



Effect of Auditory Stimulation by Family Voices and Recitation of Prayers on Hemodynamic Changes in Comatose Patients: A Clinical Trial With Control Group

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Abstract

Objective: Coma stimulation has been a method that is proposed to improve the results of the coma. In this way, planned and purposeful, the stimulation of a sensory system is multidimensional. The purpose of this study was to evaluate the effect of the auditory stimulation by family voices and recitation of prayers on hemodynamic changes of comatose patients.

Materials and Methods: This study was a clinical trial. Fifty-one brain injury traumatized patients (including 18 patients in the familiar voice group, 18 patients in recitation of prayer group and 15 patients in the control group) were divided into experimental and control groups. The first group was tested for 14 days, twice a day and received family voices through headphones at noon and evening prayer time. The second group was tested under similar condition and received the Azan sound. Immediately hemodynamic changes before and after each intervention were recorded. The average duration of voice in the two groups was 4 minutes. The control group received no intervention and hemodynamic status was recorded twice a day at noon and evening prayer time. The data was analyzed by using SPSS and chi-square test, ANOVA and repeated measures.

Results: The age range was 14 to 68 years. Azan group had the highest average age (41.2 ± 18.5 years). The highest initial consciousness level was in the control group (7.6 ± 3.5). Azan group before the intervention had the longest duration of coma (8 ± 4.7 days). The experimental group showed a significant correlation with the number of days and in some variables to the baseline, but did not show the uniformity trend in hemodynamics variables. Followed by post hoc test there was a significant increase in levels of hemodynamic parameters' (systolic pressure, diastolic pressure, mean arterial pressure and breathing), especially after the Azan sound.

Conclusion: Auditory stimulation by family voices and recitation of prayers or Azan sound cannot increase or decrease the uniform trend in hemodynamics variables in comatose patients.

Keywords: Auditory stimulation, Coma, Hemodynamic status

Introduction

Traumatic brain injuries (TBI) are issues causing brain damages which may result in coma and physical, intellectual, emotional, social and occupational changes in an individual. TBI are one of the causes of death and disability all over the world (1). In Iran, trauma is the second cause of death. The statistics indicate that Iran is among the first countries in the world to have accidents with most damages (31%) occurring in head, neck and brain (2).

Brain damage can result in coma. Coma is a clinical condition in which patients lose their excitability and responsiveness; hence, they do not show purposeful responses to internal and external stimuli, although they may exhibit un-purposeful responses to painful stimuli and brain stem reflexes. In general, the longer the duration of coma, the lower the possibility of reversal of patients condition. Comatose patients need more holistic cares than other patients encountered during health-providers' career (3).

Due to the long stay of these patients in intensive care units (ICUs) and the need to obtain adequate information under certain circumstances, several measures, including frequent measurements of hemodynamic signs, will be effective (4). Hemodynamic is an important part of cardiovascular physiology which becomes possible by heart's pumping force and circulation in cardiovascular system. Adequate blood flow is a necessary condition for the supply of oxygen to the body tissues. In fact a good cardiovascular health increases the longevity and quality of life (5). Auditory stimulation in patients with the loss of consciousness is a non-medicinal method to maintain cardiovascular stability (4). To this end, a multi-sensory stimulation system is used in a planned and purposeful manner (3).

Different researchers have used a variety of sounds to stimulate hearing in comatose patients, including the use of a familiar voice, nurse's voice, music, researcher's voice,

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Quran recitation, whistles, applause, ringing and birds' sound (6-13). Studies using familiar voice have improved patients' consciousness and some contradictions were observed in patients whose hemodynamic changes were studied; however, it seems that each of the aforementioned methods is associated with some limitations.

Regarding the family visit, it should be noted that visits in ICU are restricted in Iran due to policies such as infection control; therefore, it is difficult for families to visit their patients (14). Some studies used message broadcast from the loved ones. Such messages would be produced in accordance with the statements of family members (indirect citation); however, they maybe in conflict with patients' interests in some cases, which may not be recognizable with respect to the patients' conditions. It is also possible that the use of music will be in conflict with patients' interests and religious beliefs.

A study used the *Yassin Surah* to measure comatose patients' vital signs (13). Given the effectiveness of Quran recitation in studies (12), the present study, however, used the sound of Azan (Islamic call to prayer) as an auditory stimulant, due to the unknown effects of different Surahs on patients and unfamiliarity of them with some verses. These divine slogans are the first words called in infants' ears. It was highly suggested to say Azan at home, especially during illness (15). Therefore, since it is easily possible for nurses to broadcast Azan, the use of auditory stimuli with Azan will be simpler and more useful. It will then resolve the problem of unawareness of patients' history and patients' loved one. In addition, the sound of Azan was used in this study because some patients may be sensitive to sounds of their family members and show positive or negative emotions (10).

Different sounds have been used for auditory stimulation in various studies; however, no study was found in which the impact of Azan was compared to the familiar sound of a member in patient's family. Therefore, the aim of this study was to evaluate the effect of auditory stimulation with a familiar voice and Azan sound on the hemodynamic signs of patients with traumatic coma.

Materials and Methods

Consisting of two intervention groups and one control group, this was a clinical trial, the code of which is IRCT2014081418794N1. The study population included Muslim traumatic brain comatose patients admitted to the ICUs of Ayatollah Mousavi hospital in Zanjan and Emdadi hospital in Abhar county. To allocate eligible people into two groups of test one and two, the table of random numbers was used. Therefore, a number was selected from the table and was progressed to the right. If the number of one's was odd, the subject was placed in the test group one; however, if the number of one's was even the subject was placed in the test group two. After completing the samples of the two test groups, the control group was sampled. The sample size was calculated to be 18 patients for each group in accordance with the following formula, with test power and a confidence 95%.

$$n = \frac{(z_{1-\frac{\alpha}{2}} + z_1 - \beta)^2 (s_1^2 + s_2^2)}{(X_1 - X_2)^2}$$

In this study, the inclusion criteria were traumatic comatose patient, Islam religion, age range of 14-68 years, consciousness level of ≤ 8 (consciousness level of 3 was not included), no fracture and surgery in the temporal lobe, family consent for participation in the study and no hearing impairment. The exclusion criteria were patient's death before the day 14 in both groups, changes in patients' condition making it impossible to perform intervention such as referring patients to other hospitals and cardiac arrest. The tools used to collect data included demographic forms, the recording form of hemodynamic signs including blood pressure, pulse pressure, mean arterial pressure, breathing, heart rate, temperature and SPO_2 , and the clinical status form included the date of coma, brain surgery after the injury and the use of drugs affecting the level of consciousness and hemodynamic status.

Hemodynamic signs were measured with the monitoring device of the ward (Model S1 800, Pooyandegan Rah Saadat Co, Iran). The same model was used in both hospitals. The devices were calibrated according to manufacturer's instructions. The temperature was measured with an oral mercury thermometer (used for axillary). The scientific validities of the questionnaires of clinical status and hemodynamic signs were established through content validity and taking the opinions of ten professors from Zanjan University of Medical Sciences after applying their corrective views.

The subjects were enrolled in the study after obtaining written consent from the legal guardian of the patient and the authorization was issued by Zanjan University of Medical Sciences.

In the experimental group, the familiar sound was broadcasted twice a day for 2 weeks from an averagely 4-minute recorded tape of one of the patient's family members voice with his/her presentation, reassuring messages and a brief description of the incident that had occurred, along with noon and sunset Azan, using an mp3 player (Marshall) and headsets. For the Azan group, Mr. Moazen Zadeh's voice was broadcasted at noon and sunset prayer times and the hemodynamic status was recorded immediately before and after the intervention. Hemodynamic signs were also recorded in the control group twice a day at noon and sunset prayer times without any intervention. Sampling took 7 months.

The data were collected and analyzed using SPSS version 16 with chi-square test and analysis of variance (ANOVA) to assess the consistency of the demographic and confounding variables, repeated measures to evaluate the changes and post hoc test to pursue significant levels during fourteen days.

Results

According to the findings, the subjects were mostly male ($n=43$). The Azan group had the highest mean age

(18.5 ± 41.2 years). The majority of subjects were married (n = 34). The majority of cases did not undergo surgery or consumed hemodynamic-affecting medicines after traumatic brain injury. Hemodynamic signs including baseline systolic pressure, diastolic pressure, mean arterial pressure, respiration, pulse and temperature were checked before analysis by ANOVA and it was shown that the groups were similar with respect to these variables. The variables SPO₂ and pulse pressure were not similar at baseline in both groups (P = 0.03). Based on the findings, no steady decreasing or increasing trend was observed in any of the hemodynamic variables of daily average. During the follow-up of significance levels through post hoc test, most hemodynamic symptoms (systolic pressure, diastolic pressure, mean arterial pressure and respiration) were increased especially after the auditory stimulus with the sound of Azan. In other words, the sound of Azan differed among the two groups of familiar voice and control and it increased the amount of hemodynamic signs. Results are shown in Tables 1-9.

Discussion

Based on the findings, although some variables were significant in the two groups of familiar voice and Azan on some days, given their non-uniform trend, they were not statistically valuable. According to this study, it can be said that auditory stimulation cannot have a uniform increasing or decreasing trend on hemodynamic signs during fourteen days.

Moreover, it takes at least two weeks for the effects of sensory stimulation to start. In this context, Oh et al carried out a quasi-experimental, single group, time series study in 2003, entitled *the Impact of Stimulus on Improving Comatose Patients*. This study showed that at least two weeks was required for the onset of sensory stimulation impact (16). In this regard, the duration of study treatment was considered 14 days. The beneficial effects of auditory stimulation on enhancement of consciousness level were emphasized in some studies (6-8); however, some contradictions were seen regarding its effect on vital signs. Inconsistency in results could be due to the type of auditory

Table 1. Demographic Data and the similarity of Study Variables Within the Groups

Variable	Familiar Group	Azan Group	Control Group	P Value	Statistical Test
Mean age	29.6 ± 12.8	41.2 ± 18.5	38.2 ± 16.6	0.09	Variance analysis
Gender				0.39	χ ²
Male	16	16	11		
Female	2	2	4		
Marital				0.76	χ ²
Single	6	7	4		
Married	12	11	11		
Mean coma time before intervention	2.5 ± 1.9	8 ± 4.7	7.8 ± 3.4	0.45	Variance analysis
Brain surgery				0.76	χ ²
No	14	12	11		
Yes	4	6	4		
Mean primary consciousness	7.4 ± 3.3	6.3 ± 2.2	7.6 ± 3.5	0.4	Variance analysis
Drugs on level of consciousness				0.14	χ ²
No	2	0	0		
Yes	16	18	15		
Drugs on hemodynamic				0.55	χ ²
No	12	10	11		
Yes	6	8	4		

Table 2. Changes in Mean Systolic Pressure Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	117.6	17.2	0.1	125.3	20.4	0.30	132.3	17.7	0.005
Second day	117	16.4	0.86	130.7	15.09	0.03	126.8	15.5	0.36
Third day	123.9	19.1	0.31	126.4	19.85	0.23	123.5	17.9	0.81
Fourth day	122.4	17.1	0.30	125.1	17.3	0.36	124.3	18/6	0.73
Fifth day	125.2	13.4	0.18	121.7	14.7	0.76	122.3	17.9	1.00
Sixth day	122	14.5	0.48	131.6	27.9	0.18	123.1	11.8	0.86
Seventh day	123.06	15.7	0.33	128.2	17.7	0.08	124.8	15.3	0.44
Eighth day	121.8	16.7	0.52	124.8	16.6	0.41	125.5	16.04	0.58
Ninth day	122.8	15.2	0.42	124.3	15.8	0.37	121.9	13.09	0.93
Tenth day	128.4	15.3	0.10	126.4	16.07	0.18	122.3	16.5	1.00
Eleventh day	126.6	18.6	0.13	123.2	17.6	0.57	124	15.6	0.76
Twelfth day	120.4	10.7	0.53	128.6	15.6	0.12	122.2	11.7	0.99
Thirteenth day	126.1	16.8	0.13	128.2	16.8	0.02	128.2	18.5	0.31
Fourteenth day	123.2	12.5	0.28	127.8	18.2	0.19	125.7	14.9	0.49

*P value according to the repeated measures test.

Table 3. Changes in Mean diastolic Pressure Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	75.6	13.1	0.1	74.7	13.1	0.6	79.7	14.4	0.003
Second day	73.6	11.6	0.35	78	9.2	0.07	71.8	10.2	0.91
Third day	78.6	12.4	0.45	75.9	11	0.4	75	14.8	0.4
Fourth day	73.7	12.5	0.49	75.7	13.9	0.5	76.7	18.6	0.3
Fifth day	79.6	13.09	0.33	73.9	13.2	0.8	73.1	12.5	.6
Sixth day	79.8	10.6	0.2	79.4	13.8	0.1	74.5	10.8	0.4
Seventh day	79.5	14.6	0.4	75.8	13.4	0.42	74.6	11.8	0.3
Eighth day	81.8	13.3	0.2	76.7	11.5	0.3	76.5	13.4	0.2
Ninth day	78.4	15.02	0.5	76.1	11.9	0.2	74.9	13.6	0.4
Tenth day	79	10.9	0.3	77.7	10.6	0.12	76.6	13.5	0.1
Eleventh day	82	16.5	0.2	77.5	10.8	0.16	76.2	18.4	0.3
Twelfth day	76.2	9.8	0.8	79	10.8	0.15	80.2	16.5	0.07
Thirteenth day	82.9	11.1	0.05	78.2	11.7	0.06	79.2	19.4	0.15
Fourteenth day	72.3	18.5	0.5	78.3	10	0.16	79	19.6	0.17

*P value according the repeated measures test.

Table 4. Changes in Mean SPO₂ Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	95.2	4.4	0.28	98.4	1.6	0.81	96.16	4.4	0.95
Second day	94.6	4.5	0.1	97.6	3.1	0.33	97.2	2.7	0.22
Third day	92.5	4.9	0.63	97.7	3.08	0.44	97.6	2.7	0.20
Fourth day	94.8	5.03	0.03	98	2.3	0.52	96.7	3.1	0.47
Fifth day	94	4.7	0.80	97.2	4.1	0.24	96.6	3.2	0.47
Sixth day	95	4.2	0.40	95.5	5.4	0.3	96.6	3.3	0.60
Seventh day	94	4.1	0.87	98.3	2.1	0.92	97.4	2.7	0.15
Eighth day	93.4	5.4	0.31	97.2	3.8	0.25	96.5	3.8	0.66
Ninth day	93.9	5.3	0.26	98.9	1.2	0.05	97.3	3.3	0.24
Tenth day	94.3	4.5	0.43	98.05	2.2	0.59	96.4	2.8	0.73
Eleventh day	94.8	4.5	0.50	98.2	2.4	0.79	97.5	3.8	0.25
Twelfth day	96.2	3.8	0.68	95.9	5.4	0.06	97.4	2.8	0.08
Thirteenth day	95.8	4.1	0.37	98.5	2.06	0.77	97.1	3.05	0.30
Fourteenth day	93.06	6.2	0.25	98.1	2.8	0.79	96.3	3.1	0.79

*P value according the repeated measures test.

Table 5. Changes in Mean Arterial Pressure Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	86	12.9	0.1	89.7	14.9	0.33	94.5	14.9	0.009
Second day	87.1	12.4	0.63	94.5	10.6	0.059	49.9	12.1	0.39
Third day	92.8	15.6	0.17	92.3	16.4	0.21	91.4	16.01	0.31
Fourth day	90.2	10.9	0.23	91.2	15.6	0.29	91.9	19.2	0.36
Fifth day	90.9	13.2	0.30	89.3	13.2	0.47	87.7	13.2	0.78
Sixth day	92	12.04	0.18	95.6	16.5	0.12	90.2	10.1	0.32
Seventh day	93.8	14.7	0.12	91.8	15.6	0.18	88.9	11.8	0.51
Eighth day	93.4	14.5	0.19	91.6	13.01	0.25	93.4	16.3	0.22
Ninth day	94.2	11.2	0.07	91.3	12.1	0.17	89.5	12.7	0.55
Tenth day	93.9	12.7	0.09	94.2	13.6	0.08	89.6	12.7	0.45
Eleventh day	93.4	13.9	0.056	93.1	13.8	0.19	88.3	13.9	0.72
Twelfth day	89.9	9.2	0.21	94.5	14.7	0.15	91.8	12.4	0.27
Thirteenth day	94.06	13.2	0.08	94.3	15.1	0.06	93.4	16.9	0.22
Fourteenth day	91.8	11.4	0.14	97.2	15.1	0.06	93	16.6	0.20

*P value according the repeated measures test.

stimulus because, according to studies, different sounds can have different effects on patient (17).

Some studies have used Quran to stimulate the hearing. Shirvani et al carried out this study on 20 unconscious

patients of ICU for 4 weeks and Quran recitation eventually reduced the quantities of vital signs; however, it had no significant impact on the variable of temperature (13). This study differed from ours in the sound type and the in-

intervention duration. Atari et al studied the impact of Quran recitation on vital signs stability. In the intervention group, Quran was recited to patients waiting before surgery on headphones for 20 minutes. The average heart rate changes were less than the control group and there was no significant difference in systolic and diastolic blood pressure and respiratory rates between the two groups (18). In a study entitled *Quran's Music and Phonetic Order*, Momtahan et al wrote "One of the aspects of the Quran which has been little studied is the miracle which lies in its music and phonetic order." The effects arisen from recitation of Quran verses are due to its sound, words, and pleasant music rather than from meanings and valuable content incorporated in it; the effects come from the structure and not the content. This music lies in the context of the words and the combination of the sentences and it is only perceived with invisible feeling and transcendent power (19). The effects of Azan and its content are similar to Quran recitation and since the Quran is cure, Azan is also healing during disease (15).

Other studies have also used various sounds for auditory stimulation. The study conducted by Maleki et al showed a

decrease in studied physiological parameters. Maleki used soft music for 15 minutes three times a day for three days and measured vital signs 5 minutes before, immediately and ten minutes after the intervention. The difference between the mentioned studies and the present one is in the type and duration of intervention (10). In the study by Rafieian et al, music therapy reduced systolic blood pressure and pulse while diastolic blood pressure and breathing were not much changed (20).

Almerud and Peterson carried out a study entitled *Music Therapy as a Complementary Therapy in Mechanically Ventilated Patients*. In the music therapy group, blood pressure, respiration and pulse of the patients were frequently controlled every 5 minutes during music therapy and then after 5, 30 and 60 minutes. The results of their study showed that the mean systolic blood pressure, diastolic blood pressure and pulse were reduced in the intervention group; however, they slightly increased again after 60 minutes. On the other hand, the average breathing was similar in both groups (21). In a study in Brazil, Puggina et al used classical music and voice messages for auditory stimulation. The interventions were performed in 3 days.

Table 6. Changes in Mean Pulse Pressure Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	41.9	10.5	0.1	50.7	10.8	0.18	52.5	9.2	0.83
Second day	43.3	9.7	0.60	52.7	10.6	0.06	55	14.1	0.38
Third day	45.3	11.8	0.26	50.6	12.5	0.24	48.5	9.1	0.16
Fourth day	48.7	14.4	0.06	49.4	9.03	0.41	47.6	9.3	0.12
Fifth day	45.6	9.6	0.18	47.9	8.5	0.74	49.1	11.5	0.43
Sixth day	42.2	10.3	0.94	52.2	16.8	0.20	48.6	9.3	0.24
Seventh day	42.8	10.02	0.74	52.6	12.7	0.04	50.2	8.7	0.49
Eighth day	40.3	11.8	0.63	48.1	8.5	0.74	49	10.2	0.38
Ninth day	43.8	10.4	0.64	48.3	8.1	0.67	47.1	7.5	0.052
Tenth day	51.7	14.7	0.01	48.6	10.4	0.62	47.8	11.2	0.26
Eleventh day	44.06	10.2	0.25	46.4	9.9	0.88	50.5	9.2	0.62
Twelfth day	42.4	9.3	0.87	46.2	8.1	0.84	44.3	7.2	0.008
Thirteenth day	42.06	8.4	0.96	50.8	9.9	0.06	51.4	8.3	0.87
Fourteenth day	49.5	13.9	0.10	50.6	11.2	0.27	49.5	9.02	0.43

*P value according the repeated measures test.

Table 7. Changes in Mean Pulse Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	97.3	24.1	0.1	87.1	16.7	0.52	94.2	18.7	0.10
Second day	96.8	23.8	0.80	87.7	15.2	0.77	89.7	21.8	0.02
Third day	96.5	16.7	0.85	86.3	19.4	0.50	93.8	22.4	0.38
Fourth day	91	17.6	0.31	92.9	15.5	0.45	90.1	23.5	0.10
Fifth day	97	19.8	0.93	92.2	15.2	0.40	89.2	19.1	0.04
Sixth day	91.4	19.6	0.13	90.3	17.7	0.79	81.1	10.6	0.001
Seventh day	90.4	13.8	0.13	89.4	19.05	0.92	87.6	21.8	0.03
Eighth day	86.6	12.3	0.11	92.8	23.4	0.59	88.3	22.6	0.06
Ninth day	94.8	19.6	0.68	90	19.07	0.84	87.8	20.1	0.02
Tenth day	93.7	20.6	0.60	90.4	16.08	0.78	86.7	17.9	0.01
Eleventh day	86.2	16.8	0.12	88.8	16.2	0.98	83.5	15.06	0.005
Twelfth day	80.6	13.05	0.03	92.8	18.03	0.50	86.9	19.4	0.03
Thirteenth day	90.3	19.6	0.21	87.7	19.6	0.84	91.3	20.2	0.14
Fourteenth day	86.3	29.2	0.30	87.3	18.9	0.75	88.6	21.7	0.07

*P value according the repeated measures test.

Table 8. Changes in Mean Respiration Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	17.2	7.3	0.12	15.1	4.9	0.40	14.7	4.02	0.26
Second day	14.9	6.2	0.12	17.4	5.9	0.69	14.8	5.4	0.52
Third day	16.2	6.1	0.60	21.2	6.4	0.81	17.7	8.2	0.32
Fourth day	13.6	4.8	0.07	17.7	5.5	0.71	15.5	6.09	0.90
Fifth day	14.3	3.6	0.10	18.8	5.8	0.87	15	5.3	0.64
Sixth day	14.4	4.2	0.10	19.7	5.5	0.98	14.9	3.6	0.52
Seventh day	13.6	5.6	0.05	19.3	6.6	0.93	16.6	6.3	0.62
Eighth day	14.7	5.5	0.12	18.2	5.5	0.78	15.7	4.8	0.96
Ninth day	14.8	7.09	0.26	18.05	5.9	0.76	16.1	5.4	0.74
Tenth day	14.7	6.4	0.28	18.5	5.8	0.82	16.2	5.9	0.75
Eleventh day	15.8	6.7	0.47	19.5	7.1	0.95	15.4	5.06	0.89
Twelfth day	13.8	7.3	0.18	19.6	5.3	0.97	17	6.4	0.41
Thirteenth day	15.1	4.6	0.35	19.8	6.3	0.99	17.05	8.2	0.55
Fourteenth day	14.8	5.8	0.38	21.1	5.07	0.95	16.2	5.7	0.69

*P value according the repeated measures test.

Table 9. Changes in Mean Temperature Within 14 Days of Intervention

	Control Group			Azan Group			Family Group		
	Average	SD	P Value*	Average	SD	P Value*	Average	SD	P Value*
First day	37.1	0.30	0.1	37.1	0.56	0.18	37.3	0.53	0.30
Second day	37.01	0.44	0.26	37.4	0.65	0.01	37.03	0.70	0.40
Third day	37.3	0.59	0.20	36.9	1.79	0.78	37.6	0.62	0.03
Fourth day	37.2	0.87	0.54	37.1	0.56	0.41	37.4	0.75	0.40
Fifth day	37.3	0.80	0.32	37.2	0.55	0.38	37.2	0.69	0.68
Sixth day	37.4	0.96	0.24	37.05	0.34	0.91	37.5	0.87	0.14
Seventh day	37.4	0.51	0.03	37.2	0.64	0.32	37.3	0.95	0.60
Eighth day	37.1	0.59	0.81	37.1	0.60	0.49	37.2	0.87	0.76
Ninth day	37.02	0.42	0.33	36.9	0.47	0.52	37.3	1.02	0.72
Tenth day	36.9	0.46	0.07	37.05	0.45	0.93	36.9	0.94	0.40
Eleventh day	37.4	0.59	0.10	37.06	0.40	0.85	37.04	0.77	0.46
Twelfth day	37.2	0.68	0.65	37.1	0.50	0.37	37.3	1.03	0.70
Thirteenth day	36.5	2.60	0.36	37.03	0.53	1	37.1	0.82	0.80
Fourteenth day	36.8	0.41	0.03	36.9	0.52	0.65	37.09	0.80	0.60

*P value according the repeated measures test.

Their results showed a significant increase in the respiratory rate and SPO₂ in the audio message group (22). In the present study, an increase in vital signs was also observed in some cases; however, this increase had no statistically significant uniform trend. In a study by Wang et al, despite reduced anxiety due to music effects, there was no change in heart rate and systolic and diastolic blood pressure parameters in the samples (23). According to Aghajani and Mirbagheri, the reason for this non-compliance in physiological parameters can arise from the type of auditory stimulation and the variety of environmental, social and cultural conditions in individuals (24).

This study had some limitations including the inability to control environmental sensory stimuli during the research. The control group was selected after randomized sampling of the two experimental groups. Therefore, it is advised to carry out auditory stimulation studies after resolving these limitations. It is also recommended that a study be conducted on the experiences of improved comatose patients who benefited from auditory stimuli.

Conclusion

According to the present study, auditory stimulus had no uniform effect on increasing or decreasing trend of the investigated hemodynamic parameters. Although there were significant levels in some of the variables on some days, they were not statistically significant and valuable due to the lack of uniformity.

Ethical issues

This study was conducted after obtaining approval No. (zums.rec.1392.42) from the ethics committee. This project was recorded in a clinical trial center (<http://www.irct.ir/>) with registration number of IRCT2014081418794N1.

Conflict of interests

Authors declare that there is no conflict of interest.

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