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Research Paper

A Study on Analgesic Effect of Music Interventions after Chemotherapy or Radiotherapy in Cancer Patients

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ABSTRACT

One of the most considerable side effects of chemotherapy and radiotherapy in cancer patients is pain. The pain that caused by these treatments can include muscle pain, stomach pain, headaches and pain caused by nerve damage. These pains can get better after treatment sessions but in some patients, permanent nerve damage cause severe symptoms after treatment. The present study examines the palliative efficacy of active and receptive music therapy cancer patients after chemotherapy or radiotherapy. 184 young adult cancer patients in age range of 20-40 years, who were undergoing chemotherapy or radiotherapy, have been studied inactive and receptive music therapy intervention groups, and a control group. Participants were questioned by McGill pain questionnaire visual analogue scale in pre-test and post-test after 10 sessions of active or receptive music therapy(with each session of 15-30 minutes). Results indicated significant differences in reduction in scores of pain from pre-therapy to post-therapy scores for both intervention groups as compared to no intervention group. Analyses of Covariance applied to compare these three independent groups revealed that active music therapy had the greatest impact on the reduction of pain as compared to the receptive music therapy group. The study has great implications for analgesic effect of music therapy in cancer patients during chemotherapy or radiotherapy.

Keywords: *Analgesia, Cancer, Chemotherapy, Music therapy, Pain, Radiation therapy.*

Cancer after cardio-vascular and cerebrovascular diseases is the third worldwide chronic disease that is increasing every year along with the growing technology and can become one of the most important reasons of death in humans (Gao, Chen, Lin & Han, 2015). On the other hand, advancement of science has lead to enhancing the percentage of cancer patient survivors and fighters in the world. But physical and psychological symptoms of cancer or side effects of cancer treatment, such as chemotherapy or radiation therapy can affect the life of oncology patients. One of the most annoying results of chemotherapy and radiation

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therapy is pain that can bother the patients after treatment for a long time. In cancer, pain can become part of each day of life, and it may cause the feeling of desperation and can lead to depression. So if the pain is not taken care of, consequently, the quality of life will decrease. More over, though there is medication for managing the pain, there are several psychological techniques that can be useful and can be used in conjunction with medication to effectively manage pain.

According to Arora and Kurkure (2010), the working mechanism of music is that it acts as a distracter that can cause self control perception in patients, controlling the breathing and heart beats, endorphin release in body and relaxation that can lead to counteract the pain. The distracting aspect of music can work as a moderator of pain by effecting on the cognitive component as in the gate control theory of pain. It has been found that music can be used as a clinical intervention and it helps a patient in decreasing the pain perception by making relaxation, rhythmic breathing, controlling anxiety and changing the mood positively (Hilliard, 2003).

Researchers found music therapy as an effective intervention for acute and chronic pain reduction (Guétin et al., 2012; Roy, Lebuis, Hugueville, Peretz, & Rainville, 2012; Korhan, Uyar, Eyigör, Yönt, Çelik & Khorshid, 2013). Other studies also have shown the analgesic effect of music listening that cognitively and emotionally influence the patients by distraction from the pain, anxiety, memory evoked emotions and relaxation (Mitchell, Macdonald & Brodie, 2006; Juslin and Västfjäll, 2008; Wiech & Tracey, 2009; Bernatzky, Presch, Anderson & Panksepp, 2011; Salimpoor, Benovoy, Larcher, Dagher & Zatorre, 2011).

Kwekkeboom (2003) compared the effects of music therapy and routine nursing care on pain in hospitalized patients and discovered that participants did not prefer using the headsets because it interfere with hearing the instruction of doctors, and it leads to more anxiety. As anxiety and pain have direct effect on each other, it is better to don't use headset for patients. According to Frank (1985); Ezzone, Baker, Rosselet & Terepka (1998) and Bozcuk et al. (2006) music is useful to lessen treatment side effects such as pain in oncology patients. Mitchell et al. (2006) found that music therapy effectively increased patients' tolerance to pain and enhanced perceived control over pain.

According to Akombo (2006) and Clark et al. (2006) music can be used as an intervention to increase pain management in cancer patients and they found that music therapy resulted in greater pain reduction than standard routine care. Clark et al. (2006) analyzed a subsequent analysis excluding his data resulted in a moderate effect of music on pain perception in 391 participants with cancer. Two trials compared the effects of music to other interventions. Shaban, Rasoolzadeh, Mehran & Moradalizadeh (2006) by comparing progressive muscle relaxation method and receptive music therapy in 100 participants realized that muscle relaxation is showing more effectiveness in pain reduction than listening to music.

In a meta-analysis research, Bradt, Dileo, Grocke, and Magill (2011) evaluated the effect of music therapy as intervention on psychological and physical problems in cancer. Results showed that music therapy, as an intervention is effective to improve anxiety, quality of life, mood, and pain by decreasing heart rate, respiratory rate, and blood pressure. Cholburi, Hanucharurnkul and Waikakul (2004) in a research has found that thirty minutes of patient-preferred music can reduce self-reported pain of hospitalized cancer patients.

The review of available literature revealed there was a lack of studies which, compared active music therapy's effectiveness with receptive music therapy. It was hypothesized that effectiveness of active music therapy as compare to receptive music therapy and routine treatment will be the highest on pain of cancer patients, in male as well as female patients.

MATERIAL AND METHODS

Sample

The sample was drawn from all inpatients, meeting the inclusion criteria, and those who have been admitted for cancer treatment through chemotherapy or radiation therapy at hospitals in Golestan province of Iran. In this province, the rate of cancer patients coming to the hospitals was very high at any time of observation. The initial sample for the study was approximately 700-800 cancer patients under treatment in Golestan province hospitals. The final sample comprised of 240 male and female cancer inpatients in the age range of 20-40 years, who met the inclusion criteria. The samples were selected based on purposive sampling. Participants were randomly assigned via a computer program to either the experimental groups or control group. Then the experimental group participants were randomly assigned to either of the two therapies viz. active or receptive music therapy groups. Fifty-six patients (30 males and 26 females) dropped-out for the following reasons: leaving the chemotherapy sessions, not being interested to participate anymore, physical inability, death, and incomplete questionnaires (figure 1). The final left out sample was 184 (97 males and 87 females) (figure 2).

Inclusion criteria:

- 20–40 years of age.
- At least six-months of cancer diagnosis.
- Being under chemotherapy or radiation therapy.
- Interested in playing one of the traditional musical instruments.
- Literate and having knowledge of Persian and English.
- Negative history of psychiatric disease.
- Mentally alert person.
- Appreciable deficits in hearing or vision.
- Voluntarily consented to participate in the study.
- Ability to see sufficiently to mark the Visual Analogue Scale (VAS)

Design

Participants completed McGill pain questionnaire visual analogue scale. Scores were obtained before and after the music therapy. Intervention groups received 10 sessions of

active or receptive music therapy with each session of 15-30 minutes. The control group received only routine medical treatment. Type of music in receptive music therapy was pop music, which was preferred by patients and the instruments used in active music therapy was guitar.

Figure 1: Flow chart showing the eligibility of the sample

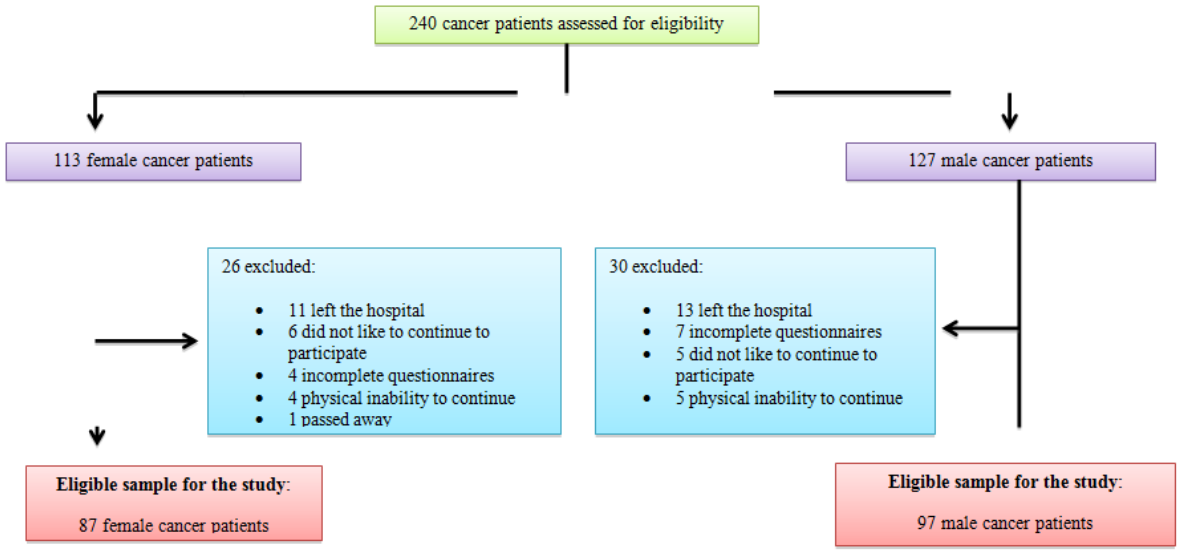
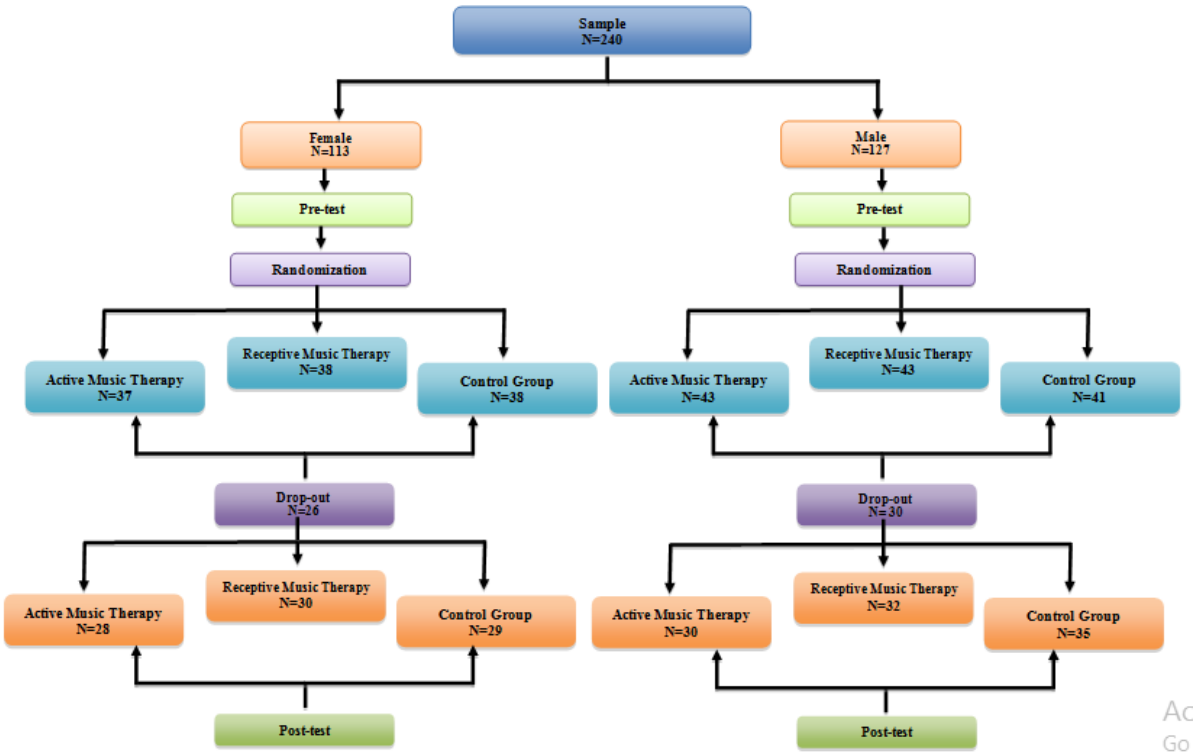


Figure 2: Flow chart showing the constitution of the sample



Ethics

The privacy of the information revealed by the participants and hospitals were ensured and all the participants were informed about the nature of the investigation. The participants had the choice of leaving in any phase of research.

RESULTS

A paired-samples t-test analysis found significant differences on overall sample on pain between pre-test and post-test ($t = 7.85$, $p \leq 0.01$) (Table 1), among pre-test and post-test Control group ($t = 2.19$, $p \leq 0.05$) (Table 1), among pre-test and post-test receptive music therapy group ($t = 8.17$, $p \leq 0.01$) (Table 1), among pre-test and post-test active music therapy group ($t = 9.47$, $p \leq 0.01$) (Table 1), among males pre-test and post-test ($t = 4.09$, $p < 0.01$) (Table 2), among females pre-test and post-test ($t = 7.11$, $p \leq 0.01$) (Table 4).

The mean scores of the aforementioned groups revealed groups of overall sample pain pre-test (M = 7.91), Control group pre-test (M = 7.92), Receptive music therapy pre-test (M = 8.04), Active music therapy pre-test (M = 7.77), males' pre-test (M = 7.98), females pre-test (M = 7.83), as scoring higher than groups of overall sample post-test (M = 6.56), control group post-test (M = 8.35), receptive music therapy post-test (M=6.33), active music therapy post-test (M = 4.86), males post-test (M = 7.10) and females post-test (M = 6.96) (Table 2 and Table 3).t-test indicated that scores of pain post-test in receptive music therapy group were significantly higher for the males (M = 6.87, SD = 2.39) than for the females (M = 5.7, SD = 1.91), $t (63) = 3.19$, $p < 0.01$ (Table 6).The scores of post-test in active music therapy group were significantly higher for the males (M = 28.66, SD = 8.33) than for the females (M = 3.92, SD = 1.96), $t (63) = 3.05$, $p < 0.05$ (Table 6).There was no significant difference for pain post-test scores of male (M = 8.48, SD = 2.27) and female (M = 8.2, SD = 2.14) in control group (Table 6).

The analysis of covariance was performed among cancer patients with three intervention groups (control group, receptive music therapy and active music therapy) and gender as the independent variable and pain as the dependent variable. Scores on the dependent variable administered prior to the intervention (Pre-test scores) were used as a covariate. After controlling the effect of pre-test scores on pain, the predicted main effect of sex was significant, $F (1, 177) = 17.012$, $p \leq 0.01$, $\eta p^2 = 0.088$ (Small). The interaction between sex and groups were also significant, $F (2, 177) = 3.183$, $p \leq 0.05$, $\eta p^2 = 0.035$ (Medium). The covariate, pre-test scores of pain, was significantly related to the music therapy effectiveness, $F (1,177) = 156.59$, $p \leq 0.01$, $\eta p^2 = 0.469$ (Table 7).

These results suggest that different types of music therapy had a significant impact on pain among cancer patients and revealed significant gender differences on the variable. Post-hoc comparisons using the Tukey HSD test indicated that the mean scores for post-test active music therapy (M=4.68) were significantly lower from receptive music therapy (M=6.30) and control group (M=8.35) (Table 8).Table 6 indicates that the active music therapy significantly

reduced pain among cancer patients as compared to the receptive music therapy and control group. Among gender as well, active music therapy revealed lowest scores on pain, while overall scores of females (M=3.92) showed substantial decrease than their male counterparts (M=5.73).

DISCUSSION

This study examined the effectiveness of music intervention on cancer patients' pain, who, were undergoing radiation therapy or chemotherapy. Findings of current study are congruent with other studies which identified that music may help to relieve pain that may be caused by cancer itself or by cancer treatment, and these supporting the hypothesis. Sahler et al. (2003) found that blood and marrow transplantation patients reported that their pain and nausea significantly decreased after receiving music therapy sessions twice a week. In the present study, two types of music therapies were used and pain reduction was studied. And according to participant reports, after 20 sessions of music therapy their pain significantly reduced.

As appreciation of music depends on cultural background and there is variety of musical styles in each part of the world, listening to music can emotionally engage by an individual attracting and holding attention, especially if individual's relationship with the song is strong. By this research, receptive music therapy applied by mp3 player (patients prefer pop music) and active music therapy (in which patients are involved in playing guitar and singing) is effective in relief from the pain, changing the perception of pain, and raise the control feelings over pain in cancer patients. Clark et al. (2006) claimed when participants have this option to select the music, which is playing, it can increase relief from pain and reduce perception of pain. Besides the benefits of listening to favorite preferred music and playing music, the nature of the music has also been shown to be important in enhancing how emotionally engaging it is for patients. Mitchell et al. (2006) found that, patient-preferred music listening greatly increased patients' tolerance to pain and enhanced perceived control over pain.

Music can reduce pain in several process such as: serve as a distracter, giving the patient a sense of control, causing the body to release endorphin to counteract pain, relaxes a person by slowing their breathing and heart beat. Present study findings are in line with results of research by Powers (2002) researches, which showed that music cause analgesia, especially when the patients preferred song or music used in therapy. Although the mechanism behind analgesic effect of music is not investigated yet, but Bernatzky et al. (2011); Hauck et al. (2013) suggested that music influence cognitively and emotionally on patients and effect on their pain perception.

According to Frank (1985); Ezzone (1998) and Bozcuk (2006); music is useful to lessen treatment side effects such as pain in oncology patients. Music has culturally and scientifically been recognized as an effective motivator of emotions and a modulator of mood (Baumgartner, Lutz, Schmidt & Jäncke, 2006; Juslin & Västfjäll, 2008; Fritz et al., 2009;

Bernatzky et al., 2011), and on the other hand, changed in emotions and mood can be effective in pain reduction (Tommaso et al., 2008; Villemure and Bushnell, 2009). It is not yet clear about the specific mechanisms of music therapy which help to reduce pain, however according to the evidences, the intrinsic and extrinsic factors of the music can influence indirectly on the pain via cognitive and emotional mechanisms (Bernatzky, Presch, Anderson & Panksepp, 2011; Roy et al., 2012; Hauck, Metzner, Rohlffs, Lorenz & Engel, 2013). The mechanism of analgesic feature of music is releasing the neurotransmitters such as dopamine that cause the regulation of autonomic system (Salimpoor et al., 2011). In the another study, Huang et al. (2010) showed the effectiveness of music therapy in which the participants listened to patients preferred music and found improvement in pain reduction significantly ($P < 0.001$).

In different studies, the analgesic effect of music therapy with mechanisms of distraction, reward (Kringelbach, 2005), reappraisal and expectation of pain relief (Wiech, Ploner & Tracey, 2008) was found. The music styles listened by the participants in this study was pop music. There is a cultural belief that classical music is better to reduce pain than any other type, which was probably started or exacerbated by the so-called "Mozart effect" that is not even related to pain perception (McKelvie & Low, 2010).

The findings of this recent study contribute to existing knowledge of the effectiveness of music therapy as an intervention to decrease pain of cancer patients undergoing chemotherapy or radiation therapy.

LIMITATIONS AND SUGGESTIONS

In music therapy there are some risks that may occurrence to the nature of these types of interventions, and although researchers attempt to decrease it, it will still remain as the risk of bias. The music therapist has to be present in the therapeutic sessions, so both the therapist and patients cannot be blinded and it effects the completing assignments. As the participants are not in blinded situation in the intervention, it can lead to bias when therapist ask them to report and explain about subjective outcomes such as pain (Bradt et al., 2011). Other limitation was the therapy duration that was less than one month and just 20 sessions. However, there is a need to check whether the effect of music therapy is sustainable or will give better results after follow-up or not.

The advantages of the present investigation are large number of participants involved in research, applying and comparing two types of music therapy interventions.

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TABLES

Table 1- Means, Standard Deviations and t-ratios for Group Differences

Control Group				t-ratio	Receptive Music Therapy				t-ratio	Active Music Therapy				t-ratio
Pre-test		Post-test			Pre-test		Post-test			Pre-test		Post-test		
Mean	SD	Mean	SD		Mean	SD	Mean	SD		Mean	SD	Mean	SD	
7.92	2.1	8.35	2.2	2.19*	8.04	2.22	6.33	2.23	8.17**	7.77	2.63	4.86	2.4	9.47**

*p≤0.05

**p≤ 0.01

Table 2- Mean, Standard Deviation and t-ratio for Group Differences Among Males

Control Group (Males)		N	Mean	Std. Deviation	Std. Error Mean	t-value
Pain	Pre-test	35	8.00	1.79	.30	1.55
	Post-test	35	8.48	2.27	.38	
Receptive Music therapy group (Males)						
Pain	Pre-test	32	8.03	2.29	.40	5.60**
	Post-test	32	6.87	2.39	.42	
Active Music therapy Group (Males)						
Pain	Pre-test	30	7.93	2.69	.49	5.18**
	Post-test	30	5.73	2.49	.45	

Table 3- Mean, Standard Deviation and t-ratio for Group Differences Among Females

Control Group (Females)		N	Mean	Std. Deviation	Std. Error Mean	t-value
Pain	Pre-test	29	7.82	2.56	.47	1.65
	Post-test	29	8.20	2.14	.39	
Receptive Music therapy group (Females)						
Pain	Pre-test	30	8.06	2.19	.40	6.75**
	Post-test	30	5.70	1.91	.34	
Active Music therapy Group (Females)						
Pain	Pre-test	28	7.60	2.61	.49	9.07**
	Post-test	28	3.92	1.961	.37	

Table 4- Means, Standard Deviations and t-ratios for differences among males and females

Males				t-ratio	Females				t-ratio
Overall Pre-test		Overall Post-test			Overall Pre-test		Overall Post-test		
Mean	SD	Mean	SD		Mean	SD	Mean	SD	
7.98	2.24	7.10	2.61	4.09**	7.83	2.43	5.96	2.64	7.11**

Table 5- Descriptive Statistics of Pre-test scores among Male and Female

Dependent Variable	Groups	Gender	N	Mean	Std. Deviation	Std. Error Mean	t-value
Pain	Control	Male	35	8.00	1.79	0.30	.31
		Female	29	7.82	2.56	0.47	
		Total	64	7.92	2.16	0.27	
	Receptive Music therapy	Male	32	8.03	2.29	0.40	.06
		Female	30	8.06	2.19	0.40	
		Total	62	8.04	2.22	0.28	
	Active Music therapy	Male	30	7.93	2.69	0.49	.46
		Female	28	7.60	2.61	0.49	
		Total	58	7.72	2.63	0.34	

Table 6- Descriptive Statistics of Post-test scores among Male and Female

Dependent Variable	Groups	Gender	N	Mean	Std. Deviation	Std. Error Mean	t-value
Pain	Control	Male	35	8.48	2.27	0.38	.50
		Female	29	8.2	2.14	0.39	
		Total	64	8.35	2.20	0.27	
	Receptive Music therapy	Male	32	6.87	2.39	0.42	2.12*
		Female	30	5.7	1.91	0.35	
		Total	62	6.30	2.23	0.28	
	Active Music therapy	Male	30	5.73	2.49	0.45	3.05**
		Female	28	3.92	1.96	0.37	
		Total	58	4.86	2.40	0.31	
	Overall sample	Male	97	7.1	2.61	0.27	
		Female	87	5.96	2.64	0.28	
		Total	184	6.56	2.68	0.19	

Table 7- Test of between subjects Effects - (2x3) ANCOVA-

Dependent Variable	Tests of Between-Subject effects					
	Source	Type III sum of squares	Df	Mean Square	F-value	Partial Eta Squared
Pain	Pre-test	409.80	1	409.80	156.59**	0.469
	Groups	365.43	2	182.71	69.81**	0.441
	Gender	44.52	1	44.52	17.01**	0.088
	Groups * Gender	16.66	2	8.33	3.18*	0.035
	Error	463.21	177	2.61		
	Total	1321.21	183			

Table 8- Post-Hoc Multiple Comparisons: Tukey

Groups		Mean Difference	Std. Error	95% C.I for difference	
				Lower Bound	Upper Bound
Control group	Receptive music therapy	2.14**	0.28	1.44	2.84
	Active music therapy	3.42**	0.29	2.71	4.13
Receptive music therapy	Control group	-2.14**	0.28	-2.84	-1.44
	Active music therapy	1.27**	0.29	0.56	1.99
Active music therapy	Control group	-3.42**	0.29	4.13	-2.71
	Receptive music therapy	-1.27**	0.29	-1.99	-0.56

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