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ORIGINAL ARTICLE

Influence of Music in Anxiety Reduction in 18F-FDG PET-CT Studies

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Abstract

Purpose: The purpose of this investigation was to find the anxiety levels, physical data and subjective perception and explore the relationship between demographic, clinical and cancer patients' variables, pre and post-procedure during a positron emission tomography/computed tomography PET-CT scan.

Methods: The sample was distributed in two groups (experimental and control group), 54 subjects in each group, with clinical indication for performing an 18F-2-fluoro-2-deoxy-D-glucose [18F]FDG-PET/CT scan. The study was conducted using an *ad hoc* questionnaire and the standardized State-Trait Anxiety Inventory (STAI) The pre-procedure questionnaire focused on demographic information, oncological situation, subjective perception of anxiety and STAI test. The post-procedure questionnaire included the subjective perception anxiety and STAI test after the procedure. Prior to the PET-CT, most of participants do not exhibited physical symptoms.

Results: Regarding the effectiveness of the intervention, we found a significant effect on the level of post-intervention subjective anxiety, controlling for the effect of pre-intervention anxiety levels ($F = 496.599$; $p = 0.000$; η^2 partial = 0.82). Statistically significant differences were found between the control group and the music group. With respect to the effectiveness of the music on the post-intervention STAI state anxiety score we found significant differences between the intervention group and controls ($F = 416.408$; $p = 0.000$; η^2 partial = 0.79). The music group (11.72) presented lower corrected mean scores on the post-intervention STAI state anxiety scale, showing statistically significant differences with the control group.

Conclusions: In conclusion, our work shows that relaxing meditative music can be used as a relaxation and anxiolytic mechanism as an integral multimodal part in patients during the uptake phase before PET-CT studies.

Keywords

Anxiety, Positron emission tomography, Music, Patient perspective, Oncology

Introduction

The notion that "music is medicine" has roots that extend deeply into the history of mankind through healing rituals practiced in preindustrial societies based on tribes. In contemporary society, music is still used to promote health and wellness in clinical settings, such as pain management, relaxation, psychotherapy and personal growth.

The potential therapeutic effects of listening to music have been largely attributed to its ability to reduce stress and modulate excitement levels. Listening to relaxing music (it is generally considered to have a slow rhythm, low tone and no lyrics) has been shown to reduce stress and anxiety in healthy subjects and in patients undergoing invasive medical procedures (e.g., surgery, colonoscopy, dental procedures, pediatric patients undergoing medical procedures or patients with coronary heart disease or surgery). It has also been found to reduce sedation, as well as pain and the

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need for an analgesic. These effects are conventionally considered due to the ability of music to distract or modulate the mood [1-4].

Therefore, listening to relaxing music has positive effects in reducing anxiety by facilitating relaxation by distracting the patient's attention from the negative sensation [5] and awareness of the time that passes may be less while focusing on the music, thus increasing relaxation.

A high percentage of patients who go to the Nuclear Medicine service to perform [18F]FDG-PET-TAC feel this experience as a threat that produces anxiety and restlessness, since by performing the test you can confirm or not the diagnosis of a disease, as well as assess the presence of relapse or response to treatment. In other cases they are completely unaware of why they have been referred, the treatment that will be administered to them, the test that will be done to them or whether they will have to do hospital or home isolation because of the radioactive component of the treatment administered [6].

Anxiety can occur during image acquisition in a Nuclear Medicine service for a number of reasons. People may experience claustrophobia due to the large and voluminous structure of the gamma cameras that are used, which are very close to the person. Radio phobia can also be a problem since patients can be prone to undue anxiety by using the word "nuclear" [7].

In addition, this presence of high anxiety may even cause false positives, as in the case of the uptake of the [18F]FDG-PET-CT. in muscles and brown fat [8-10] which leads to a decrease in image quality and therefore lower diagnostic performance.

Therefore, the presence of a patient with anxiety who goes to a Nuclear Medicine Service to perform a PET-CT scan can not only affect the usual workflow due to the need for more time to calm the patient or the need for more attention on the part of the infirmary, but they can give rise to the existence of artifacts which can complicate the diagnosis when interpreting the studies.

All of this shows the need to understand that anxiety must be evaluated, diagnosed and previously treated in order to guarantee an adequate doctor-patient relationship and a service based on the quality of care and the patient's biopsychosocial well-being. One of the ways of intervening about the anxiety presented by patients who go to a Nuclear Medicine Service to perform the [18F]FDG-PET-CT has to do with music. Little is known about the effects of listening to meditative music on anxiety in patients during the uptake phase before conducting the PET-CT study. However, some studies [11] that study the relationship between music and PET studies, demonstrate that relaxing meditative music can be used as an anxiolytic and that it is adequate as an integral part of the study modality PET-CT.

With all this, the objective of the present work is to evaluate the anxiety and effectiveness of an intervention based on listening to music for the reduction of anxiety in a sample of cancer patients who come to the Nuclear Medicine Service to conduct a study [18F]FDG-PET-TAC.

Methods

Patients

The present study is an analytical epidemiological study with pre/post-intervention measures with one intervention group and a control group, recruiting a total of 108 patients undergoing a PET-CT study. The sample was distributed in two groups (one experimental group and one control group), with 54 subjects in each group.

Patients are eligible if they meet the following criteria: (1) Over 18 years of age, (2) Oncological patients (i.e., those who had diagnosis of previous cancer of at least 2 months), and (3) Able to hear audio recordings. Patients are excluded if they are (1) Considered by the clinician to be too unwell to participate or (2) Unable to understand and complete the self-administered questionnaires.

The study simply comprised 108 participants, distributed in two groups (experimental and control) of 54 patients each. Mean age was 60.12 years (SD, 13.69). In general, participants presented no history of depression (96.3%), anxiety (93.5%), or family history of psychopathology (93.5%). Only 9.3% had knowledge of relaxation techniques. Regarding the current illness, the most frequent location of the primary tumor was the lymphatic system (22.2%), breast (21.3%), lung, (13.9) and cabeza y cuello (10.2%). Most of the patients had received treatment prior to the PET/ CT study; only 25% had not commenced treatment.

Measures

The study was conducted using an ad hoc questionnaire and the standardized State-Trait Anxiety Inventory (STAI) [12]. To assess the variables most directly related to patients' personal and medical data, an ad hoc questionnaire was designed including the most representative and characteristic variables relevant to the study. This ad hoc questionnaire contained questions on the following categories: (1) Sociodemographic data (age, gender, date of birth, educational background, job, marital status, number of children); (2) Family history of psychopathology (personal history of depression or anxiety, family history of depression or anxiety, knowledge of relaxation techniques or similar); (3) Data on current diagnosis (primary location of tumor, treatment received, reason for PET-CT); (4) Pre-intervention physical data (blood pressure [BP], heart rate [HR], feeling of dyspnea, digestive problems [nausea, vomiting], muscle tension and stiffness, dizziness and instability; level of subjective anxiety [0-10] at current time); and (5) Post-intervention physical

data (blood pressure [BP], heart rate [HR], feeling of dyspnea, digestive problems [nausea, vomiting], muscle tension and stiffness, dizziness and instability; level of subjective anxiety [0-10] at current time).

Procedure

This study was approved by the Clinical Research Ethics Committee (number HULP:4286) and the authors report no conflict of interest. After patients accepted and signed the informed consent, they were immediately assigned to one of the two groups: 54 in the experimental group (intervention based on music) and 54 in the control group. All patients initially completed a demographics ad hoc questionnaire and mood measures (STAI) followed by acquisition of a blood pressure (BP) and heart rate (HR) baseline. Immediately following [18F]FDG was injected in the waiting room and during this time, music group listened to MP3 intervention (described below), and only rest in the control group. Once the waiting time was over, the patients in both groups were taken for the PET/CT scan. Subsequently, following the diagnostic test, participants were administered the STAI questionnaire (post-test administration), as well as psychical parameters and the ad hoc questionnaire.

The patients in the experimental group were told that they were going to listen to a recording on an MP3 player with earphones in the 50-60-min waiting period during which they had to remain in a state of rest after being injected with the [18F]FDG before undergoing the study. Dan Gibson's music has been selected in this study based on recommendations and guidelines in which they recommend a number of features [13-15].

According to the guides studied, the selection of music that most relieved anxiety has characteristics of tempo, melody, harmony, etc., with the music classified as the most relaxing being the most likely to ascend (moving from low to high notes) and contain a narrow interval, that is, harmonious sounds. With these music the most common adjectives present in research are 'peaceful', 'serenity', 'sadness' and 'joy' [1,15,16].

Therefore, the selected music is a music that mixes compassionately balanced classical harmonies and sounds of nature (swamps, night sounds, thunder, light rain...) giving a mysterious, relaxing and captivating and harmonious sound.

Data analyses

Once the data were collected, we conducted statistical analysis using SSPS 22. We performed a univariate analysis to compare frequency distribution. We also conducted descriptive analyses (mainly means and standard deviations) and covariance analyses, which were used to measure the effectiveness of the intervention in modifying anxiety and different biomedical parameters. For the analysis, we took the post intervention measures of anxiety, HR and BP as dependent variables. The independent variable was the intervention group music status vs. control. Finally, we took the pre-intervention measures as covariates. Thus, we assessed the effects of the intervention on the two groups, taking into account the prior levels of each group.

Results

As regards the type of treatment received prior to the PET-CT study, the most frequent treatment was chemotherapy (20.4%). A total of 26.9% had not yet started treatment, with the PET-CT being used as an initial staging test (Table 1). The motives for performing the PET-CT study were monitoring treatment response (44.4%), initial staging (30.6%), and detection of recurrence (25%). This was the first PET-CT study for

Table 1: Patient characteristics.

Characteristic	Entire cohort (N = 108)
Age (median, SD)	60.12 (13.69)
Gender, n (%)	
Male	45 (41.7)
Female	63 (58.3)
Localización del tumor, n (%)	
Cabeza y cuello	11 (10.2)
Linfoma	24 (22.2)
Mama	23 (21.3)
Colorectal	7 (6.5)
Ginecológico	9 (8.3)
Pulmón	15 (13.9)
Esofagogastrico	6 (5.6)
Sarcoma partes blandas	2 (1.9)
Melanoma	4 (3.7)
TNE	3 (2.8)
Otros	4 (3.7)
Tratamiento, n (%)	
No tratamiento	29 (26.9)
Cirugía	14 (13)
QT	22 (20.4)
CX + QT	13 (12)
QT + RT	12 (11.1)
CX + RT	3 (2.8)
Todo	15 (13.9)
PET/CT Indication, n (%)	
Initial staging	33 (30.6)
Monitoring treatment	48 (44.4)
Relapse	27 (25)
PET previos, n (%)	
No (1ª vez)	57 (52.8)
Si (más veces)	51 (47.2)
Número de PET previos (median, SD)	1.03 (1.5)

Table 2: Descriptive statistics of the different pre and post-intervention measures of anxiety between two groups.

Statistic	Pre-intervention level of subjective anxiety	STAI pre-intervention state anxiety	STAI pre-intervention trait anxiety	STAI pre-intervention total anxiety	Post-intervention level of subjective anxiety	STAI post-intervention state anxiety	STAI post-intervention trait anxiety	STAI post-intervention total anxiety
Mean	5.91	28.01	16.36	11.56	3.46	20.28	16.33	3.69
Deviation	1.68	8.53	6.74	8.46	2.79	10.85	6.78	10.67
Minimum	1	9	4	-14	0	4	4	-35
Maximum	9	58	44	28	9	48	44	28

the majority of the patients (52.8%), compared with (47.24%) who had previously undergone one or more studies. The mean number of previous PET/CT studies per patient was 1.03 with a standard deviation of 1.5. No antihypertensive treatment was required by 85.2% of the sample before PET-CT; nobody needed anxiolytic treatment due to anxiety crisis during the procedure.

Prior to the PET-CT, participants exhibited no dyspnea (100%), digestive problems (98.1%), muscle stiffness (99.1%), or dizziness (93.5%). Similarly, after the test, they exhibited no problems of dyspnea, muscle stiffness, digestive problems (98.1%), or dizziness (95.4%). The mean diastolic blood pressure before the test was 71.01 with a standard deviation of 12.27; the mean systolic blood pressure before the test was 129.97 with a standard deviation of 12.81; and the heart rate was 70.51 with a standard deviation of 6.65. After the intervention, the mean diastolic blood pressure was 72.41 with a standard deviation of 9.47; the mean systolic blood pressure was 130.28 with a standard deviation of 12.23 and the heart rate was 70.28 with a standard deviation of 6.67.

The PET-CT results showed that 59.3% of the participants tested positive for metabolically active tumor tissue, compared with 30.6% who tested negative for tumor viability with 18F-FDG affinity. An associated infectious-inflammatory process was clearly detected in 4.6% of participants, while 5.6% presented doubtful findings which might be related to an acute infectious-inflammatory process, but the existence of metabolically active tumor tissue could not be ruled out. As regards tumor staging, 34.3 exhibited no staging; the tumor was metastatic in 24.1%, localized in 23.1%, and loco regional in 18.5%. No artifacts were detected in the immense majority of patients (97.2%), meaning no problems were encountered for diagnostic interpretation. Artifacts were detected in 2.8% of studies as a result of movements and due to patient preparation only in the control group. Presence of artifacts was never a consequence of Brown fat or muscle tension.

Regarding the effectiveness of the intervention, firstly, we found a significant effect on the level of post-intervention subjective anxiety, controlling for the effect of pre-intervention anxiety levels ($F = 496.599$; $p = 0.000$; η^2 partial = 0.82). Statistically significant differences were found between the control group (5.81) and the music group (1.11) in the corrected means of the level of post-intervention anxiety. With respect to the effectiveness of the music on the post-intervention STAI state anxiety score, controlling for the effect of the pre-intervention STAI state anxiety, we found significant differences between the intervention group and controls ($F = 416.408$; $p = 0.000$; η^2 partial = 0.79). The music group (11.72) presented lower corrected mean scores on the post-intervention STAI state anxiety scale, showing statistically significant differences with the control group (28.83).

The post-intervention STAI trait anxiety (Table 2) score yielded no significant differences between groups. This suggests that almost all the variability's in the post-intervention STAI trait anxiety scores were explained by the level of the pre intervention score. This confirms the stability of this variable, which coincides with our prior expectations based on trait anxiety being a personality characteristic.

Results for the post-intervention total STAI score reveal statistically significant effects for both the covariate (pre intervention total STAI) and the intervention group, with effect sizes between moderate and high (Table 3). This model explains 68% of the variance of the post-intervention STAI total scores. On assessing the means of the post-intervention total STAI scores corrected for the effect of the covariate, we found statistically significant differences between the control group (10.85) and the music group (-3.46).

In relation to systolic blood pressure, we did find statistically significant differences between the intervention group and controls ($F = 37.601$; $p = 0.000$; η^2 partial = 0.26). The music group (127.91) presented lower corrected mean scores on the post-intervention systolic blood pressure, showing statistically significant differences with the control group (132.65). Besides, there is a statistically significant differences in the post-intervention blood pressure diastolic ($F = 39.714$; $p = 0.000$; η^2 partial = 0.27) between the control group (75.41) and the music group (69.39). Finally, for the post-intervention heart rate variable, we found statistically significant effects of the covariate (pre intervention heart rate) and the music group. The model

Table 3: Results of ANCOVA on the post-intervention total STAI score.

	Type III sum of squares	*df*	Root mean square	*F*	*p*	η^2 partial
Corrected model	8389.094	2	4194.547	115.542	< 0.000	0.686
Interception	452.520	1	452.520	12.465	< 0.001	0.106
Pre-intervention total STAI	2856.418	1	2856.418	78.683	< 0.000	0.428
Intervention group	7081.057	1	7081.057	195.054	< 0.000	0.650
Error	3811.823	105	36.303			
Total	13675.000	108				
Corrected total	12200.917	107				

R^2 adjusted = 0.682.

Table 4: Results of ANCOVA on the post-intervention heart rate.

	Type III sum of squares	*df*	Root mean square	*F*	*p*	η^2 partial
Corrected model	4067.038	2	2033.519	307.387	< 0.000	0.854
Interception	109.959	1	109.959	16.621	< 0.000	0.137
Pre-intervention total STAI	3309.668	1	3309.668	500.289	< 0.000	0.827
Intervention group	392.499	1	392.499	59.330	< 0.000	0.361
Error	694.628	105	6.616			
Total	538170.000	108				
Corrected total	4761.667	107				

R^2 adjusted = 0.851

explains 85% of the variance of the post-intervention heart rate (Table 4). On assessing the means of the post-intervention heart rate scores corrected for the effect of the covariate, we found statistically significant differences between the control group (72.93) and the music group (67.63).

Discussion

This paper has measured the emotional change in patients who undergo PET-CT throughout brief hypnosis intervention with relevant results in well-being patients with cancer.

Broadly speaking, the data collected for the present work indicate that the primary location of the tumor for which the patients were to undergo a PET-CT study was the lymphatic system, followed by the breast, lung and head and neck. Chemotherapy is the most frequently administered treatment, according to international guides and protocols [17]. However, lymphoma appears in our sample as one of the three most frequent tumors. Hodgkin lymphoma is a more frequent pathology in young adult patients and on the other hand the PET-CT study is the fundamental and most important diagnostic tool for this pathology in all stages of the disease, from the initial staging, control of treatment, assessment of response at the end of treatment until therefore, it is a pathology in high demand in the Nuclear Medicine services, hence the highest percentage of lymphomas in our sample.

The most common reason for implementing the PET-CT studies was to monitor treatment, followed by initial staging and detection of recurrence. For most of the participants, however, this was their first experience of a PET-CT test, and for a large number, no antihypertensive treatment took previously. Indeed, in our study, nobody needed anxiolytic treatment during the procedure; this finding is important since many studies report the need to administer anxiolytics [18-20]. We find that most participants have no psychopathological history of anxiety or depression [21].

The participants exhibited no dyspnea, digestive problems, muscle stiffness, or dizziness either before or after undergoing the PET-CT. It is also worth noting the lack of artifacts generated during the test [22] as a result of patient movement or muscle tension, with the subsequent accumulation of brown fat, in our experimental group.

Focusing on the aim of the present work, total STAI score indicated the appearance of subjective and objective preintervention anxiety [6,23-25]. However, post-interventions, both the level of subjective anxiety and the standardized indicators, decrease. This finding highlights the effectiveness of an intervention of the type administered in the current study in reducing both subjective and objective anxiety.

As regards the effectiveness of the intervention conducted [26-28] in the present study, as expected, statistically significant differences were found between the music group and the control group in all the post-intervention anxiety measures (level of subjective

anxiety, STAI state anxiety score, and STAI total anxiety score). In contrast, the post-intervention STAI trait anxiety score showed no significant differences between groups. Furthermore, the music intervention was effective in reducing post-intervention HR.

Many studies have evaluated the effect of relaxing music on the anxiety of patients undergoing surgery or invasive procedures finding positive results in reducing anxiety. However, there are few studies that have studied the influence of music on patients who undergo a PET-CT scan.

In the work of Lee W, et al. [23], the effect of listening to meditative music on the level of anxiety and HR parameters in patients during the uptake phase before the PET test is evaluated. As in our study, the experimental music group after listening to 30-minute meditative music presents a significant reduction in their state of anxiety in all their measurements and in heart rate. The authors indicate that listening to meditative music can serve to distract patients' attention or avoid feeling uncomfortable before PET scans.

Thus, it seems to be evident that listening to music has the inherent ability to reduce the response to psychobiological stress, with neuroendocrine, autonomic, cognitive and emotional effects in the response to stress with improved levels of cortisol, alpha-amylase, heart rate , blood pressure, respiratory rate, subjective perception of stress and anxiety [11,29-32]. Therefore, in our case in relation to physical symptoms, the improvement in blood pressure and heart rate figures in the intervention group that receives the music recording are related to what the published works mentioned propose when there is a balance towards parasympathetic activity reflecting a state of relaxation in the experimental music group.

All of this suggests the relevance of implementing interventions based on listening to relaxing, meditative and sound-based music of nature with specific melodic characteristics in order to improve the levels of anxiety, discomfort and restlessness of the patients who attend PET-CT scan.

Along these lines, there is a strong appeal and interest for both patients and healthcare professionals regarding the use of music in healthcare settings, such as reception, waiting rooms, rooms, surgical room, etc. However, the evidence to support its integration into health care is equivocal.

In conclusion, our work shows that relaxing meditative music can be used as a relaxation and anxiolytic mechanism as an integral multimodal part in patients during the uptake phase before PET-CT studies. In addition, reducing anxiety has the potential to reduce the risk of false positives and improve image and image quality in the absence of artifacts.

Listening to music is safe, cheap, easy to implement, relieves anxiety and helps maximize efforts to promote the comfort and relaxation of patients undergoing a PET-CT scan. Therefore, it is encouraged to include initiatives such as the one presented in this paper, taking into account the recommendations made by the studies presented in our argument, as well as assessing its effectiveness and efficiency [33-36] for the best personal and emotional well-being of the patient attending a nuclear medicine service for the exploration of a PET-CT.

Finally, the present study has a number of limitations. In the first place, the sample size, although the results can be considered adequate, cannot be generalized to other areas of medicine because they can only be extrapolated to the nuclear medicine service. Secondly, the music has been chosen by the research team, which sometimes may not be liked by all participants.

Thirdly, one of the questionnaires used has been prepared "ad hoc" with the lack of validity and reliability thereof. Finally, the existence of little research in this field of the application of music in PET-CT studies for the reduction of anxiety and physical parameters.

Compliance with Ethical Standards

Conflict of interest

The authors declare that they have no conflict of interest.

Ethical approval

"All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards."

Informed consent

"Informed consent was obtained from all individual participants included in the study".

References

1. Evans D (2002) The effectiveness of music as an intervention for hospital patients: A systematic review. J Adv Nurs 37: 8-18.
2. Thaut MH, McIntosh GC, Hoemberg V (2015) Neurobiological foundations of neurologic music therapy: Rhythmic entrainment and the motor system. Front Psychol 5.
3. Stegemöller EL (2014) Exploring a neuroplasticity model of music therapy. J Music Ther 51: 211-217.
4. Soria-Urios G, Duque P, García-Moreno JM (2011) Música y cerebro: Fundamentos neurocientíficos y trastornos musicales. Revista de Neurolología 52: 45-55.
5. Johnson AJ, Elkins GR (2020) Effects of music and relaxation suggestions on experimental pain. Int J Clin Exp Hypn 68: 225-245.
6. Domènech A, Notta P, Benítez A, Ramal D, Rodríguez-

Bel L, et al. (2010) Evaluation of the anxiety state in patients receiving radioiodine treatment or who undergo a sentinel lymph node examination in the Nuclear Medicine Department. Rev Esp Med Nucl 29: 63-72.

7. Munn Z, Jordan Z (2011) The patient experience of high technology medical imaging: A systematic review of the quantitative evidence. JBI Libr Syst Rev 9: 631-678.
8. Freudenberg LS, Rosenbaum SJ, Beyer T, Bockisch A, Antoch G (2010) PET versus PET/CT dual modality imaging in evaluation of lung cancer. Thorac Surg Clin 20: 25-30.
9. Rosenbaum SJ, Lind T, Antoch G, Bockisch, A (2006) False-positive FDG PET uptake--the role of PET/CT. Eur Radiol 16: 1054-1065.
10. Kong MC, Nadel HR (2018) 18F-FDG PET/CT with diffusely high FDG uptake throughout subcutaneous adipose tissues. Clin Nucl Med 43: 762-763.
11. Walworth DD (2010) Effect of live music therapy for patients undergoing magnetic resonance imaging. J Music Ther 47: 335-350.
12. Spielberger CD, Gorsuch RL, Lushene R, Vagg PR, Jacobs GA (1983) Manual for the state-trait anxiety inventory. Consulting Psychologists Press, Palo Alto, CA.
13. Robb SL, Burns DS, Carpenter JS (2011) Reporting guidelines for music-based interventions. Music Med 3: 271-279.
14. Robb SL, Burns DS, Carpenter JS (2011) Reporting guidelines for music-based interventions. J Health Psychol 16: 342-352.
15. Gibson D (2006) Zen relaxation. Solitudes [CD-ROM]. USA & Canada.
16. Richards T, Johnson J, Sparks A, Emerson H (2007) The effect of music therapy on patient´s perception and manifestation of pain, anxiety and patient satisfaction. Medsurg Nurs 16: 7-14.
17. Ledesma D, Kumano H (2009) Mindfulness-based stress reduction and cancer: A meta-analysis. Psycho-Oncology 18: 571-579.
18. Sheldon LK, Swanson S, Dolce A, Marsh K, Summers J (2008) Putting evidence into practice: Evidence-based interventions for anxiety. Clin J Oncol Nurs 12: 789-797.
19. Helmus TC, Tancer M, Johanson C (2005) Reinforcing effects of diazepam under anxiogenic conditions in individuals with social anxiety. Exp Clin Psychopharmacol 13: 348-356.
20. Miyasaka LS, Atallah AN, Soares BG (2003) Valerian for anxiety disorder. Cochrane Database Syst Rev.
21. Novak SP, Hakansson A, Martinez-Raga J, Reimer J, Krotki K, et al. (2016) Nonmedical use of prescription drugs in the European Union. BMC Psychiatry 16: 274.
22. Zukotynski KA, Fahey FH, Laffin S, Davis R, Treves ST, et al. (2010) Seasonal variation in the effect of constant ambient temperature of 24 degrees C in reducing FDG uptake by brown adipose tissue in children. Eur J Nucl Med Mol Imaging 37: 1854-1860.
23. Lee WL, Sung HC, Liu SH, Chang SM (2017) Meditative music listening to reduce state anxiety in patients during the uptake phase before positron emission tomography (PET) scans. Br J Radiol 90: 20160466.
24. Abreu C, Grilo A, Lucena F, Carolino E (2017) Oncological patient anxiety in imaging studies: The PET/CT example. J Cancer Educ 32: 820-826.
25. Vogel W, Valdes-Olmos R, Tijs T, Gillies M, van Elswijk G, et al. (2012) Intervention to lower anxiety of 18F-FDG PET/CT patients by use of audiovisual imagery during the uptake phase before Imaging. J Nucl Med Technol 40: 92-98.
26. Kabat-Zinn J (1990) Full catastrophe living. Delta Books, New York.
27. Kabat-Zinn J (2009) Full catastrophe living. Bantam Dell, New York.
28. Kabat-Zinn J, Lipworth L, Burney R (1985) The clinical use of mindfulness meditation for the self-regulation of chronic pain. J Behav Med 8: 163-190.
29. Binns-Turnes P, Wilson L, Pryor E, Boyd G, Prickett C (2011) Perioperative music and its effects on anxiety, hemodynamics and pain in women undergoing mastectomy. AANA J 79: S21-S27.
30. Zhang ZS, Wang XL, Xu CL, Zhang C, Zhi C, et al. (2014) Music reduces panic: An initial study of listening to preferred music improves male patient discomfort and anxiety during flexible cystoscopy. J Endourol 28: 739-744.
31. Evanovich K, Benavage A, James P, Easter K, Pontieri-Lewis V, et al. (2014) The effects of music on pain and anxiety during screening mammography. Clin J Oncol Nurs 18: E45-E49.
32. Vanderboom T, Arcari P, Duffy ME, Somarouthu B, Rabinov JD, et al. (2012) Effects of a music intervention on patients undergoing cerebral angiography: A pilot study. J Neurointerv Surg 4: 229-233.
33. Rossetti A, Chadha M, Torres BN, Lee JK, Hylton D, et al. (2017) The impact of music therapy on anxiety in cancer patients undergoing simulation for radiation therapy. Int J Radiat Oncol Biol Phys 99: 103-110.
34. Jayakar JP, Alter DA (2014) Music for anxiety reduction in patients undergoing cardiac catheterization: A systematic review and meta-analysis of randomized controlled trials. Complement Ther Clin Pract 28: 122-130.
35. Wu PY, Huang ML, Le, WP, Wang C, Shih WM (2017) Effects of music listening on anxiety and physiological responses in patients undergoing awake craniotomy. Complement Ther Med 32: 56-60.
36. Shanmuganandan AP, Siddiqui MRS, Farkas N, Sran K, Thomas R, et al. (2017) Does music reduce anxiety and discomfort during flexible sigmoidoscopy? A systematic review and meta-analysis. World J Gastrointest Endosc 9: 228-237.