



# The Effect of Music Therapy on Pain, Anxiety, Perceived Stress, and Biochemical Parameters in Hospitals Among Patients with Cancer

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## Abstract

**Background:** Diagnosis of cancer and its long and hard treatment process induce great stress and anxiety in patients. Cancer patients may also suffer from severe pain due to their primary disease, metastases, or the received treatments. However, the patients' chief physical complaint is the main aspect that physicians pay attention to, and the mental health of these patients is usually neglected.

**Objectives:** This study aimed to predict the effect of music therapy (MT) on pain, perceived stress, anxiety, and biochemical parameters in patients with cancer.

**Methods:** This semi-experimental study was conducted on cancer patients referring to the Oncology Clinic at Amir Hospital in Shiraz (affiliated with Shiraz University of Medical Sciences) from April to September 2016. A total number of sixty cancer patients were recruited using a random sampling method and divided into two groups of control and intervention. Patients in the intervention group listened to light music for at least 20 minutes for 8 weeks (two continuous sessions weekly). After the intervention group, a follow-up test and questionnaires were conducted on both groups. Data were analyzed by SPSS version 21 using the *t*-test, chi-square test, and paired *t*-test.

**Results:** The results of this study showed that the control group had no significant difference regarding the McGill Pain Questionnaire (MPQ) (P-value = 0.797), cortisol (P-value = 0.841), and the Perceived Stress Scale (PSS) (P-value = 0.001) variables before and after the study, but it had a significant increase in the Beck Anxiety Inventory (BAI) (P-value = 0.026). Our findings indicated a significant difference in the MPQ, BAI, and cortisol variables in the MT group (P-value  $\leq$  0.001). In general, the PSS showed no significant difference between the two groups.

**Conclusions:** The results of the present study showed that MT for eight weeks, selected by patients from a list, could significantly reduce patients' anxiety, pain, and perceived stress. Therefore, we recommend the inclusion of this intervention in the routine care of patients with cancer.

**Keywords:** Music Therapy, Cancer Pain, Stress, Psychological, Anxiety, Music

## 1. Background

Cancer is one of the main health problems in today's world and the second leading cause of mortality, responsible for 8.8 million deaths worldwide in 2015 (1). An increasing trend in cancer incidence and mortality (46% and 33%, respectively, since 2005) has been reported in the Eastern Mediterranean region, which is estimated to be influenced by underlying factors such as population growth and aging (2), as well as an increased risk of exposure (1). Diagnosis is complicated since cancer is not an acute and discrete event but an experience of strong, recurrent trauma of indefinite duration. This is while

developed countries like the USA and European countries have reported decreased cancer incidence and mortality rates in recent years, showing the role of preventive measures and screening methods (3, 4).

In cancer patients, defining a traumatic stressor is a problem. It is difficult to single out and define a stressor within the multiple crises experienced by cancer patients during the fight against the disease. A stressor can be a diagnosis, the awareness that the disease can be fatal, a prolonged period of severe pain, symptoms and signs of relapse, aversive procedures, or staying in a room with a person who is dying or has died. Therefore, the

psychological problems in women with cancer require help throughout the diagnostic and therapeutic process. The most important point is that the patient should receive all relevant information promptly and that the source of information should be reliable, professional, and of high quality. About two-third of cancer patients do not develop chronic psychological disorders (5).

In addition to the high disease burden, cancer has a persistent nature, and most symptoms remain during and after treatment, significantly impairing patients' quality of life (6). Pain is a common symptom in patients with cancer, affecting 39.3% of these patients after curative treatment, 55.0% during anticancer treatment, and 66.4% in advanced and metastatic stages (7). Pain severity is reported as moderate to severe in nearly 40% of patients (7), and despite several treatments suggested, no major progress has been observed in managing cancer-related pain in the past decades (8).

Using a modified stress-disease-vulnerability model for cancer patients, we can define cancer and cancer treatment as stressors and patient adaptation as an outcome. Stressful life events and social support have been found to independently and significantly affect the emotional state of patients, and the social support level must be high to reduce the serious psychological distress of patients with malignant diseases (5).

In addition to the persistent pain and other symptoms, patients with cancer may suffer from a range of psychological problems, mainly since most types of cancers have no definite cure, and the treatment processes are long, costly, and probably associated with several adverse effects (9). Among different types of psychological disorders that may be present in cancer patients, depression and anxiety are the two most common disorders affecting such patients, with a prevalence of nearly 30%, varying based on the patient's age, cancer type, and disease duration (10, 11). Stress, fatigue, and lack of motivation caused by these psychological problems may decrease the patient's adherence to the medications and course of treatment (12). Therefore, assessment, screening, and treatment of patients' stress, anxiety, and depression are of great importance in cancer patients and should not be neglected (13).

The failure of medical treatments to manage pain and distress in such patients has resulted in the popularity of various complementary and alternative methods, such as music therapy (MT) (14). The relaxing effect of MT, used since World War II (15), has been suggested to reduce patients' pain, improve body movement, facial expressions, anxiety, and mood in those with advanced or chronic illnesses (16), and also decrease stress hormone levels (17). Studies on patients with

cancer have also suggested that MT reduces patients' pain, anxiety, and depression (18, 19). On the other hand, some meta-analyses have declared no efficacy for MT in patients' anxiety stemming from cancer (20), while some have determined its efficacy on patients' anxiety but not on their pain or depression (21). Other review studies have also declared the low quality and high risk of bias in studies investigating the effect of MT on patients' psychological and physical symptoms (22, 23). Due to the discrepancy in the results of studies and the significance of this issue in our country, the current study aimed to predict the effect of MT on pain, perceived stress, anxiety, and biochemical parameters in patients with cancer.

According to cognitive-behavioral learning theories, the main factor influencing adaptation to illness is thoughts about illness and its implications; however, in treatment, the primary goal of the cognitive-behavioral approach is to help patients learn how to regulate negative emotions.

Cognitive-behavioral treatment is structured, short-term (6 - 12 sessions), focused, problem-oriented, and instructive, develops through mutual cooperation, and uses homework, non-directive, behavioral, cognitive, and interpersonal techniques (5).

## 2. Methods

### 2.1. Study Design

This semi-experimental study was conducted on cancer patients referring to the Oncology Clinic of Amir Hospital in Shiraz (affiliated with Shiraz University of Medical Sciences) from April to September 2016. The study was approved by the Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.MED.REC.1395.178). In this study, a sample size of 30 patients per group was obtained based on a previous study (24) with a minimum mean difference of 2.42 in anxiety and depression measurements between MT and control groups after the intervention, standard deviations of 2.9 and 3.04, power 0.80 and type I error of 0.05 with 0.20 dropout rate. In this study, cancer patients aged 20 to 63 had a history of uncontrolled depression and anxiety. Thirty Patients were randomly assigned to each group using block randomization. Random sequences were generated by creating a blocked randomization list from [www.sealedenvelope.com](http://www.sealedenvelope.com) in blocks 4, 6, and 8. Patients were randomly assigned to two groups in a 1:1 ratio. Thirty cancer patients were selected as the control group, and 30 were selected as the MT group. In this study, the two groups were nearly matched regarding age, gender, education level, and disease stage.

## 2.2. Inclusion Criteria

The inclusion criteria included both female and male genders, aged between 20 - 63 years, type of cancer, no severe physical ailments, no medical history of past or present psychotic disturbances, elementary school as the lowest educational level, adequate conversation ability, and signed informed consent.

## 2.3. Exclusion Criteria

The exclusion criteria included unwillingness to participate in research as defined in the patient's informed consent, having other severe physical diseases, pregnancy, breastfeeding, and a positive history of past or present psychotic disorder, mental retardation, major personality disorder, permanent personality disorders, psychoactive substance or alcohol abuse during the last 3 months before the beginning of the research.

First, pre-test data were collected. Then, the experimental group was exposed to MT. At this stage, the control group received no experimental intervention, but in order to comply with ethical principles, a 45-minute counseling session was held for these patients, in which only the disease description was discussed. After eight sessions, both groups underwent a post-test, and a follow-up was carried out two months later.

The researcher explained the design and objectives of the study to the participants and asked them to read and sign the written informed consent. The participants were assured that they were free to leave the study at any time, and their refusal to participate in this study would not affect their treatment process. All principles of the latest version of the Helsinki Declaration on human studies were met throughout the study.

Data collection tools included serum measurement of cortisol and the Persian versions of the following questionnaires:

### 2.3.1. The Beck Anxiety Inventory

This questionnaire, designed by Beck and Steer in 1990 (25), measures patients' anxiety by a four-point Likert scale (scored as 0 - 3) in 21 questions on different symptoms of anxiety. The Persian version of this questionnaire, validated by Kaviani and Mousavi, confirmed its high internal consistency by Cronbach's alpha of 0.92 (26).

### 2.3.2. The McGill Pain Questionnaire

The McGill Pain Questionnaire (MPQ) is the most useful standard measure to assess pain. This scale contains a 78-word description of 20 subscales forming three main sensory, affective, and evaluative domains. Due to cultural differences, the questionnaire has been translated into

several languages. This study aimed to translate the MPQ into Persian and assess its reliability, validity, and acceptability in patients with cancer (27). The MPQ was designed by Melzack in 1975 and was validated on 297 patients with several types of pain (28). This questionnaire measures patients' pain in the following dimensions: Sensory (questions 1 - 10), affective (questions 11 - 15), evaluative (question 16), and type of pain (questions 17 - 21). If not relevant, the patient scores zero, and the final scores are then summed up; the higher score indicates higher pain perceived by the patient. The Persian version of this questionnaire was validated by Adelmanesh et al. in 2011, which indicated the internal consistency of the questionnaire by Cronbach's alphas of 0.951, 0.832, and 0.840 for sensory, affective, and total scores, respectively (29). The revised MPQ is rated on a Likert scale from 1 to 10, where feeling pain is scored 1, and very severe pain is scored 10. In the case of moderate conditions, the corresponding score is between 1 and 10 (24). Regarding reliability and validity, the validity of this questionnaire has been confirmed, and its reliability was calculated using Cronbach's alpha. The Cronbach's alpha coefficient for all dimensions was 0.85 ( $n = 84$ ), and the reliability coefficient was calculated to be above 8 in all areas (sensory, emotional evaluation, and miscellaneous). The reliability coefficient of the constituent groups maintained a significant relationship during the test (27).

### 2.3.3. The Perceived Stress Scale

The Perceived Stress Scale (PSS) was prepared in 1983 by Cohen et al. In this research, the 10-question version of the questionnaire was used, and the scoring method of the questionnaire is based on a five-point Likert scale. The lowest score obtained is zero, and the highest is 40, with a higher score indicating greater perceived stress. The results of Cohen et al.'s (30) research to investigate the scale's psychometric characteristics showed good reliability with Cronbach's alpha of 0.78 on this scale. In Iran, Khalili et al. demonstrated good validity and reliability of the Persian version of this scale, with Cronbach's alpha coefficient of 0.90 (31).

In the research of all three questionnaires, the reliability coefficients of internal consistency of the scale with Cronbach's alpha in the range of 0.84 to 0.86 have been obtained. The correlation coefficient was calculated with the clinical symptoms' dimensions to calculate the scale's criterion validity. In order to assess the validity of this scale, its correlation coefficient was calculated with the size of symptoms between 0.52 and 0.76.

In Iran, 10 expert professors at Mashhad University of Medical Sciences confirmed the content validity of

this questionnaire, reporting the questionnaire's content validity to be favorable.

Once the researcher explained how to complete the questionnaires to the participants, the participants completed the questionnaires in a quiet room, and the researcher was present to answer patients' questions while completing the questionnaires. Demographic characteristics of the patients, including gender, age, and marital status, were also recorded by the researcher. Then, the patients were referred to another center to measure their serum cortisol levels. Blood samples were taken twice at 8:00 AM and 2:00 PM because the hypothalamic-pituitary-adrenal (HPA) axis follows a circadian rhythm. Thus, cortisol levels will be high in the morning and low at night (31) (after listening to music). Blood samples were kept in gelatin clot tubes to separate the plasma; if not available, they were centrifuged. The samples were kept at room temperature before laboratory measurements. The serum cortisol levels were measured by the enzyme-linked immunosorbent assay (ELISA) method. The normal range was 5 - 25  $\mu\text{g/dL}$ .

Then, the participants selected their list of music (from a mixture of classic, pop, Iranian, and meditation music) based on their desire from the provided list and were referred to the center to listen to the selected list of music at our center, two 20-minute sessions weekly. The selected music was also given to the patients on a CD so that they could listen to it whenever they wanted. After 8 weeks, the case groups re-completed the questionnaires and were referred again to measure their serum cortisol levels. The primary outcome included the three questionnaires' scores and the patients' serum cortisol levels.

#### 2.4. Data Analysis

In this study, continuous variables were reported as a mean  $\pm$  standard deviation. Independent sample *t*-test for continuous variables. The paired *t*-test was used to analyze before and after the study. Categorical variables were reported as numbers and percentages. Also, the chi-square test was used to test the differences in the categorical outcome variables. Data were analyzed using SPSS version 21, and P-values  $< 0.05$  were considered statistically significant.

### 3. Results

Among the 60 eligible patients enrolled in the study, 6 were lost to follow-up. Finally, 54 patients completed the study with a mean score of  $44.06 \pm 12.19$  (age range = 21 - 63 years; 84.3% = female; 19.6% = single; 56% = academic education; 58% = housewives) in the Oncology Clinic at Amir Hospital in Shiraz between April and September 2016.

Table 1 shows no statistically significant difference between the two groups' demographic characteristics.

Table 2 shows no significant difference in the mean scores of MPQ (P-value = 0.055), PSS (P-value = 0.932), and Beck Anxiety Inventory (BAI) (P-value = 0.057) before the study. There was a significant reduction in the mean scores of MPQ and BAI between groups (P-value  $\leq 0.001$ , P-value  $\leq 0.001$ ). In contrast, there was no significant reduction in the mean score of PSS (P-value = 0.397) between groups.

There was no significant difference in the mean score of MPQ (P = 0.797) before and after the study within the control group. On the other hand, there was a significant reduction in the MPQ, PSS, and BAI in the MT group (P-value  $\leq 0.001$ , P-value = 0.002, P-value  $\leq 0.001$ ). The BAI increased significantly in the control group (0.026) (Table 3).

There was no significant difference in the mean cortisol score before the study, while it was significant after the study. On the other hand, unlike the control group, there was a significant reduction in the mean cortisol scores in the MT group.

### 4. Discussion

The findings of this study show the effect of MT on pain, anxiety, perceived stress, and cortisol levels in patients with cancer.

Several studies have been conducted on the effect of MT on different physiological and psychological symptoms of cancer patients (22). Each of these studies has used music in different disease stages, for example, during chemotherapy (32) or before surgery (33), during which patients may have had different conditions. In the present study, cancer patients and their mean baseline anxiety scores in the intervention and control groups ( $75.80 \pm 12.81$  and  $67.51 \pm 19.43$ , respectively) showed that all patients had high levels of anxiety, which could be due to persistent symptoms, hospitalization, disease duration, or long treatment processes, as suggested previously (10). The results of our study showed a significantly different decrease in the mean anxiety score in the intervention group after 8 weeks. Several studies have addressed the changes in cancer patients' anxiety scores after undergoing MT, but they have reported different results. A pooled analysis of cancer patients' self-reported anxiety showed a significant reduction in the mean anxiety score (-12.84) after undergoing MT (18), which is consistent with the results of the present study. Nevertheless, some other studies (34, 35) and the pooled analysis of a meta-analysis (20) revealed no significant difference in anxiety scores between the intervention and control groups. These discrepant results could be due to the fact that each study has used a different scale for measuring patients' anxiety,

**Table 1.** Demographic Characteristics of the Control and Intervention Groups

Variables	Music Therapy (N = 25)	Control (N = 29)	P-Value
Age	47.74 ± 13.96	41.14 ± 9.87	0.052
Gender, male	4 (16)	4 (14.3)	0.821
Marital status, single	6 (24)	4 (14.3)	0.340
Children ≥ 4	7 (28)	4 (18.2)	0.200
Academic education	7 (28)	5 (17.2)	0.347
Job			0.272
Employee	3 (12)	4 (14.3)	
Worker	0 (0)	0 (0)	
Free	3 (12)	4 (14.3)	
Housewife	13 (52)	18 (64.3)	
Retired	4 (16)	0 (0)	
Others	1 (4)	2 (7.1)	

**Table 2.** Comparing the Mean Scores of the McGill Pain Questionnaire, the Perceived Stress Scale, and the Beck Anxiety Inventory Between the Control and Intervention Groups

	Music Therapy (N=25)	Control (N=29)	P-Value	P-Value, Change Score (Difference Between Before and After the Study)
<b>MPQ</b>				< 0.001
Before the study	67.77 ± 16.91	59.96 ± 13.46	0.055	
After the study	29.47 ± 3.53	60.86 ± 14.73	< 0.001	
P-value	< 0.001	0.797		
<b>PSS</b>				0.482
Before the study	60.17 ± 12.29	59.93 ± 8.24	0.932	
After the study	49.41 ± 9.95	51.75 ± 10.95	0.397	
P-value	0.002	0.001		
<b>BAI</b>				< 0.001
Before the study	75.80 ± 12.81	67.51 ± 19.43	0.057	
After the study	28.90 ± 7.32	77.13 ± 18.36	< 0.001	
P-value	< 0.001	0.026		

Abbreviations: MPQ, McGill Pain Questionnaire; PSS, Perceived Stress Scale; BAI, Beck Anxiety Inventory.

**Table 3.** Comparing the Mean Cortisol Scores After and Before the Study Between the Control and Intervention Groups

Cortisol	Music Therapy (N = 25)	Control (N = 29)	P-Value
Before the study	29.51 ± 6.85	29.19 ± 4.35	0.838
After the study	16.17 ± 5.48	29.34 ± 3.66	< 0.001
P-value	< 0.001	0.841	

including the Hospital Anxiety Depression Scale (HADS), the State-Trait Anxiety Inventory (STAI), the Self-Rating Anxiety Scale (SAS), or the Visual Analogue Scale (VAS) (20). In addition, the types of music (live, Chinese, jazz, verbal relaxation, or wordless music) and different methods of listening have been used in different studies (such as using headphones or ambient music), which could be another

reason for the discrepant results of different studies (20). Also, the person selecting the music has been determined as an important factor affecting the effect size of MT on patients' pain, anxiety, and depression (19). In this study, we provided the patients an option to select their desired selection from a general list, which could be the factor for the significant effect of music on patients' anxiety.

Perceived stress is not only determined as the factor causing anxiety and depression in patients but also chronic stress has been identified to be associated with cancer progression (36). In this study, we examined patients' perceived stress by a valid questionnaire, and the results showed a high baseline level of stress perceived by the intervention and control groups ( $60.17 \pm 12.29$  and  $59.93 \pm 8.42$ , respectively), emphasizing the need to pay greater attention to the stress levels of patients with cancer. The results also indicated that MT could significantly reduce patients' stress in the intervention group and predict a 64% variation in stress in the patients.

Another important problem in cancer patients is persistent pain, impairing the quality of life (7, 37). According to the results of the present study, the total baseline scores of patients' pain were  $67.77 \pm 16.91$  in the intervention group and  $59.96 \pm 13.46$  in the control group, confirming the high pain levels in patients with cancer. In addition, studying the pain scores in the four pain dimensions showed that MT could predict the majority of variances of sensory, affective, and pain types (79%, 69%, and 65%, respectively), while the effect size of evaluative pain was not very large (34%). Huang et al. compared the effects of MT between 62 patients in the intervention group receiving MT (folk songs, Buddhist hymns, harp, and piano) for 30 minutes and the control group and reported a large effect size for the lower post-test pain scores in the intervention versus the control group; they concluded that music was very helpful for pain in cancer patients (38). These results are consistent with the results of the present study. However, most previous studies have the great limitation of using a visual analog scale or numeric rating scale for reporting the effect of MT on pain in cancer patients (18). The effect of MT on patients' pain can be attributed to the relaxing effect of music and distraction of the patient from the pain and also increasing patients' pain threshold by endorphin release (39).

In this study, we examined patients' serum cortisol levels of blood samples kept in gelatin clot tubes for separating the plasma, and the results showed high baseline cortisol levels in the intervention and control groups ( $29.51 \pm 6.85$  and  $29.19 \pm 4.35$ , respectively), emphasizing the need to pay greater attention to cancer patients' stress levels.

Patients with such a "severe and significant" disease as cancer due to ignorance should consider their psychological difficulties normal. Oncologists are primarily focused on treating the somatic conditions of patients; therefore, the patients' mental disorders remain unnoticed; if they do notice them, they often consider them part of a normal response. In addition, there are a small number of consultative-collaborative

psychiatrists in the field of oncology who work with cancer patients and are trained to diagnose these disorders.

#### 4.1. Conclusions

In conclusion, the results of the present study showed that cancer patients suffer from high levels of anxiety, pain, and perceived stress. Eight-week MT, selected by patients' from a list of classic, pop, Iranian, and meditation music, could significantly reduce patients' anxiety, pain, and perceived stress. The decreased serum cortisol levels after undergoing MT confirmed that this intervention caused physiological changes in patients. As the patients' psychological problems may be ignored by physicians, particularly in those with critical diseases, such as cancer, it is suggested that greater attention be paid to appropriate diagnosis and treatment of perceived stress and anxiety of cancer patients, for which MT is recommended to be included in the routine care of cancer patients and be taught to the students in medical schools, as it has been proven as an effective non-invasive measure without adverse effects and high costs of medications. The therapist-patient relationship is a key part of the treatment process, and the therapist can significantly influence the course of treatment with his or her personality and attitudes.

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#### Footnotes

**Authors' Contribution:** M. T., A. R., and S. B.: Substantial contribution to the conception design of the study, drafting and revising the study critically for important intellectual content, final approval of the version to be published, and investigating and resolving questions related to the accuracy or integrity of the study.

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