Original Article

The Effect of Music Therapy on the Sleep Quality of Patients with Heart Failure: The Miracle of Nature Music

Abstract

Background: Patients with heart failure experience poor sleep quality due to the nature of disease they suffer from. The aim of this study was to investigate the effect of music on the sleep quality of patients with heart failure. **Materials and Methods:** The present study is a randomized clinical trial, which was performed on 76 patients with heart failure, hospitalized in the cardiac ward of an educational hospital. These patients had obtained a score of 5 or higher on Pittsburgh's sleep quality index. The block randomization method was used to generate the allocation sequence. Thus, the number of subjects in each block was determined to be 4 people in 18 blocks. Intervention was collection of nature music played through headphones for 30 minutes over three nights, and at the end of the third night, the Pittsburgh's index was completed again by both groups. Data were analyzed using descriptive and inferential statistics. **Results:** After the intervention, the mean scores of mental quality of sleep ($p = 0.007$) and daily function disorders improved significantly in the intervention group ($p = 0.025$). Significant differences were seen between the mean scores of mental quality of sleep ($p < 0.001$), daily function disorders ($p = 0.002$), delay in falling asleep ($p = 0.01$), sleep disorders ($p < 0.001$), and use of sleeping pills ($p < 0.001$) before and after the intervention in the intervention group. **Conclusions:** Playing relaxing music like nature sounds and spending time in nature after discharge can improve the sleep quality and sense of relaxation in patients with heart failure. The implementation of such affordable and amusing interventions can be proposed by nurses in heart failure patients.

Keywords: *Heart failure, music, sleep quality*

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Introduction

Heart failure is known as a new epidemic in cardiovascular diseases,[1] which affect 37.7 million people worldwide.[2,3] In Iran, the incidence of heart failure is higher than that in other countries in the region and probably in the world, and its prevalence is reported to be 8%.[4,5] Heart failure is a highly debilitating and costly disease, so 29% to 47% of patients with heart failure will be re-admitted 3 to 6 months after initial discharge.[6]

Redeker and Stein's study showed that more than 60% of patients with heart failure suffer from sleep problems.[7] In Iran, 90% of patients with heart failure have poor sleep quality,[8] of whom only 2% are diagnosed and treated.[9] Continued poor sleep quality along with other causes leads to re-admission of patients with heart failure.[10,11] Getahun (2021) states that sleep disorder reduces the quality of life in patients with heart failure.[12] Edmealem (2020) showed that self-care activities reduce due to sleep disorders[13] in patients with heart failure; therefore, there is a need for sleep quality improvement.

Today, new interventions are needed to control the complications of heart failure, such as poor sleep quality. Among these interventions are complementary and non-pharmacological therapies that have been highly regarded due to their positive effects and no side effects.[14] One of these interventions is music therapy.[15] The use of music as a nursing intervention[16] and treatment[14] and also as an inexpensive, non-invasive, and uncomplicated method[4] plays an important role in cardiac care. It is important to note that taking such steps (performed by nurses) is critical to pave the way for professional independence.[17] In the past 2 decades, due to the popularity and complementary role of music in treatment and health care, the tendency to use this

How to cite this article: Hosseini N, Seylani K, Matourypour P, Fakhrodini M, Haghani H, Zakerimoghadam M. The effect of music therapy on the sleep quality of patients with heart failure: The miracle of nature music. Iran J Nurs Midwifery Res 2024;29:424-30.

Submitted: 15-Dec-2022. **Revised:** 01-Dec-2023. **Accepted:** 25-Dec-2023. **Published:** 24-Jul-2024.

Access this article online

Website: https://journals.lww.com/jnmr

DOI: 10.4103/ijnmr.ijnmr_385_22

Quick Response Code:

method has increased as a nursing intervention in patient care.[18] The effects of music can be found in clinical studies. For instance, in the field of heart disease, these positive effects can be seen in cardiac catheterization,[19] open heart surgery,[20] post-operative heart rehabilitation,[21] hypertension,[22] and cardiovascular disease.[23] However, no study has examined the effect of music on patients with heart failure. New age music style, which is referred to as nature music, was born in Europe and America in the late 1960s. The purpose of this style of music is to achieve peace of mind.[24] Music of nature sounds is a combination of classical music and sounds of nature such as birds, waves, wind, and water flow, which as a complementary medicine has achieved satisfactory results in relaxing and improving the physical and mental statuses of patients in different age groups.[25]

In the Psycho Neuro Immune Endocrine (PNIE) theory introduced by Fancourt and colleagues, the effect of music on psychology, neurology, immunology, and endocrinology has been investigated. The authors of this study believed that music can affect health through a combination of personal, social, auditory, and physical factors. Listening to music includes two features: the characteristics of music itself (such as the pitch, the song, and the psychological effect of the music) and personal characteristics (such as one's liking or disliking the music and familiarity or lack of familiarity with the music). The PNIE framework suggests that these factors influence the body's psycho-physical systems through psychological well-being, cardiovascular improvement, a decrease of stress hormones, and adjustment of immune system biomarkers. For example, music can affect a wide range of physiological and psychological systems as a therapeutic agent and in the long term.[26] Therefore, considering the physical, social, and psychological aspects of the disease and also the complications of conventional treatments, decreasing the disease symptom can improve sleep quality and psychological well-being of patients. On the other hand, in similar studies in the past, which examined the quality of sleep using Pittsburgh's questionnaire, the quality of sleep was analyzed in general, but the quality of sleep in various areas was just described and not discussed. Considering the advantages of nature music as an independent, affordable, and amusing nursing intervention for patients and taking into account the chronic nature of heart failure, this study was conducted to investigate the effect of nature music on the sleep quality of patients with heart failure.

Materials and Methods

This study, which is a randomized controlled clinical trial (IRCT2019010929321), is part of a larger study conducted between 2018 and 2019. The research environment in this study was the cardiac ward of an educational hospital. The study population included all patients with heart failure who met the inclusion and exclusion criteria. Inclusion criteria included II to IV functional heart failure classified by New York Heart Association (NYHA) and diagnosed by a physician and documented in the clinical record, having the ejection fraction of less than or equal to 40, being between 18 and 80 years old, having low sleep quality based on the Pittsburgh sleep quality index (a score of more than 5), having a stable disease status (stable hemodynamic, absence of diagnosed psychological disease, lack of hearing problems, and lack of an implantable cardioverter defibrillator), and being hospitalized in the cardiac ward. Exclusion criteria were unwilling to take part in the intervention and experiencing a decreased level of consciousness.

The required sample size was calculated to be 34 patients in each group based on the study of Gaffey *et al.*, with 95% confidence level, 80% test power, and standard deviation of sleep quality score (4.20) in each of the two groups,[8] assuming that the effect of music on the sleep quality of patients in the intervention group should be 2 points higher than that in the control group and to be considered statistically significant. However, taking into account the possibility of 10% sample drop, a total of 38 patients were considered for each group (76 patients in total) [Figure 1]. Random allocation was performed in the two groups of intervention and control by block random allocation. The allocation sequence was generated using the http://www.randomization.com/free web-based system. To generate the allocation sequence in this system, the number of subjects in each block was determined to be 4. In addition, letters A and B were considered for the intervention group and the control group, respectively. Finally, by confirming the allocation sequence in this system for 18 blocks, the allocation sequence for 76 subjects was produced by combining letters A and B.

The data collection tools used in this study included a demographic and disease information questionnaire and the Pittsburgh's last week sleep quality index. The demographic and disease information questionnaire was used to measure variables, such as sleep habits, age, sex, marital status, education, employment status, income level, smoking, and body mass index, as well as ejection fraction rate, heart disease classification (NYHA classification), co-morbidities (diabetes, hypertension, dyslipidemia, etc.), and medications. This questionnaire was completed using hospital records and questioning patients or their family members. The second questionnaire was related to sleep quality, for which the Pittsburgh sleep quality index was used. This tool was developed by Daniel G. Bayes and colleagues to measure sleep quality and also to help diagnose people who have good or bad sleep.[27] In this study, the Pittsburgh last week sleep quality index (PSQI PW) was used after obtaining permission from its author. This questionnaire consists of 10 questions in seven dimensions of sleep, including mental quality of sleep, delay in falling asleep, duration of sleep, sleep adequacy,

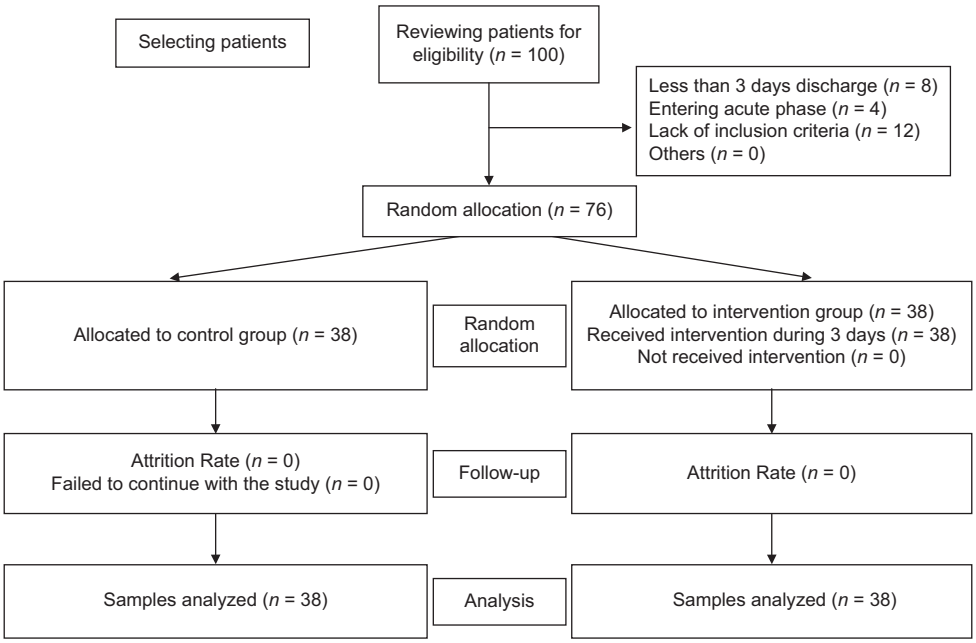

Figure 1: The CONSORT diagram

sleep disorders, use of sleep medication, and dysfunction in daily activities. Each sub-group in this tool receives the score of 0 to 3. The scoring system in this tool is from 0 (good sleep quality) to 21 (worse sleep quality). A score of 5 or more indicates poor sleep quality. This tool was completed before and after the study by both control and intervention groups.[28] The reliability of this questionnaire was calculated to be 0.83%. The validity of this index, with 89.6% sensitivity and 86.7% specificity in subjects, has been reported by the designers of this tool at an appropriate level. In Iran, Cronbach's alpha of this questionnaire has been reported to be 0.77.[29]

This study was conducted in the cardiac ward of a selected hospital. After receiving the written letter of introduction and obtaining permission from the relevant authorities, the researcher continuously attended the cardiac ward of the selected hospital and reviewed the files of hospitalized patients. First, patients who met the inclusion criteria were selected by continuous sampling, and after explaining the study design and method to them, the intervention was implemented. Informed consent was obtained from all the patients. The sleep quality questionnaire was completed for the patients' sleep in the past week. Then, those patients who obtained a score of 5 or higher were allocated to one of the two intervention and control groups by the block randomization method.

Random allocation of samples in the intervention and control groups was done by the block randomization method. The allocation sequence was generated using the free web system available at http://www.randomization.com/.To generate the allocation sequence in this system, the number of subjects in each block was determined to be 4. In addition, letter A was considered for the intervention group and B for the control group. Finally, by confirming the allocation sequence in this system for 18 blocks, the allocation sequence was produced for 76 subjects by combining letters A and B. Then, the cards containing the blocks were placed inside an envelope. In this way, the concealment of the allocation was ensured. Based on the hospitalization of the eligible patient, an envelope was randomly removed by the researcher and this way, the method of allocation was determined. The curtain was closed around the patient to make the patient more focused and prevent interference with other patients. Blinding was done by the statistical advisor (groups were marked as group 1 and group 2, not control and intervention groups). The intervention consisted of playing five tracks of music by a music box. The music contained classical non-verbal music with sounds of nature such as ocean, water wave, wind, and seabirds, which lasted 30 minutes. According to the Iran's Music Association, the frequency production standard in these works was 80 Hz to 5–10 kHz. The speed of tracks was more than 60 beats per minute, which is equal to the number of heart rate per minute. It was possible to forward each track if the patient did not want to listen to it. For example, if it evoked unpleasant feelings or recall of unpleasant memories, the patient was able to forward the track to the next one. Headphones were also used to eliminate ambient noises and help the patient to focus more on the music. The patient listened to the music through headphones for at least 30 minutes[30] at rest or the sitting position during his/her preferred hours, which were often after dinner and night. This intervention was carried out for at least three nights. To ensure that patients are listening to the music (the intervention), the researcher paid a visit to them. In the control group, routine care such as recommendations on nutrition and medication

administration was carried out. The researcher explained to the control group that they can receive the music package after the study. Data analysis was performed by SPSS software (version 25; SPSS Inc., Chicago, Illinois) using descriptive (frequency, percentage, mean, and standard deviation) and inferential statistics (Chi-squared and Fisher's exact test). These tests were also used for the comparison of data distribution. The data related to sleep quality before and after the intervention were analyzed by paired *t*-test. Also, the dimensions of sleep quality were analyzed by Wilcoxon test. The independent *t*-test and Chi-square test were used to compare the mean scores of sleep quality between the two groups.

Ethical consideration

This study was approved by the ethics committee of Tehran University of Medical Sciences (IR.TUMS.FNM.REC.1396.4352). Written informed consents were taken from the participants after explaining the purpose of the study and ensuring the principles of confidentiality and anonymity.

Results

In this study, 76 participants (38 control and 38 intervention groups) completed the data collection tools. Results showed that the mean (SD) age range of the participants was 65.70 (7.32) years (control group) and 61.90 (9.047) years (intervention group). There was no significant difference between the control and intervention groups in terms of demographic variables ($p > 0.05$). More than 80% of participants in both groups did not have a specific habit of falling asleep, and more than half of patients in both groups reported that they also sleep during the day. Moreover, 36.8% of the participants in both groups had been diagnosed with heart failure for less than 6 months, and most of the participants in both groups were on the second day of their hospitalization. Shortness of breath and lower extremity edema were the most common reasons for hospital admission in both groups, and more than 50% of patients in both groups were taking diuretics. In terms of underlying disease, hypertension was the most underlying disease among patients in both groups according to their health records. The results showed no statistically significant difference between the two groups in terms of demographic information ($p > 0.05$) [Table 1].

The results of Chi-square, Fisher's exact, and independent t-tests showed that the two groups of intervention and control were homogeneous in terms of age, sex, body mass index, marital status, employment status, education, monthly income level, smoking, alcohol consumption, use of drugs, sleeping habits, daytime sleepiness, duration of diagnosis of heart failure, heart failure classification, ejection fraction rate, length of hospital stay, reasons for hospitalization, medications used, and co-morbidities ($p > 0.05$).

A statistically significant difference was observed between the mean scores of sleep quality in the intervention group before and after the intervention ($t_{5.88} = 37$, $p < 0.001$) so that sleep quality had significantly improved in the intervention group after the intervention ($p < 0.05$). In the control group, a statistically significant difference was also observed between the scores of sleep quality before and after the intervention ($t_{2.62} = 37$, $p = 0.013$) so that sleep quality had improved at the end of the study. However, the changes in the mean scores of sleep quality in the intervention group were more significant than those in the control group [Table 2].

The results of paired *t*-test showed a statistically significant difference between the mean scores of sleep quality in the intervention group before and after the intervention in the areas of mental quality of sleep, delay in falling asleep, sleep disorders, use of sleeping pills, and daily function disorders ($p < 0.05$). Sleep disorders and the use of sleeping pills at the end of the study were also significantly reduced in the control group ($p < 0.05$) [Table 3]. There was a statistically significant difference between the two groups in terms of the mean scores of mental quality of sleep ($F = 12.20$, $p = 0.007$) and daily functional disorders after the intervention ($F = 1.40$, $p = 0.025$) [Table 4].

Discussion

Results of this study demonstrated that the sleep quality of all patients in the two groups was at a low level before the intervention. In previous studies, high prevalence of sleep problems and low quality of sleep among patients with heart failure have also been reported. According to Gaffey and colleagues, most of heart failure patients suffer from sleep problems.[8] This is also true for Iran as most heart failure patients in Iran also experience poor sleep quality,[9] which is potentially related to the characteristics of the disease, side effects of the drugs used, or diseases such as mood disorders or psychological stress that are often associated with heart failure.[11] A study in Yazd in 2014 showed that patients with heart failure experience poorer quality of sleep than patients without health failure, but this difference was not significant.[31] However, in this study, patients with heart failure experienced more problems with their sleep.

The mean score of sleep quality in both groups at the end of the study was significantly improved, but this improvement in the intervention group was more significant than that in the control group. This shows the effect of intervention on patients in the intervention group and also the effect of time on improving sleep quality of patients in the control group without considering the intervention. Although both groups showed an improvement in sleep quality at the end of the study, sleep quality still did not reach the desired level (a score of less than 5), which could be due to the short duration of intervention, the high prevalence of poor sleep quality in patients with heart failure, and the probable impact of demographic and disease characteristics on sleep quality of patients.[32]

Table 1: Demographic information of the study participants

Demographic Variables	Intervention Group *n* (%)	Control Group *n* (%)	*p*
Age			
<50	5 (13.20)	2 (5.30)	X^2=1/62, *p*=0.109*
50-59	8 (21.10)	7 (18.40)	
60-69	16 (42.10)	16 (42.10)	
70 and above	9 (23.70)	13 (34.20)	
Gender			
Male	28 (73.70)	28 (73.70)	X^2=0.42, *p*=0.91*
Femail	10 (26.30)	10 (26.30)	
Marital Status			
Married	35 (92.10)	36 (94.70)	X^2=3.76, *p*=0.999*
Single	0	0	
Widow	2 (5.30)	2 (5.30)	
Divorced	1 (2.60)	0	
Education			
Literacy	7 (18.40)	11 (28.90)	X^2=3.05, *p*=0.332*
Under Diploma	21 (55.30)	14 (36.80)	
Diploma	7 (18.40)	11 (28.90)	
Above	3 (7.90)	2 (5.30)	
Job			
Non-Governmental	3 (7.90)	2 (5.30)	X^2=1.87, *p*=0.465*
Housekeeper	9 (23/70)	8 (21.10)	
Jobless	0	3 (7.90)	
Jobless because of disease	7 (18.40)	8 (21.10)	
Retired	16 (42.10)	17 (44.70)	
Clerk	2 (5.30)	0	
Worker	1 (2.60)	0	
Heart Failure Class (NYHA)			
2	7 (18.40)	8 (21.10)	X^2=0.22, *p*=0.893*
3	14 (36.80)	15 (39.50)	
4	17 (44.70)	15 (39.50)	
Ejection Fraction (EF)			
10-15%	8 (21.10)	4 (10.50)	X^2=0.81, *p*=0.42*
20-25%	12 (31.60)	21 (55.30)	
30-40%	18 (47.40)	12 (31.60)	

Note: Values are expressed as no (%). *Chi-square test

In our study, improvement in sleep quality in the intervention group was more prominent in the areas of sleep quality, delay in falling sleep, sleep disorders, use of sleeping pills, and daily function disorders. This means that the intervention had a greater impact on the dimensions of sleep quality in the intervention group compared to the control group. In the study of Moradi *et al*.[32] (2014), poor sleep quality was more prominent in the areas of delay in falling asleep, daily function disorders, sleep efficiency, and sleep duration. Another study conducted in Yazd in 2014 showed that among the areas of sleep, a statistically significant difference was found between patients with and without heart failure only in the area of daily function disorders.[31] This could also be due to the nature of heart failure because heart failure can affect the ability to perform activities of daily living.

In this regard, we suggest other methods of complementary medicine to be used as intervention to improve the quality of sleep in these patients in future studies and also make a comparison between music and other methods of alternative therapies. It is also recommended to use this intervention for a longer period of time after discharge due to the limited length of hospital stay in patients with heart failure.

Considering the positive effect of music on improving the quality of different areas of sleep in heart failure patients, this approach can be considered as complementary treatment in the care plan. During hospitalization, patients can be

Table 2: Frequency distribution of sleep quality in the intervention and control groups before and after the intervention

Group Sleep quality	Intervention Mean (SD)	Control Mean (SD)
Before intervention	12.86 (3.39)	12.50 (3.45)
After intervention	9.76 (3.98)	10.94 (4.10)
Results of paired *t*-test	*t*=5.88, df=37 *p*<0.001	*t*=2.62, df=37 *p*=0.013

Table 3: Numerical indices of sleep quality dimensions in the intervention and control groups before and after the intervention

Group Sleep quality		Intervention Mean (SD)	Control Mean (SD)
Mental quality of sleep	Before	2.21 (1.14)	1.55 (1.38)
	After	1.26 (1.31)	1.65 (1.34)
Results of Wilcoxon test		*p*<0.001	*p*=0.564
Delay in falling sleep	Before	2.18 (0.92)	1.84 (0.91)
	After	1.68 (1.14)	1.55 (1.08)
Results of Wilcoxon test		*p*=0.01	*p*=0.201
Duration of sleep	Before	2.65 (0.48)	2.26 (0.75)
	After	2.31 (0.87)	0.36 (0.75)
Results of Wilcoxon test		*p*=0.058	*p*=0.554
Sleep adequacy	Before	0.73 (1.22)	0.28 (0.69)
	After	0.5 (0.95)	0.52 (1.05)
Results of Wilcoxon test		*p*=0.293	*p*=0.162
Sleep disorders	Before	1.84 (0.43)	1.86 (0.34)
	After	1.39 (0.59)	1.55 (0.50)
Results of Wilcoxon test		*p*<0.001	*p*=0.003
Usage of sleeping pills	Before	2.57 (0.64)	2.71 (0.51)
	After	1.76 (1.69)	1.65 (0.84)
Results of Wilcoxon test		*p*<0.001	*p*<0.001
Daily function disorders	Before	2.15 (1.10)	1.52 (1.35)
	After	1.28 (1.37)	1.73 (1.50)
Results of Wilcoxon test		*p*=0.002	*p*=0.485

Table 4: Comparison effect of nature music between control and intervention groups of patients with heart failure

Group Sleep quality	Intervention Mean (SD)	Control Mean (SD)	*p*
Mental quality of sleep	12.86 (3.39)	12.50 (3.45)	0.007*
Delay in falling sleep	9.76 (3.98)	10.94 (4.10)	0.584**
Duration of sleep	2.31 (8.70)	2.36 (0.75)	0.764*
Sleep adequacy	0.95 (0.50)	1.05 (0.52)	0.737**
Sleep Disorders	1.39 (0.59)	1.55 (0.50)	0.082**
Usage of sleeping pills	1.76 (1.69)	1.65 (0.84)	0.853**
Daily function disorders	1.37 (1.28)	1.73 (1.50)	0.025*

*Analysis Covariance. **Man Whitney *U*

introduced to supportive and complementary treatments so that they can use these treatments for a long time after discharge. During the hospitalization period, the necessary facilities including headphones and music tracks can be provided and used in the ward so that patients can use them in their spare time. Limitations of this study include the short duration of intervention and the high prevalence of poor sleep quality in patients with heart failure, so we suggest longer intervention in future studies to obtain more accurate results. The limitation of study was, based on previous studies, that sleep quality in patients with heart failure in different parts of the world varies, which indicates that the impact of sleep quality depends on many factors in addition to a sole intervention. Therefore, the effects of other factors can prevent or facilitative the impact of intervention.

Conclusion

The results of this study can be used as an idea in the implementation of such affordable and amusing interventions for heart failure patients to improve and enhance their quality of sleep and care. Patients can even be encouraged to spend time in nature and consciously listen to the nature sounds after discharging from hospital as an effective complementary treatment. By considering the results of such researches, nurses can have an effective role in improving the complications of heart failure such as low quality of sleep in heart failure patients. Improvement of mental quality of sleep and daily functioning after the intervention in this study indicates that patients need spiritual support and attention in addition to routine treatments, and this attention can facilitate the recovery of patients in a shorter period of time.

Acknowledgements

The authors would like thank all participants during the different stages of this study for their willingness to participate in this study.

Financial support and sponsorship

Tehran University of Medical Sciences

Conflicts of interest

Nothing to declare.

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