contributing to its effectiveness is lacking. Music intervention primarily affects the pituitary gland. The stress response is mediated by sound or musical stimulation. In response to music therapy, the nervous system induces changes in the body that produce positive emotions and thoughts and regulate the activity of the vital organs, promoting feelings of contentment and relaxation and effectively reducing blood pressure and plasma cortisol levels (Fujioka & Hunt, 2024).

Music intervention is common in medical treatments in the United States and Europe. However, in

Taiwan, music interventions are not yet widely used. To the best of the authors' knowledge, no randomized research has examined the effect of music intervention on quality of life, anxiety, and fatigue among patients with breast cancer. This study investigated the effects of music intervention on quality of life, anxiety, and fatigue among patients with breast cancer in Taiwan.

Conceptual Framework

The current study employs insights from music neurobiology (Vuust et al., 2022) to investigate the relationships among quality of life, anxiety, and fatigue (Redeker et al., 2000).

Study Hypotheses and Outcome

Assessments

This study tested the following three hypotheses: (a) Individuals in the treatment group will have improved quality of life compared to individuals in the control group after the music intervention; (b) individuals in the treatment group will experience a reduction in anxiety and fatigue compared to individuals in the control group after the music intervention; and (c) the treatment effect will vary over time, indicating an interaction between the treatment group and time.

Patient assessments of the primary outcome were conducted using the World Health Organization Quality-of-Life Scale (WHOQOL-BREF). Secondary outcomes were assessed using the State-Trait Anxiety Inventory (STAI) and the Taiwanese version of the Brief Fatigue Inventory (BFI-T) at baseline (T₁), week 4 (T₂), week 8 (T₃), and week 12 (T₄).

Methods

Study Design

This study used the assessor-blind randomized controlled parallel-group method and enrolled individuals from the general surgery unit of Kaohsiung Chang Gung Memorial Hospital in Taiwan. Comprehensive nursing management for breast cancer consists of interprofessional team care. Considering that music intervention has no adverse events, this study assumed that it could be an optimal add-on therapy for individuals with breast cancer. Therefore, this study assessed the impacts of music intervention on quality of life, anxiety, and fatigue among individuals with breast cancer.

Participants

The study was conducted from December 2019 to November 2020. The inclusion criteria standards were

the following: (a) being aged between 20 and 80 years, (b) having a new diagnosis of breast cancer, and (c) being able to follow basic instructions (verbal or gestural) and tolerate music for one hour. The following individuals were excluded from the trial: (a) those who had received any psychotherapeutic interventions or taken antidepressants during the trial period; (b) individuals who were significantly hearing impaired, unable to mark the informed consent, or did not approve further evaluation; and (c) pregnant women. This research was officially passed by the Chang Gung Medical Foundation Institutional Review Board (IRB No: 201901698B0), and the research protocol is registered on ClinicalTrials.gov (NCT04540471).

Instruments

The participants' characteristics, including demographic data, marital status, age, and education level, were recorded.

WHOQOL-BREF: The WHOQOL-BREF consists of 26 questions. Two questions pertain to overall quality of life and general health status, whereas the remaining 24 questions assess quality of life along 24 dimensions. These 24 dimensions are classified into four main areas as follows: physical health, psychology, social relations, and environment. The WHOQOL-BREF measurement ranges from 4 to 20 points; a higher score corresponds to better quality of life. WHOQOL-BREF's internal consistency has a Cronbach's alpha of 0.9, and the test-retest reliability of WHOQOL-BREF is 0.75 (Yao et al., 2002). The construct validity of the Taiwanese version of WHOQOL-BREF was examined by Pearson's correlation coefficient ($r = 0.48-0.82$) (Yao et al., 2002).

STAI: STAI consists of 40 questions. The current study assessed anxiety using the Chinese version of STAI, which consists of 20 questions assessing the state of anxiety and 20 questions assessing trait anxiety (Du et al., 2022). The Chinese version of STAI has a split-half reliability of 0.87 and Cronbach's alpha of 0.9 (Du et al., 2022). The trait anxiety statements include the following: "I am a steady person," "I am content," "That really doesn't matter," and "I worry too much over some things." The state anxiety statements include the following: "I feel calm," "I am tense," "I feel secure," and "I am worried." All questions are evaluated on a four-point Likert-type scale ranging from 1 (almost never) to 4 (almost always). A higher score indicates higher anxiety. Individuals are qualified for STAI if they have a sixth-grade reading level. The test-retest coefficient reliability ranges from 0.65 to 0.75 over two months, and the internal

consistency coefficients for these questions range from 0.86 to 0.95 (Du et al., 2022). Considerable evidence demonstrates the concurrent and construct validity of the measures. The test-retest coefficients for the scores in this scale range from 0.69 to 0.89 (Du et al., 2022).

BFI-T: BFI-T consists of nine questions with a total score ranging from 0 to 10 points, where a higher score corresponds with greater fatigue. The internal consistency of the BFI-T shows a Cronbach's alpha of 0.97. The construct validity of the BFI-T is estimated by factor analysis, with a factor loading range of 0.8–0.94 on a single factor. The convergent validity is examined by the correlation between the worst BFI and fatigue severity scores with a Profile of Mood States vigor ($r = 0.69$ and 0.71 , respectively) and fatigue subscale scores ($r = 0.82$ and 0.87 , respectively) (Chou et al., 2016).

Data Collection

Sampling: This randomized controlled trial employed a convenience sampling method in the general outpatient surgery department of the Kaohsiung Chang Gung Memorial Hospital in Taiwan, from December 2019 to November 2020.

Sample size estimation: A priori hypothesis was that the music intervention would be more effective in decreasing or maintaining anxiety (Palmer et al., 2015). The expected mean difference between the two sets was calculated using the formula for effect size, which is the difference between the means of the two sets ($\mu_1 - \mu_2$) divided by the pooled SD. Regarding generalized estimating equations analysis, to achieve adequate power (80%, $\alpha = 0.05$), the investigator conducted power statistical analysis to determine the differences in the outcomes calculated between both groups. The power of G*Power, version 3.1.9.2, was calculated based on the difference in the outcome estimates between the two groups to determine the required sample size for generalized estimating equations analysis. According to previous research, the minimal sample size needed to estimate the assumed correlation within factors, which is 0.5, was calculated using an effect size ($f = 0.21$) (Palmer et al., 2015).

Randomization and blinding: Randomization was executed by a computer randomizer procedure using sealed envelopes prior to data gathering, and each envelope included a group designation after enrollment and demographic characteristic gathering were complete. Each patient completed a questionnaire that served as a baseline assessment of quality of

life, anxiety, and fatigue. Randomization at a 1:1 ratio was carried out using a computer-generated randomization table, and all individuals were randomly assigned to either the treatment group or the control group. Although both groups received breast cancer education for 12 consecutive weeks, the treatment group received additional music intervention during the period. The participants in the treatment group received music intervention one hour per week, for a total of 12 hours during 12 consecutive weeks. The primary outcome was a perceived change of quality of life after music therapy, and the secondary outcomes were changed anxiety and fatigue. All psychometric measures were assessed at baseline, 4 weeks, 8 weeks, and 12 weeks after participation. The individuals were assessed at four different time points; the beginning period consisted of a preliminary interview with the request for informed consent, the completion of a sociodemographic form, and the STAI and BFI-T questionnaires. In the control group, the individuals received postsurgery education but did not undergo the music intervention.

FIGURE 1. CONSORT Flow Diagram for Sample

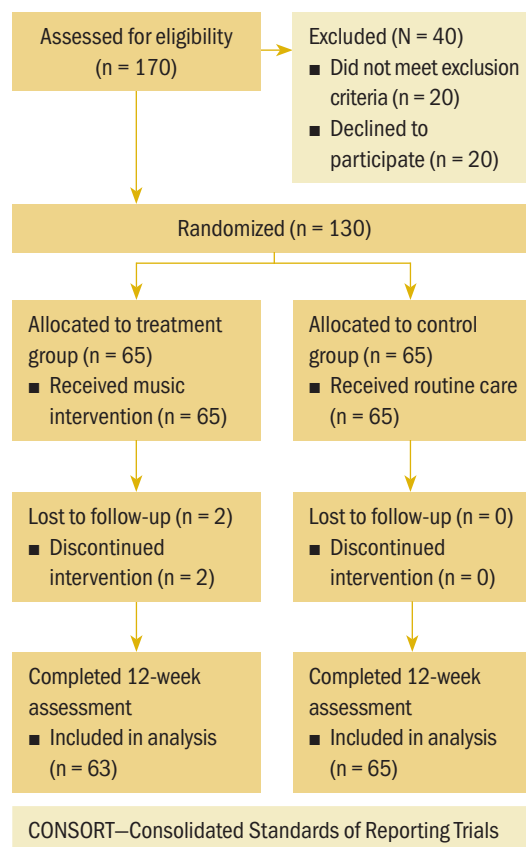


TABLE 1. Baseline Sample Characteristics by Group

Characteristic	Total (N = 128)		Treatment Group (N = 63)		Control Group (N = 65)		p
	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	
Age (years)	52.6	9.8	52	10	53.2	9.6	0.49
Height (cm)	157.9	5.3	158.4	5.1	157.4	5.5	0.266
Weight (kg)	60.3	11.8	61.3	11.7	59.3	11.9	0.347
Characteristic	n	%	n	%	n	%	p
Marital status							0.739
Married	89	70	43	68	46	71	
Unmarried	13	10	8	13	5	8	
Divorced	15	12	8	13	7	11	
Widowed	11	9	4	6	7	11	
Education level							0.56
Elementary school or below	13	10	8	13	5	8	
Junior high school	15	12	5	8	10	15	
High school	43	34	20	32	23	35	
Junior college	25	20	15	24	10	15	
University	30	23	14	22	16	25	
Graduate school	2	2	1	2	1	2	
IV chemotherapy							0.547
Yes	21	16	12	19	9	14	
No	107	84	51	81	56	86	
Surgery site							0.655
Left	67	52	31	49	36	55	
Right	60	47	31	49	29	45	
Bilateral	1	1	1	2	-	-	
Radiation therapy							0.71
Yes	15	12	8	12	7	11	
No	113	88	55	88	58	89	
Targeted therapy							0.891
Yes	19	15	9	14	10	15	
No	109	85	54	86	55	85	
Oral chemotherapy							0.259
Yes	12	9	4	6	8	12	
No	116	91	59	94	57	88	
Other chemotherapy							0.09
Yes	103	80	47	75	56	86	
No	25	20	16	25	9	14	
Cancer stage							0.345
0	17	13	10	15	7	11	
I	1	1	1	2	-	-	
IA	42	33	23	37	19	29	
II	3	2	-	-	3	5	

Continued on the next page

TABLE 1. Baseline Sample Characteristics by Group (Continued)

Characteristic	Total (N = 128)		Treatment Group (N = 63)		Control Group (N = 65)		p
	n	%	n	%	n	%	
Cancer stage (continued)							0.345
IIA	35	27	15	23	20	31	
IIB	15	12	9	14	6	9	
III	3	2	2	3	1	2	
IIIA	2	2	-	-	2	3	
IIIB	4	3	1	2	3	5	
IIIC	4	3	1	2	3	5	
IV	1	1	1	2	-	-	
IVA	1	1	-	-	1	2	
Metastasis							0.444
Yes	41	32	18	29	23	35	
No	87	68	45	71	42	65	
Recurrence							0.096
Yes	10	8	2	3	8	12	
No	118	92	61	97	57	88	
Note. Because of rounding, percentages may not total 100.							

Procedure

This study established the optimal procedure for music intervention as a combination of dynamic listening and relaxed deep breathing, guided by the music. Music induces relaxation, strengthens auditory skills, and promotes memories connected with places, events, and people (Juslin & Västfjäll, 2008). Participants in the treatment group listened to a one-hour session of music, which included crystal (glass harmonica), popular, light, Chinese religious, and European classical music. They were presented with a MixerBox MP3 playlist containing 200 songs across these four types of music. The patients in the treatment group were instructed to select their preferred music, listen through headphones, and adjust the volume to their liking. They received music intervention for an hour each week, totaling 12 hours over 12 consecutive weeks following their initial enrollment. When participants wanted to listen to music, they recorded the specific times in a diary and were required to listen to the playlist they had created. During the music intervention, the participants were alone in their rooms and were not disturbed by anyone at home. To minimize stress from external noises, the participants were directed to adopt a comfortable posture and relax. One study suggested

that such music interventions must continue for at least three months of weekly sessions to be effective (Cohen et al., 2023).

Data Analysis

All data were analyzed using an intention-to-treat method. Descriptive statistics were described using means and SDs, and chi-square testing was used for the categorical variables. Inferential statistics were carried out using generalized estimating equations to calculate the repeated measures and examine the effects of music intervention on quality of life, anxiety, and fatigue. All data were measured at T1-T4. Statistical analysis was executed using IBM SPSS Statistics, version 21.0, and a value less than 0.05 was considered statistically significant. The list of participants was recorded in an electronic device, and all participants were coded and de-identified. Sensitive information was not recorded in this study, and all the data were secured. Secured data transmission and storage was used to protect against data interception, and security breaches were prudently avoided.

Ethical Considerations

Informed consent was secured from all participants. All procedures adhered to relevant guidelines and

TABLE 2. WHOQOL-BREF, STAI, and BFI-T Mean Scores

Variable	Time							
	Baseline		4 Weeks		8 Weeks		12 Weeks	
	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD	\bar{X}	SD
WHOQOL-BREF total								
Treatment	92.9	15	93.5	14.5	94.5	15.4	96.6	14.7
Control	97.1	13.2	95.2	15.1	94.1	15.7	94.2	15.9
STAI (state)								
Treatment	42.79	11.41	41.57	10.44	39.65	10.34	40.24	9.91
Control	40.74	12.33	40.98	12.39	40.68	11.49	39.69	12.62
STAI (trait)								
Treatment	42.32	10.62	42.62	8.75	40.94	9.25	41.44	8.91
Control	42.28	12.17	42.43	11.66	42.58	11.17	41.86	12.17
BFI-T total								
Treatment	29.3	19.9	29.6	19.1	26.7	17.3	28.4	19.4
Control	27.7	16.8	28.7	18.7	31.5	18.5	28.8	19.3

BFI-T—Taiwanese version of the Brief Fatigue Inventory; STAI—State-Trait Anxiety Inventory; WHOQOL-BREF—World Health Organization Quality-of-Life Scale

regulations, including the Declaration of Helsinki. For patients meeting the inclusion criteria, experts from the continuation care team explained the study's purpose and process, ensuring that personal information would be used solely for this study. The authors confirmed that participants comprehended the trial's purpose and their responsibilities during the informed consent process. Each patient provided informed consent independently. In addition, all methods were conducted in compliance with relevant guidelines and regulations.

Results

Participant Demographic Characteristics

A total of 170 individuals were checked for eligibility, and data were collected from January to July 2020. The participants were randomly divided into the treatment or control group. Overall, 130 participants were included in this study (see Figure 1); no unfavorable events occurred that would indicate that urgent treatment was required, and the trial attrition rate was 1.5% in the treatment group at T3 and T4. As shown in Table 1, the treatment group ($N = 63$, \bar{X} age = 52 years) and control group ($N = 65$, \bar{X} age = 53.2 years) baseline data show no notable discrepancy between groups ($p > 0.05$). After the music intervention, mean WHOQOL-BREF, STAI, and BFI-T scores were compared between the treatment group

and the control group at each of the four time points (see Table 2).

Music Intervention and Quality of Life

As shown in Table 3, WHOQOL-BREF scores for the two groups at T2–T4 during music intervention changed significantly over time. As shown in Table 4, the interactions of group and time on WHOQOL-BREF were significant at 4 weeks ($\beta = 11.367$, $p < 0.001$), 8 weeks ($\beta = 16.9$, $p < 0.001$), and 12 weeks ($\beta = 19.633$, $p = 0.002$); that is, the differences were significant between the WHOQOL-BREF at T1 and at T2, T3, and T4 for the treatment group and control groups. The patients in the treatment group had higher WHOQOL-BREF scores than their peers in the control group at T2, T3, and T4, which shows that the participants had crucial enhancements in quality of life following 4–12 weeks of music intervention.

Music Intervention and Anxiety

The STAI scores for the two groups at T1–T4 during the music intervention did not change significantly over time. The individuals in the treatment group indicated no statistically notable discrepancy in STAI (state) during the follow-up; compared to the control group, as shown in Table 5, the treatment group reported lower scores in STAI (trait), indicating lower anxiety ($\beta = -1.391$, $p < 0.003$) at T3.

Music Interventions and Fatigue

Perceived fatigue values for the two groups at T1–T4 during the music intervention did not change significantly over time. The perceived fatigue of participants with breast cancer did not differ by group. The BFI-T outcomes were not statistically significant during follow-up at T2, T3, and T4 (see Table 6).

Discussion

Quality of Life in Patients With Breast Cancer

The authors examined whether music intervention improved quality of life of patients with breast cancer. As expected, listening to music increased quality of life. The authors tested whether quality of life in music listening would change depending on the 4- to 12-week duration of music intervention. The effect of time was statistically significant. These results do not allow the authors to recommend using shorter-duration music intervention for patients with breast cancer. In contrast, no music intervention was accompanied by reduced levels of quality of life in patients with breast cancer. These results are in line with existing evidence

for the impact of music intervention (Di Meglio et al., 2022). Music intervention improves quality of life in patients with breast cancer. This study's results are consistent with a previous study on the effect of music on quality of life in patients with breast cancer (Lima et al., 2020). This trial confirmed that quality of life among patients was improved. Music therapy is a passive intervention, which has great impact on emotional state (Gramaglia et al., 2019). However, for patients who were admitted to the hospital, music therapy was less effective in improving quality of life (Gramaglia et al., 2019). The study provided guidance on research outcomes, designs, and implementation for music intervention. Listening to music at home can enhance quality of life of patients with breast cancer. Music intervention for patients with breast cancer must account for individual preferences, and technology should be used in delivery and assessment.

Anxiety in Patients With Breast Cancer

This trial investigated anxiety in patients with breast cancer after 4, 8, and 12 weeks of music intervention.

TABLE 3. The Effect of Music Intervention on WHOQOL-BREF, STAI (State), STAI (Trait), and BFI-T Scores

Variable	β	SE	Wald χ^2	p
WHOQOL-BREF				
Group	-8.667	3.466	6.251	0.012
Time 2	-4.567	1.4	10.644	0.001
Time 3	-4.833	1.524	10.059	0.002
Time 4	-6.133	1.674	13.427	< 0.001
STAI (state)				
Group	35.6	2.746	168.012	< 0.001
Time 2	3.2	1.655	3.739	0.053
Time 3	0.5	2.321	0.046	0.829
Time 4	2.733	1.802	2.301	0.129
STAI (trait)				
Group	29	2.541	130.214	< 0.001
Time 2	1.867	0.989	3.566	0.059
Time 3	0.067	1.178	0.003	0.955
Time 4	0.9	0.969	0.863	0.353
BFI-T				
Group	3.367	4.66	0.522	0.47
Time 2	3.533	5.035	0.492	0.483
Time 3	6.233	4.899	1.619	0.203
Time 4	5.433	4.964	1.198	0.274

β —regression coefficient; BFI-T—Taiwanese version of the Brief Fatigue Inventory; SE—standard error; STAI—State-Trait Anxiety Inventory; WHOQOL-BREF—World Health Organization Quality-of-Life Scale

Note. Times 2, 3, and 4 refer to 4 weeks, 8 weeks, and 12 weeks, respectively.

TABLE 4. Group Effect on WHOQOL-BREF Scores

Variable	β	SE	95% CI	p
WHOQOL-BREF				
Group	-8.667	3.466	[-15.461, -1.873]	0.012
Time 2 ^a	-4.567	1.4	[-7.31, -1.823]	0.001
Time 3 ^a	-4.833	1.524	[-7.82, -1.846]	0.002
Time 4 ^a	-6.133	1.674	[-9.414, -2.853]	< 0.001
Group*Time 2 ^b	11.367	2.902	[5.679, 17.054]	< 0.001
Group*Time 3 ^b	16.9	2.866	[11.282, 22.518]	< 0.001
Group*Time 4 ^b	19.633	2.951	[13.85, 25.416]	< 0.001

^aReference: Control group and baseline are the references for group effect and times 2–4, respectively.

^bGroup effect: the discrepancy between groups at 4 weeks; time 2, time 3, and time 4: the time effect on control group at 4 weeks, 8 weeks, and 12 weeks, respectively, compared with weeks; group*time: the discrepancy of the change between 2 groups at 4 weeks, 8 weeks, and 12 weeks post-music intervention with respect to baseline

β —regression coefficient; CI—confidence interval; SE—standard error; WHOQOL-BREF—World Health Organization Quality-of-Life Scale

Note. Times 2, 3, and 4 refer to 4 weeks, 8 weeks, and 12 weeks, respectively.

The findings show significant improvements in anxiety in the present trial after eight weeks. The music intervention significantly improved anxiety, possibly because of music's ability to promote relaxation and the recall of pleasant memories. The findings of the present study indicate that music intervention significantly reduces anxiety as assessed on the STAI (trait) after eight weeks. Another study also reported significant improvements in anxiety following music intervention (Lima et al., 2020). However, a Cochrane review indicated that most music interventions had high risk of bias and exhibited low or extremely low certainty of evidence (Bradt et al., 2021). Previous trials involving music therapy revealed mixed results regarding short-term improvements in cancer-related anxiety. Specifically, short-term interventions were associated with statistically significant improvements, whereas long-term interventions were not (Silverstein et al., 2023). The present study observed greater improvement in anxiety scores of patients with breast cancer who received music intervention at eight weeks, consistent with the results of an earlier study (Li et al., 2012). A comparison of anxiety between the music intervention and routine care found no discrepancy between these two kinds of interventions for anxiety in a long period (Archer et al., 2015). One study suggested that generation of anxiety has conscious origins, which are related to feelings modulation of stimulus expressions in the amygdala and primary cortices (Dunsmoor & Paz, 2015). Anxious individuals are recognized as having a high potential to feel a loss of control over their disease progression.

This situation often requires multiple interventions to manage effectively (Dunsmoor & Paz, 2015). Music can distract individuals from their anxiety (Palmer et al., 2015). None of the patients' conditions improved after surgery in the present study, leading to persistent anxiety at 12 weeks, which was one of the influencing factors.

Fatigue in Patients With Breast Cancer

After 12 weeks of music intervention, the results show no statistically significant difference in the alleviation of participants' fatigue. There was no statistically significant difference that showed that participants' fatigue was alleviated after 4, 8, and 12 weeks of music intervention. In addition, no significant improvement in fatigue was observed between groups, and the interaction effect between time and the music intervention was also not significant. Several studies have explored the impact of music intervention on fatigue in patients with breast cancer, yielding mixed results. Hsieh et al. (2019) found that music intervention could decrease overall fatigue, suggesting the need for further research to confirm this effect and understand the underlying mechanisms. Conversely, Zhang et al. (2012) reported that music intervention did not significantly reduce fatigue and could even worsen it, aligning with the findings of the current study. Alcântara-Silva et al. (2018) noted that music could temporarily distract individuals from their fatigue, although this effect was not consistent across all studies.

The relationship between fatigue and neural mechanisms is complex. Zavotsky et al. (2014) found

that music did not distract patients with cancer from fatigue, supporting the current study's findings. Fatigue should be considered a multisymptom condition, with trials indicating that mental and physical fatigue are distinct entities (Van Cutsem et al., 2017). Fatigue involves a progression from exhaustion to collapse, leading to weakness and discomfort.

Previous research has shown that appropriate physical activity can reduce physical fatigue, whereas mental fatigue is linked to psychological issues such as future concerns and social support (Syrowatka et al., 2017). The current study suggests that individualized treatment approaches should be tailored to the type of fatigue experienced by patients.

This trial has three strengths. First, the attrition rate for these patients was less than 1.5%. Second, the participants had easy access to music in this blind assessor trial. The use of blind assessors and concealed allocation significantly decreased the possibility of bias in this research. Third, all patients were divided into the groups based on a random number generated by computer, and the researcher was blind to the group assignment to strengthen internal validity.

KNOWLEDGE TRANSLATION

- Postmastectomy, 4–12 weeks of music intervention is the crucial period to improve quality of life for patients with breast cancer.
- Music intervention is convenient, safe, and simple to apply, rendering it an excellent option for improving overall quality of life.
- Listening to music cannot completely treat breast cancer fatigue because cancer-related fatigue is a complex symptom usually caused by multiple factors, including the cancer itself, side effects of treatment, and psychological stress; music effects are usually temporary and need to be combined with other treatment methods to achieve the best results.

Limitations

This study has a number of limitations. First, this study is based on a sample size of 130 patients, and the sample size defined by a former study (Palmer et al., 2015) had 30 patients, which could decrease the statistical power. This should be taken into account in future research. Second, following the participants' data required 12 weeks, and all statistics were

TABLE 5. Group Effect on STAI (State) and STAI (Trait) Scores

Variable	β	SE	95% CI	p
STAI (state)				
Group	35.6	2.746	[30.217, 40.983]	<0.001
Time 2 ^a	3.2	1.655	[-0.044, 6.444]	0.053
Time 3 ^a	0.5	2.321	[-4.049, 5.049]	0.829
Time 4 ^a	2.733	1.802	[-0.798, 6.265]	0.128
Group*Time 2 ^b	0.153	0.166	[-0.172, 0.477]	0.356
Group*Time 3 ^b	-0.206	0.172	[-0.544, 0.131]	0.23
Group*Time 4 ^b	-0.16	0.173	[-0.498, 0.179]	0.355
STAI (trait)				
Group	29	2.541	[24.019, 33.981]	<0.001
Time 2 ^a	1.867	0.989	[-0.071, 3.804]	0.059
Time 3 ^a	0.067	1.178	[-2.241, 2.375]	0.955
Time 4 ^a	0.9	0.969	[-0.999, 2.799]	0.353
Group*Time 2 ^b	-0.758	0.48	[-1.699, 0.182]	0.114
Group*Time 3 ^b	-1.391	0.468	[-2.307, -0.475]	0.003
Group*Time 4 ^b	-0.746	0.467	[-1.661, 0.17]	0.11

^aReference: Control group and baseline are the references for group effect and times 2–4, respectively.

^bGroup effect: the discrepancy between groups at 4 weeks; time 2, time 3, and time 4: the time effect on control group at 4 weeks, 8 weeks, and 12 weeks, respectively, compared with weeks; group*time: the discrepancy of the change between 2 groups at 4 weeks, 8 weeks, and 12 weeks post–music intervention with respect to baseline

β —regression coefficient; CI—confidence interval; SE—standard error; STAI—State-Trait Anxiety Inventory

Note. Times 2, 3, and 4 refer to 4 weeks, 8 weeks, and 12 weeks, respectively.

TABLE 6. Group Effect on BFI-T Scores

Variable	β	SE	95% CI	p
BFI-T				
Group	3.367	4.66	[-5.767, 12.501]	0.47
Time 2 ^a	3.533	5.035	[-6.335, 13.402]	0.483
Time 3 ^a	6.233	4.899	[-3.369, 15.835]	0.203
Time 4 ^a	5.433	4.964	[-4.296, 15.162]	0.274
Group*Time 2 ^b	0.524	0.449	[-0.355, 1.403]	0.242
Group*Time 3 ^b	-0.576	0.446	[-1.451, 0.298]	0.196
Group*Time 4 ^b	-0.214	0.406	[-1.01, 0.581]	0.597

^aReference: Control group and baseline are the references for group effect and times 2–4, respectively.

^bGroup effect: the discrepancy between groups at 4 weeks; time 2, time 3, and time 4: the time effect on control group at 4 weeks, 8 weeks, and 12 weeks, respectively, compared with weeks; group*time: the discrepancy of the change between 2 groups at 4 weeks, 8 weeks, and 12 weeks post-music intervention with respect to baseline β —regression coefficient; BFI-T—Taiwanese version of the Brief Fatigue Inventory; CI—confidence interval; SE—standard error

Note. Times 2, 3, and 4 refer to 4 weeks, 8 weeks, and 12 weeks, respectively.

composed using measurements with elevated subjective selection. Third, the patients were chosen from a medical center based on the criteria of experiencing cancer along with a decreased quality of life. Anxiety and fatigue left little room for improvement, making it difficult to detect discrepancies in cancer-related quality of life, anxiety, and fatigue between groups. In addition, this study recruited only patients who were one to six months postsurgery and provided one hour of music therapy per week. This study could not prevent contamination between groups. These limitations may affect the study results and generalized applications.

Conclusion

Participants in the treatment group demonstrated a significant improvement in Trait Anxiety Inventory throughout the study, with the most notable improvement observed at eight weeks. The interaction effect between intervention and time on adherence was significant. Compared to the control group, the treatment group exhibited a higher quality of life at 12 weeks. Music intervention needs to be established immediately following mastectomy and continued through the post-breast cancer survivorship stages.

Although music intervention demonstrated positive impacts on quality of life and anxiety among patients with breast cancer, future trials should attempt to verify the relationship regarding quality of life, anxiety, fatigue, and neural mechanisms under the circumstance of music intervention.

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