The Effect of Two Different Types of Music Played to Cancer Patients During Chemotherapy on Anxiety, Nausea, and Satisfaction Levels

Öznur ERBAY DALLI (oznurerbay@uludag.edu.tr)
Uludağ University
Derya AKÇA DOĞAN
Uludağ University
Seda PEHLİVAN
Uludağ University
Yasemin YILDIRIM
Ege University
Türkkan EVRENSEL
Uludağ University

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Abstract

Purpose: To investigate the effect of two different types of music on anxiety, nausea, and satisfaction levels in cancer patients receiving chemotherapy (CT) for the first time.

Methods: The study was conducted as a single-blind, pre-test, post-test, three-group randomized controlled trial in an outpatient CT unit between August 2022 and February 2023. A simple (computer-based) and stratified (age and gender) randomization method was used to assign 75 patients to the relaxing music group (RMG), Turkish classical music group (TCMG), and control group (CG) (n=25 each). The primary outcome was the change in anxiety levels measured by Spielberger's State Anxiety Inventory before (T0) and after (T1) CT session. Secondary outcomes were the change in the severity of nausea from T0 to T1 and the level of satisfaction at T1.

Results: The groups were similar in terms of baseline sociodemographic and health-related characteristics. Anxiety levels were lower than the baseline in RMG and TCMG in comparison to CG, and repeated measures analysis showed a significant group × time interaction (p=0.001, F=210.221, η2=0.745). Nausea severity increased from T0 to T1 for CG but decreased for RMG and TCMG with a significant group × time interaction (p=0.001, F=100.785, η2=0.583). The satisfaction level was significantly higher in TCMG than in CG and RMG (8.64±0.95 vs. 7.88±0.72 and 7.00±0.70, respectively).

Conclusion: Music may be an effective non-pharmacologic option to relieve patients' anxiety and nausea during first-time CT, irrespective of music type. Larger, multicenter studies evaluating the long-term effect of music are needed to confirm these findings.

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Introduction

Cancer is a major global health problem that has been on the rise, especially in the last 10 years, and is one of the leading causes of death worldwide [1, 2]. One of the most effective treatment methods for cancer is chemotherapy (CT) [3]. CT is a form of treatment with natural or synthetic chemicals and biological agents that have selective lethal effects, especially against rapidly proliferating cells [4]. Chemotherapeutic drugs prevent the growth and proliferation of cancer cells but also affect rapidly proliferating healthy cells such as intestinal and oral mucosal epithelium, bone marrow cells, and hair follicle cells [5]. Likewise, CT has several side effects such as myelosuppression, mucositis, nausea, vomiting, diarrhea, alopecia, fatigue, and pain, which altogether significantly affect patient comfort [6]. This situation may cause patients to worry about the development of such side effects and to experience anxiety before CT due to the procedures performed [7–9]. Studies have shown that the prevalence of CT-related anxiety in cancer patients ranges from 16.2–26.7% [10, 11].

High levels of chemotherapy-induced anxiety can cause various physiological (rapid heartbeat, chest tightness, shortness of breath, etc.) and psychological (restlessness, inability to concentrate, etc.) distress by stimulating the stress response in patients [12, 13]. This can also trigger digestive symptoms such as nausea, vomiting, or diarrhea, leading to amplified side effects during and after CT [14–16]. Healthcare professionals and nurses who implement CT sessions must take precautions before CT to reduce the anxiety of cancer patients, provide comfort by minimizing the possible side effects of chemotherapy, and increase the effectiveness of treatment.

Pharmacological interventions (antidepressants, benzodiazepines, antipsychotic drugs) in the management of CT-induced anxiety can also control anxiety-related symptoms such as nausea/vomiting [17, 18]. However, these drugs have side effects such as respiratory suppression, increased fatigue, decreased concentration, and causing sedation and

confusion [18]. Therefore, non-pharmacological interventions (music, relaxation, aromatherapy, etc.) are becoming preferable in managing the anxiety of cancer patients who have to cope with several other side effects related to CT [18, 19]. Compared to other non-pharmacologic approaches, music is a noninvasive and low-cost tool that is frequently used in every field and has been shown to be effective in the management of several adverse symptoms [20]. Music activates brain areas associated with memory, cognitive function, and emotions, helping to maintain cognitive function and reduce anxiety and stress levels [21]. In addition to its overall positive effects, different types of music (cultural, melodic/harmonic, and rhythmic) may also modulate the individual's response to music [22]. Although there are studies showing the positive effect of music on the management of symptoms in patients receiving CT [14, 15, 23, 24], studies examining the effect of different music genres are limited. In this context, this study aimed to examine the effect of two different types of music on anxiety, nausea, and satisfaction levels in patients receiving CT for the first time.

Methods

Study design and setting

This study was conducted in the outpatient CT unit of a university hospital in Bursa between August 2022 and February 2023 as a parallel, three-group randomized controlled trial with a prospective, single-blind, pre-test, post-test experimental design. The study was conducted according to the Consolidated Standards of Reporting Trials (CONSORT). The outpatient CT unit where the study was conducted has a capacity of 37 beds. A total of eight nurses worked in the unit, including one nurse-in-charge, one assistant nurse-in-charge, and six CT nurses. In the unit, an average of 50–60 patients are treated daily, including supportive therapies (blood transfusion, etc.).

Participants

The inclusion criteria were (a) being 18 years old or older and (b) being diagnosed with any stage or type of cancer and scheduled to receive CT for the first time. Patients with known hearing or vision problems, an education level lower than middle school [the American Psychological Association reports that the State-Trait Anxiety Inventory (STAI) is appropriate to be administered for patients with an education level of sixth grade and above], a diagnosis of psychiatric or neurological disease, and previous cancer treatment, such as surgery or radiotherapy before CT treatment, were excluded from the study.

Sample size calculation

A priori power analysis was performed using the Power Analysis and Sample Size (PASS) program to determine the sample size needed in the study. The effect size of the study groups was calculated using the results of the anxiety level measured by STAI in a similar study conducted by Al-Jubouri et al. (2021) [25] and found to be d = 0.39. Using the calculated effect size, the sample size required to reach 80% power at the 0.05 significance level was calculated as 66 participants (22 in each group). After adjusting for a 10% attrition rate [26], the final sample size required was established as 74.

Randomization and allocation

A simple and stratified randomization method was used in the study. Stratified randomization aimed to control the differential effect of age and gender on the way of perceiving and responding to music, as reported in the literature [27, 28]. In stratified randomization, which also increases the reliability of the study, patients were randomized according to age (18–40, 41–63, 64–85 years) and gender (male-female) and assigned to study groups. In simple randomization, the groups to which patients were assigned were determined by a web-based computer program at Randomization.com (http://www.jerrydallal.com/random/randomize.htm). After the assignments were obtained, a bag of sealed envelopes

containing the numbers was created, and the envelopes were drawn from the bag to determine which patient group was selected at that moment.

Blinding

Due to the nature of the intervention, blinding the participants and the nursing researchers who conducted the intervention was not possible. However, the fact that the data analysis was carried out by a statistician independent of the study ensured that the results were blinded.

Intervention

Participants were randomly assigned to one of the following groups: relaxing music group (RMG), Turkish classical music group (TCMG), and control group (CG). Two researchers, nurse-in-charge and assistant-nurse-in-charge in the outpatient CT unit worked together to identify patients who met the inclusion criteria, prepare the necessary materials for the intervention groups, and conduct the pre-test/post-test administration. The researchers recorded information on adherence with the interventions, including start/end times of music, volume, and reasons for interruptions, if any. Patients in the intervention groups were asked open-ended questions at the end of the intervention about the acceptability of the choice and application of music, the appropriateness of the materials used, and how the music made them feel; all groups were asked open-ended questions about their expectations from the healthcare professionals and nurses during the CT process.

Care was taken to select referenced headphones for the proper transmission of music and the proper utilization of neuro-acoustic therapies of music. For this purpose, neuroscience and music therapy-based recommendations were taken into account to choose headphones designed to isolate the subject from external noise to reduce distraction [29, 30]. Sennheiser HD 280 Pro over-ear headphones with the specified features were preferred. For hygienic purposes, disposable covers were placed around the headphones and replaced for each patient. The music selected by the researchers was transferred to digital media (mp3 format). The duration of the music was determined as at least 60 minutes, taking into account that the average duration of CT treatment is 1.5 to 2 hours. If the participants wanted to continue listening to the music after 60 minutes were completed, no intervention was made to stop the music. All patients received the standard premedication treatment (2x8 mg dexamethasone, 1x45.5 mg pheniramine, and 1x3 mg granisetron) before the CT.

Relaxing music group

In the RM group (RMG), "MusiCure® 5 Seasons" compositions, which have been specially developed by Niels Eje (Gefion Records, Copenhagen, Denmark), were preferred [31]. The compositions included melodies with harp, cello, strings, and sound elements from nature (rain, birds, forest sounds) in soft rhythm in the range of 60–80 bpm for relaxation purposes based on the research of the acoustic environment of hospitals and shown to have a positive effect on symptoms such as pain, well-being, and anxiety of patients [31].

Turkish classical music group

Turkish classical music (TCM), which has a special place in Turkish culture, was utilized for patients in the TCMG. TCM has a musical structure that includes *maqam* (melodic structure), which involves different chords and microtonal intervals that vary according to geographical region and artist. Most of the melodic aspects of TCM are described by the term *maqam* [32]. It has been indicated that *maqam* music, which matured during the supremacy of the Ottoman Empire and whose effects have been studied since the time of Farabi, a Turkish scientist who lived in the 8th century, has been used effectively in the treatment of several conditions and negative symptoms [32, 33]. The Turkish Music Research and Promotion Group (TÜMATA), which was established in Turkey in 1976, has continued its research on the effects of

different *maqams*. This study used TCM in the "*Rast*" *maqam*, which is one of the four main *maqams* with high therapeutic effect and included in the "Music and Health Series 2" album specially created by TÜMATA. The "*Rast*" *maqam* involves musical instruments such as *tambour*, *bağlama*, *ney*, and *oud* in the range of 60–66 bpm, which provides feelings of peace, comfort, and happiness to the individual.

Control group

Participants in the control group (CG) received standard care, including pre-CT instructions (e.g., lying down to rest, reporting any discomfort at the infusion site) and premedication treatment, without any music or distraction intervention.

Outcome measures

After obtaining written consent from the participants, data were collected by two researchers using data collection tools in face-to-face interviews and through observation. The data collection tools consisted of Patient Identification Form, Patient Follow-up Form, STAI Turkish version, Nausea Assessment Form, and Satisfaction Assessment Form. The data collection tools were administered twice: before CT (T0) and after CT (T1).

Patient Identification Form included a total of eight questions about the demographic characteristics (age, gender, education level, marital status) and health status (cancer type, comorbidities, CT protocol) of the patients.

Patient Follow-up Form was used to record the changes in the patient's condition during the music application, the volume of the music, and the duration of listening to the music.

Spielberger's STAI was used to assess the level of anxiety. The STAI self-administered scale with a total of 40 four-point Likert items; 20 items assess the state anxiety (STAI-S) (a transient state affected by the current situation in which the respondent reports how he/she currently feels), and 20 items assess the trait anxiety (STAI-T) (a general tendency to worry in which the respondent reports how he/she feels "in general") [34]. The possible scores range from a minimum of 20 points to a maximum of 80 points on both the STAI-T and STAI-S subscales. The scores are categorized as "no or low anxiety" (20–37), "moderate anxiety" (38–44), and "high anxiety" (45–80) [34]. Both STAI-S and STAI-T were assessed at T0; only STAI-S was assessed at T1.

Nausea Assessment Form was used to assess the nausea level of the participants at T0 and T1 based on a Visual Analog Scale (VAS) within a range of 0–10 points, where "0" represents no nausea and "10" represents the most severe nausea.

Satisfaction Assessment Form was used to assess the satisfaction of patients about the interventions at T1 based on a VAS within a range of 0–10 points, where "0" represents "not at all satisfied" and "10" represents "very satisfied". This form also included open-ended questions about the acceptability of interventions and the expectations during the CT process.

Analysis

The data obtained from the study were analyzed in SPSS 28 (IBM, Statistical Package for Social Sciences). Before proceeding to the data analysis, the normality of the data was checked with skewness/kurtosis values and the Shapiro-Wilk test. Appropriate descriptive statistics were used to summarize the characteristics of the participants and outcome variables. Continuous variables were expressed as means and standard deviation; categorical variables were expressed as frequencies and percentages. Sociodemographic data and key outcome variables for different groups were compared using the chi-square test or one-way ANOVA test. Mixed model ANOVA with post hoc Bonferroni adjustment was used to determine the effects of time, group, and group × time interactions. Mauchly's test was used to test for the sphericity of the variance-covariance matrix. If the variance-covariance matrix lacked sphericity, the Greenhouse-Geisser technique

was used to correct it. The effect sizes for the mixed measures ANOVAs were calculated as partial eta squared (η^2) and classified as small 0.02–0.13, medium 0.13–0.26, and large > 0.26 [35]. The significance level was set as $p < 0.05$ (2-tailed).

Results

Recruitment, attrition, and adherence

The flowchart for the recruitment and group assignment stages of the study is shown in Fig. 1. Initially, 328 patients were assessed for eligibility. Of these, 218 did not meet the inclusion criteria, 19 eligible patients refused to participate, and 15 were excluded for other reasons, such as not being available in time for the start of CT or limited intervention materials (3 on-ear headphones + 3 mp3 players). Thus, the remaining 76 patients were randomly divided into three groups.

One participant in the TCMG could not continue the music intervention due to dyspnea and low oxygen saturation at the eighth minute after the initiation of CT. Apart from this, all participants in the intervention groups completed a single session of music intervention for at least 60 minutes (Table 1). As a result, 75 participants (25 in each group) were included in the final analysis. No music-related adverse events occurred during the interventions. Across participants in the intervention groups, the mean volume of self-tuned music was 20.22 ± 1.07 and there was no significant difference in the volume of music between the groups. The average duration of the music across the intervention groups was 70.60 ± 6.88 minutes. The duration of listening to the music was significantly longer in the TCMG than that in the RMG ($p = 0.011$) (Table 1).

Table 1
Descriptions of interventions

Adherence variables	RMG (n = 25)	TCMG (n = 26)	p value
Number of patients receiving eligible intervention (60 minutes), *n (%)*	25 (100)	25 (96.2)	0.998
Number of patients discontinued intervention, *n (%)*	0 (0)	1 (3.8)	
Music volume, *mean ± SD*	20.36 ± 1.15	20.08 ± 0.99	0.362
Duration of music (minutes), *mean ± SD*	68.16 ± 5.38	73.04 ± 6.61	0.011*
SD: standart deviation; RMG: relaxing music group; TCMG: Turkish classical music group; *: $p < 0.05$			

Participants' baseline characteristics

The socio-demographic and clinical characteristics of the patients across the whole sample and related differences between the groups are shown in Table 2. The mean age was 62.18 ± 9.71 years, 52% of the patients were female, 41.3% were high school graduates, and a great majority were married (88%). No significant difference was found between the groups in terms of age, gender, educational status, and marital status ($p > 0.05$).

The most common comorbidities in the patients included in the study were diabetes mellitus (24%) and hypertension (21.3%). More than half of the patients had lung or breast cancer (25.3% for both). The most common CT protocols received by patients were carboplatin (29.3%) and adriamycin + cyclophosphamide (AC) (25.3%). The average baseline STAI-T score across the whole sample was 41.13 ± 6.42, indicating moderate anxiety. There was no significant difference between the groups in terms of comorbidities, cancer type, CT protocol, and baseline STAI-T ($p > 0.05$).

Primary and secondary outcomes

Table 3 shows the change in anxiety and nausea levels in the study groups from the start (T0) to the end (T1) of the CT sessions. A plot of the changes in primary and secondary outcomes from T0 to T1 is presented in Fig. 2.

No significant difference was found among the baseline anxiety and nausea levels in the intervention and control groups ($p > 0.05$). Mixed-design repeated measures ANOVA analyses revealed a significant time effect in the RMG, TCMG, and CG in terms of anxiety and nausea levels ($p = 0.001$, $F = 270.602$, $\eta^2 = 0.790$, and $p = 0.001$, $F = 145.497$, $\eta^2 = 0.669$, respectively). Repeated measures group x time interaction showed significant differences in both anxiety and nausea levels among the groups ($p = 0.001$, $F = 210.221$, $\eta^2 = 0.745$, and $p = 0.001$, $F = 100.785$, $\eta^2 = 0.583$, respectively). In CG, there was no change in the anxiety levels from T0 to T1, whereas there was an increase in nausea. In the RMG and TCMG, the anxiety and nausea levels decreased significantly compared to pre-intervention, but there was no significant difference between the two groups (Fig. 2). Post-intervention satisfaction level was significantly higher in the TCMG compared to the CG and RMG (8.64 ± 0.95 vs. 7.88 ± 0.72 and 7.00 ± 0.70, respectively).

Forty-two patients (13 in the RMG, 18 in the TCMG, and 11 in the CG) completed open-ended questions about the acceptability of interventions and their expectations after the study was completed. Approximately 77% of the patients in the RMG reported that they enjoyed listening to the music and felt generally peaceful as if they were taking a walk in nature. Approximately 83% of the patients in the TCMG reported that they liked music and felt nostalgic, reminiscent of memories, and peaceful while listening to music. In both groups, some of the participants indicated that it would be good to be given the option to choose their favorite music. Participants did not provide any negative feedback about the on-ear headphones. Participants, including those in the CG, commonly reported their expectations from healthcare professionals during the CT treatment process as meeting their information needs more comprehensively, especially during the first CT application, and offering different nonpharmacological options (e.g. watching movies, providing daily newspapers or books, etc.) to make this process more comfortable.

Table 2
Baseline characteristics of participants

Characteristics		Total (n = 75)	RMG (n = 25)	TCMG (n = 25)	CG (n = 25)	χ2/F	p value
Age, *mean ± SD*		62.18 ± 9.71	61.84 ± 10.30	62.80 ± 9.31	61.92 ± 9.86	0.073	0.929
Age, *n (%)*	18–40 years	4 (5.3)	2 (8.0)	1 (4.0)	1 (4.0)	0.716	0.949
	41–63 years	39 (52.0)	12 (48.0)	13 (52.0)	14 (56.0)		
	64–85 years	32 (42.7)	11 (44.0)	11 (44.0)	10 (40.0)		
Sex, *n (%)*	Female	39 (52.0)	13 (52.0)	12 (48.0)	14 (56.0)	0.321	0.852
	Male	36 (48.0)	12 (48.0)	13 (52.0)	11 (44.0)		
Education, *n (%)*	Secondary	31 (41.3)	9 (36.0)	11 (44.0)	11 (44.0)	2.561	0.634
	High	31 (41.3)	13 (52.0)	10 (40.0)	8 (32.0)		
	Bachelor	13 (17.4)	3 (12.0)	4 (16.0)	6 (24.0)		
Marital status, *n (%)*	Married	66 (88.0)	21 (84.0)	21 (84.0)	24 (96.0)	2.273	0.321
	Unmarried/Widowed/Divorced/Separated	9 (12.0)	4 (16.0)	4 (16.0)	1 (4.0)		
Comorbidities[a], *n (%)*	Diabetes	18 (24.0)	5 (20.0)	6 (24.0)	7 (28.0)	0.439	0.803
	Hypertension	16 (21.3)	4 (16.0)	5 (20.0)	7 (28.0)	1.112	0.573
	CAD	2 (2.7)	2 (8.0)	0 (0)	0 (0)	0.411	0.128
	COPD	3 (4.0)	2 (8.0)	1 (4.0)	0 (0)	2.083	0.353
	Kidney failure	2 (2.7)	0	1 (4.0)	1 (4.0)	1.027	0.598
Cancer type, *n (%)*	Lung	19 (25.3)	5 (20.0)	9 (36.0)	5 (20.0)	9.256	0.902
	Breast	19 (25.3)	6 (24.0)	7 (28.0)	6 (24.0)		
	Endometrial	9 (12.0)	4 (16.0)	2 (8.0)	3 (12.0)		
	Pancreatic	15 (20.0)	4 (16.0)	5 (20.0)	6 (26.0)		

Characteristics		Total (n = 75)	RMG (n = 25)	TCMG (n = 25)	CG (n = 25)	χ2/F	p value
	Skin	2 (2.7)	1 (4.0)	0 (0)	1 (4.0)		
	Sarcoma	2 (2.7)	1 (4.0)	0 (0)	1 (4.0)		
	Ovarian	5 (6.7)	2 (8.0)	1 (4.0)	2 (8.0)		
	Thyroid	1 (1.3)	0 (0)	0 (0)	1 (4.0)		
	Colon	3 (4.0)	2 (8.0)	1 (4.0)	0 (0)		
Chemotherapy, *n (%)*	AC (Adriamycin + Cyclophosphamide)	19 (25.3)	6 (24.0)	7 (28.0)	6 (24.0)	4.242	0.936
	Carboplatin	22 (29.3)	9 (36.0)	7 (28.0)	6 (24.0)		
	FOLFOX (Oxaliplatin + 5-fluorouracil)	18 (24.0)	6 (24.0)	6 (24.0)	6 (24.0)		
	GC (Gemcitabine + Cisplatin)	2 (2.7)	1 (4.0)	0 (0)	1 (4.0)		
	Gemcitabine	2 (2.7)	1 (4.0)	0 (0)	1 (4.0)		
	PC (Paclitaxel + carboplatin)	12 (16.0)	2 (8.0)	5 (20.0)	5 (20.0)		
STAI-T, *mean ± SD*		41.13 ± 6.42	41.20 ± 6.21	40.28 ± 5.20	41.92 ± 7.75	0.403	0.670

SD: standart deviation; RMG: relaxing music group; TCMG: Turkish classical music group; CG: control group; CAD: Coronary artery disease; COPD: Chronic obstructive pulmonary disease; STAI-T: State-Trait Anxiety Inventory – Trait; a: some patients had more than one comorbidities.

Table 3
Repeated measures for primary and secondary outcomes in the groups at baseline and post-intervention

Outcome variables	RMG (mean ± SD)	TCMG (mean ± SD)	CG (mean ± SD)	Between Group Comparisons			Mixed design Repeated Measures ANOVA test		
				RMG vs. TCMG	RMG vs. CG	TCMG vs. CG			
				p value	p value	p value	F	$\varvec{\eta}^2$	p value
Anxiety									
T0	38.44 ± 4.27	37.88 ± 4.46	39.52 ± 6.73	0.999	0.998	0.998	270.602	0.790	**0.001**[a]
T1	28.12 ± 3.34	27.60 ± 3.12	39.84 ± 6.23	0.911	**0.001**	**0.001**	74.208	0.333	**0.001**[b]
							210.221	0.745	**0.001**[c]
Nausea									
T0	2.60 ± 1.04	2.56 ± 0.65	2.54 ± 0.64	0.996	0.996	0.998	145.497	0.669	**0.001**[a]
T1	1.12 ± 0.33	1.08 ± 0.27	4.08 ± 0.78	0.994	**0.001**	**0.001**	28.368	0.173	**0.001**[b]
							100.785	0.583	**0.001**[c]
Satisfaction									
T1	7.88 ± 0.72	8.64 ± 0.95	7.00 ± 0.70	**0.004**	**0.001**	**0.001**			

SD: standart deviation; RMG: relaxing music group; TCMG: Turkish classical music group; CG: control group; a: time effect; b: group effect; c: groupxtime effect; T0: baseline; T1: post-intervention; values highlighted in bold = $p < 0.05$

Discussion

The findings of this three-arm, randomized controlled trial showed that music interventions reduced anxiety and nausea compared to standard care, regardless of the type of music intervention, in cancer patients receiving CT for the first time. This suggests that the positive neurological effects of music in areas such as cognitive function and emotion may be useful in controlling adverse symptoms of cancer patients. Therefore, the results obtained from our study suggest that the development of music algorithms and the implementation of music therapy protocols during CT sessions, especially starting from the initial CT process, may be authorized for cancer patients.

We investigated the calming and anxiolytic effects of music in our study by choosing relaxing and peaceful compositions (60–66 and 60–80 bpm). We aimed to see the effect of both cultural and familiarity characteristics of music by choosing TCM, a more preferred music genre in Turkish culture, as an intervention arm of our study. Culturally familiar music is recommended as part of an effective music intervention since it is more likely to encourage the individual's initial engagement and evoke positive memories [36]. In the other intervention arm of the study, we preferred an RM based on nature sounds that are less familiar compared to TCM but have the ability to overcome language, social and cultural barriers. Although culturally unfamiliar music is perceived as strange by the individual at the initial stage, it is reported that it can affect different regions in the brain and provide stronger cortical activity and neurological

interaction compared to more familiar music [37, 38]. Adherence to the music sessions of at least 60 minutes in length was high. According to the feedback we received from our patients who completed the music session properly, the acceptability of both music interventions was high. However, some patients also expressed a desire to listen to their preferred music, which suggests that future study designs may take into account the patient's favorite or preferred music genres.

The results of the primary and secondary outcomes on anxiety, nausea, and satisfaction level indicate a prospect of benefiting from the music intervention regardless of the genre. The STAI (STAI-T and STAI-S), which assessed the patients' level of anxiety, showed homogeneous moderate anxiety in all groups at baseline. Anxiety was significantly lower in both RMG and TCMG compared to the CG (standard care) after the intervention. Previous studies reported that music effectively reduces anxiety in cancer patients [23, 24, 39, 40], which is in line with the results of our study. However, although the patients in the TCMG had higher levels of satisfaction and listening time, the TCMG and RMG did not differ significantly in controlling anxiety. This may have been because the sample consisted of patients newly diagnosed with cancer and patients receiving CT for the first time. A cancer diagnosis can be an unexpected life-changing event for patients and their families. Patients may experience various reactions such as shock, denial, confusion, sadness, anger, guilt, and resignation when informed about the diagnosis. In addition to emotional turmoil, patients often have to quickly acquire new information to cope with the new situation, form treatment plans together with healthcare professionals, and understand their care options [41, 42]. This process can further increase patients' anxiety levels. Therefore, patients might be inclined to need to relax and calm down regardless of the type of music. As a matter of fact, in open-ended questions in which patients reported their thoughts about music therapy during the CT process and their expectations from healthcare professionals, they stated that they were highly satisfied with the music, but they needed more information about the disease process and wanted different non-pharmacological options to be offered in addition to music.

In addition to physiological stimuli, psychological stimuli, such as anxiety caused by the stress response, may cause some unpleasant GI symptoms such as nausea and vomiting [43]. In light of this theory, we aimed to evaluate the nausea that might be caused by anxiety associated with the new cancer diagnosis and the first CT experience. In the three groups, nausea, as measured by a 10-point VAS, was low at the baseline, and there was no significant difference between the groups. Compared to the baseline, there was a decrease in post-intervention nausea in the RMG and TCMG, whereas there was an increase in the CG. Considering that all patients in the study sample received premedication treatment with strong antiemetics before CT, the fact that patients still reported nausea, even at a low level, suggests that it may be related to anxiety. Therefore, there might have been a linear decrease in the level of nausea associated with the decrease in anxiety in the intervention groups. However, it should be kept in mind that the majority of patients in this study received CT protocols such as carboplatin and AC, which are known to cause moderate to high levels of nausea [44]. In order to better clarify the effect of music on anxiety-related nausea, it may be recommended that future studies continue music therapy in the subsequent treatment sessions and evaluate patients by increasing the number of music sessions.

Although we did not examine the effects of multi-session music on the patients’ response, our findings suggest that at least one hour of music therapy may improve anxiety and nausea outcomes in patients receiving CT for the first time. However, further studies comparing session frequency, music duration, or music preferred by patients are needed to clarify the potential benefits of music.

Limitations

This study has limitations that should be considered. The study was conducted in a single center, only with patients receiving CT for the first time. Therefore, it may not be generalized or representative. Further multicenter studies with a

larger sample size are needed to confirm the findings of the current study. The use of self-reported measures to assess changes in patient outcomes might have led to social desirability and recall bias. The study evaluated the short-term effects of listening to music and did not include any follow-up for ongoing CT cycles. Blinding of patients and practitioners was not possible due to the nature of the study. The music in the current study was selected by the researchers and was not intended to provide the patient's preferred music, which has been reported to be more effective in some studies. Future studies may offer participants more music options according to their preferences. Another limitation is the lack of selection criteria or stratification parameters based on other subgroups, such as being more or less anxious, CT protocol, or cancer stage, in case a different confounding effect was present. As in other trials for complementary therapies, adjunctive treatment designs (i.e., administration of complementary therapies with standard drugs) limit the ability to isolate the effects of the complementary intervention from the overlapping effects of pharmacological intervention.

Conclusion

The results of this study highlighted that relaxing and traditional music can reduce anxiety and nausea in patients receiving CT for the first time. It was also found that the patient's satisfaction level increased after listening to music, especially when symptoms were reduced with music originating from their cultural background. Music is safe, inexpensive, and effective, thus, providing a simple, complementary, and alternative therapy. Nurses and other healthcare professionals can easily utilize music to control adverse effects in cancer patients, starting with the first course of CT. Future study designs should consider including larger samples, using patient-preferred music, extending the time frame for data collection including the subsequent CT sessions, and conducting follow-ups to determine any long-term benefit of music interventions.

Declarations

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Authorship Contributions

All authors contributed to the study conception and design. Material preparation, intervention and data collection were performed by ÖED and DAD. The full manuscript was written by ÖED, DAD, SP and YY and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data Availability

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

Ethics approval and consent to participate

The study was conducted according to the Declaration of Helsinki. Ethics committee approval was obtained from the Clinical Research Ethics Committee at xxx University School of Medicine (Decision number: 2022-13/18); other required permissions were granted by the institution where the study was conducted. Before baseline measurements and group

assignments were done, each participant was informed about the study and written informed consent for participation was obtained. Participation was voluntary. Participants had the right to leave the study at any time without affecting their treatment or services in any way. Patients' privacy was protected by ensuring anonymity and withholding personal information throughout the research process. The study protocol was registered on ClinicalTrails.gov (Registration number: NCT05687838).

Consent for publication

N/A.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Figures

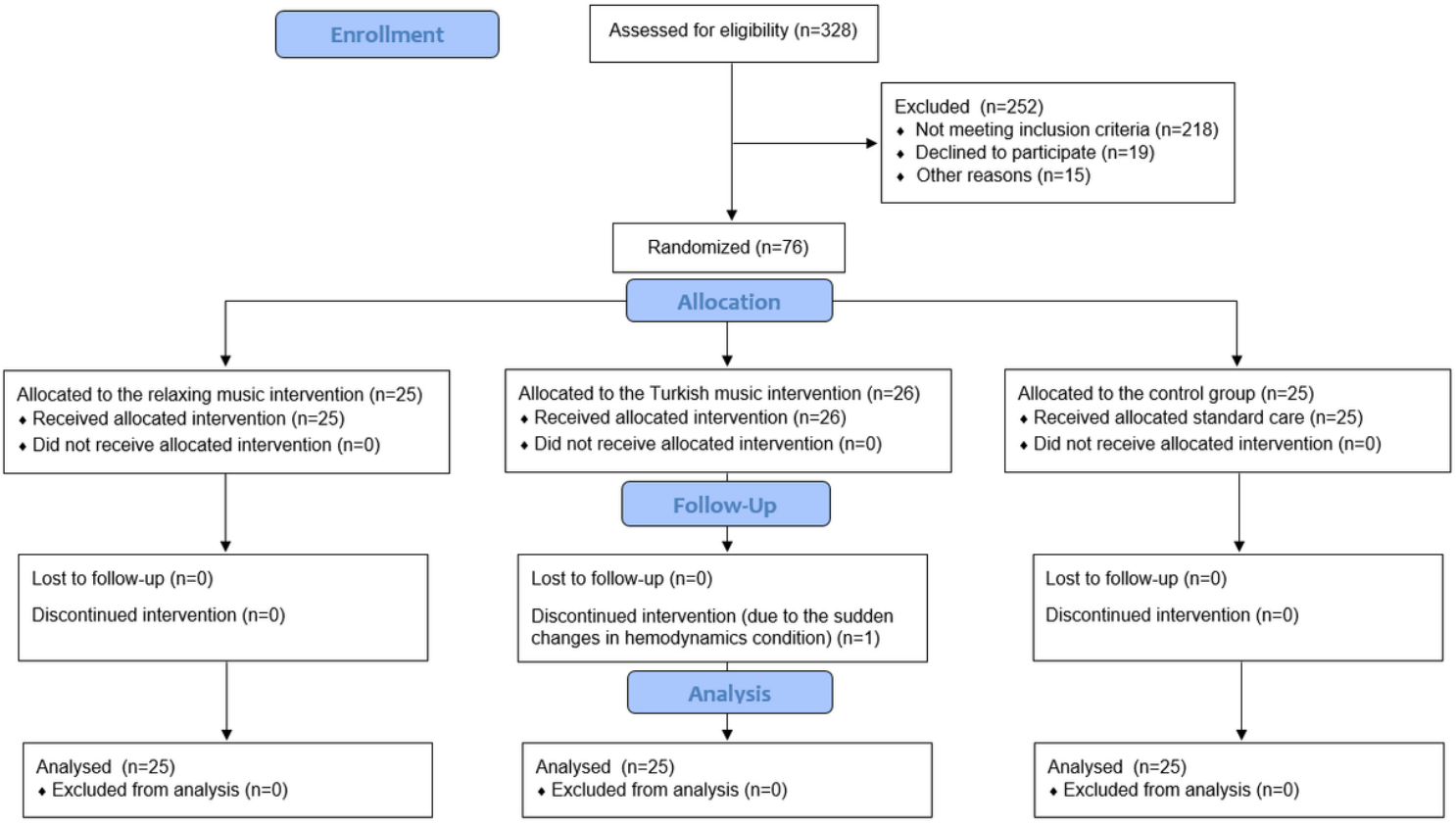

Figure 1

The flowchart for the participant recruitment and group allocation procedures

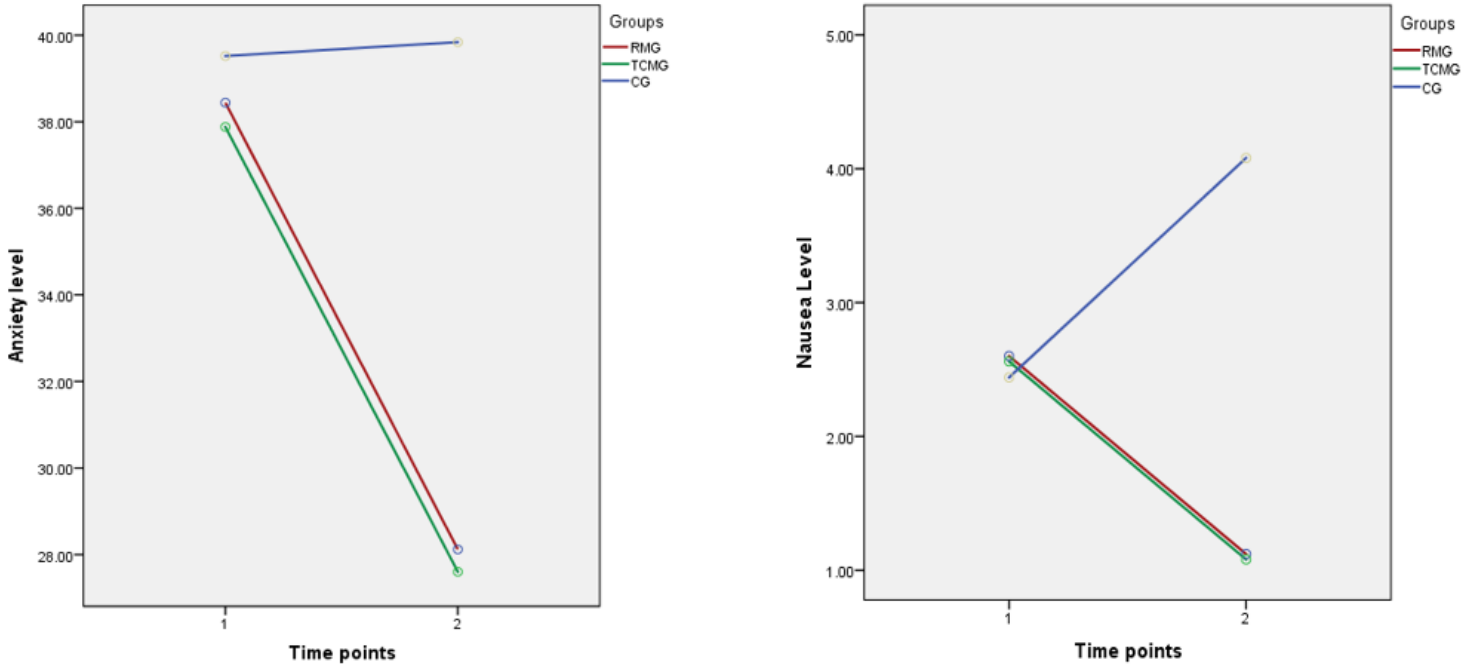

Figure 2

The changes in levels of anxiety and nausea in overall time points according to the groups