

# The Effect of Music on Anxiety and Cardiovascular Indices in Patients Undergoing Coronary Artery Bypass Graft: A Randomized Controlled Trial

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## Abstract

**Background:** The instability of cardiovascular indices and anxiety disorders are common among patients undergoing coronary artery bypass graft (CABG) and could interfere with their recovery. Therefore, improving the cardiovascular indices and anxiety is essential.

**Objectives:** This study aimed to investigate the effect of music therapy on anxiety and cardiovascular indices in patients undergoing CABG.

**Patients and Methods:** In this randomized controlled trial, 60 patients hospitalized in the cardiovascular surgical intensive care unit of Shahid Beheshti Hospital in Qom city, Iran, in 2013 were selected using a consecutive sampling method and randomly allocated into the experimental and control groups. In the experimental group, patients received 30 minutes of light music, whereas in the control group, patients had 30 minutes of rest in bed. The cardiovascular indices and anxiety were measured immediately before, immediately after and half an hour after the study. Data were analyzed using the chi-square test and repeated measures analysis of variance.

**Results:** Compared to the immediately before intervention, the mean anxiety scores immediately after and 30 minutes after the intervention were significantly lower in the experimental group ( $P < 0.037$ ) while it did not significantly change in the control group. However, there were no significant differences regarding the cardiovascular indices in the three consecutive measurements ( $P > 0.05$ ).

**Conclusions:** Music therapy is effective in decreasing anxiety among patients undergoing CABG. However, the intervention was not effective on cardiovascular indices. Music can effectively be used as a non-pharmacological method to manage anxiety after CABG.

**Keywords:** Music Therapy, Cardiovascular System, Anxiety, Coronary Artery Bypass Graft

## 1. Background

The coronary artery bypass graft (CABG) is a common cardiac surgery (1). After this surgery, patients are transported to the Cardiovascular Surgical Intensive Care Unit (CVSICU) for recovery (2). In the Intensive Care Unit (ICU), the environmental factors such as noises, intervention-related pain and discomfort, the psychological stress of having an acute disease, and disease complications may put patients at risk for the development of anxiety disorders (3, 4). Dehdari et al. reported that approximately 53.4% of patients had moderate to severe anxiety after CABG (5). Moreover, Dehghani et al. found that most of the Iranian patients experience moderate to severe anxiety after CABG (6).

Anxiety disorders are associated with increased blood pressure (BP) and heart rate (HR) (1). Therefore, alleviation of anxiety is a matter of great importance in cardiac patients. Sedative-hypnotic drugs are commonly used in ICUs to improve the patients' anxiety. However, pharmacological agents are usually associated with many side

effects (7). Hence, nurses are usually seeking for better anxiolytic methods with fewer side effects. Several complementary and alternative methods such as music therapy, aromatherapy and muscular relaxation have been investigated for improving the patients' anxiety without causing serious side effects (1, 8-10).

Music therapy is a complementary method that can improve the patients' anxiety by providing a calm atmosphere, diminishing concerns and distracting patients from negative thought. It also helps patients to cope with emotional stresses (11). However, conflicting findings have been reported about the effects of music on patients' anxiety and cardiovascular indices. For example, Bauer et al. (12) and Twiss et al. (13) found that music therapy could reduce the level of anxiety among patients undergoing CABG. Moreover, Emami Zeydi et al. (14) and Hatem et al. (15) indicated that music therapy could decrease the HR, systolic blood pressure (SBP), and mean arterial pressure (MAP) among patients undergoing CABG. In

contrast, Nilsson found that music therapy had no effect on the HR, SBP, diastolic blood pressure (DBP), MAP, and anxiety among patients undergoing cardiac surgery (11). Furthermore, Sendelbach et al. found that music therapy reduced the level of anxiety, but had no effect on SBP, DBP, and HR among patients undergoing cardiac surgery (1).

Due to the inconsistencies about the effect of music on patients' anxiety and cardiovascular indices, further studies are necessary to provide sufficient evidence in this area.

## 2. Objectives

This study aimed to investigate the effect of music therapy on anxiety and cardiovascular indices among patients undergoing CABG.

## 3. Patients and Methods

### 3.1. Study Design and Participants

This non-blind, randomized, controlled trial was con-

ducted on patients undergoing CABG in the CVSICU of Shahid Beheshti Hospital in Qom city, Iran. The study was conducted from September to December 2013. Sixty patients were consecutively sampled and randomly allocated into the experimental and control groups. To this end the researchers prepared a list of numbers from 1 to 60 and then using a random number table was divided into two equal parts.

The sample size was calculated based on a previous study in which Babaee et al. investigated the effect of massage therapy on the mood of patients after open-heart surgery and reported that the Mean  $\pm$  Standard deviation of anxiety before and after the intervention were  $27.1 \pm 5.9$  and  $21.7 \pm 6.2$ , respectively (16).

Then, based on the mentioned study and considering  $\beta = 0.2$ ,  $\alpha = 0.05$ ,  $S_1 = 5.9$ ,  $S_2 = 6.2$ ,  $\mu_1 = 27.1$ , and  $\mu_2 = 21.7$ , 20 subjects were estimated to be needed in each group. However, we recruited 30 patients in each group to compensate probable attritions and achieve more reliable results. Figure 1 shows the study flow diagram.

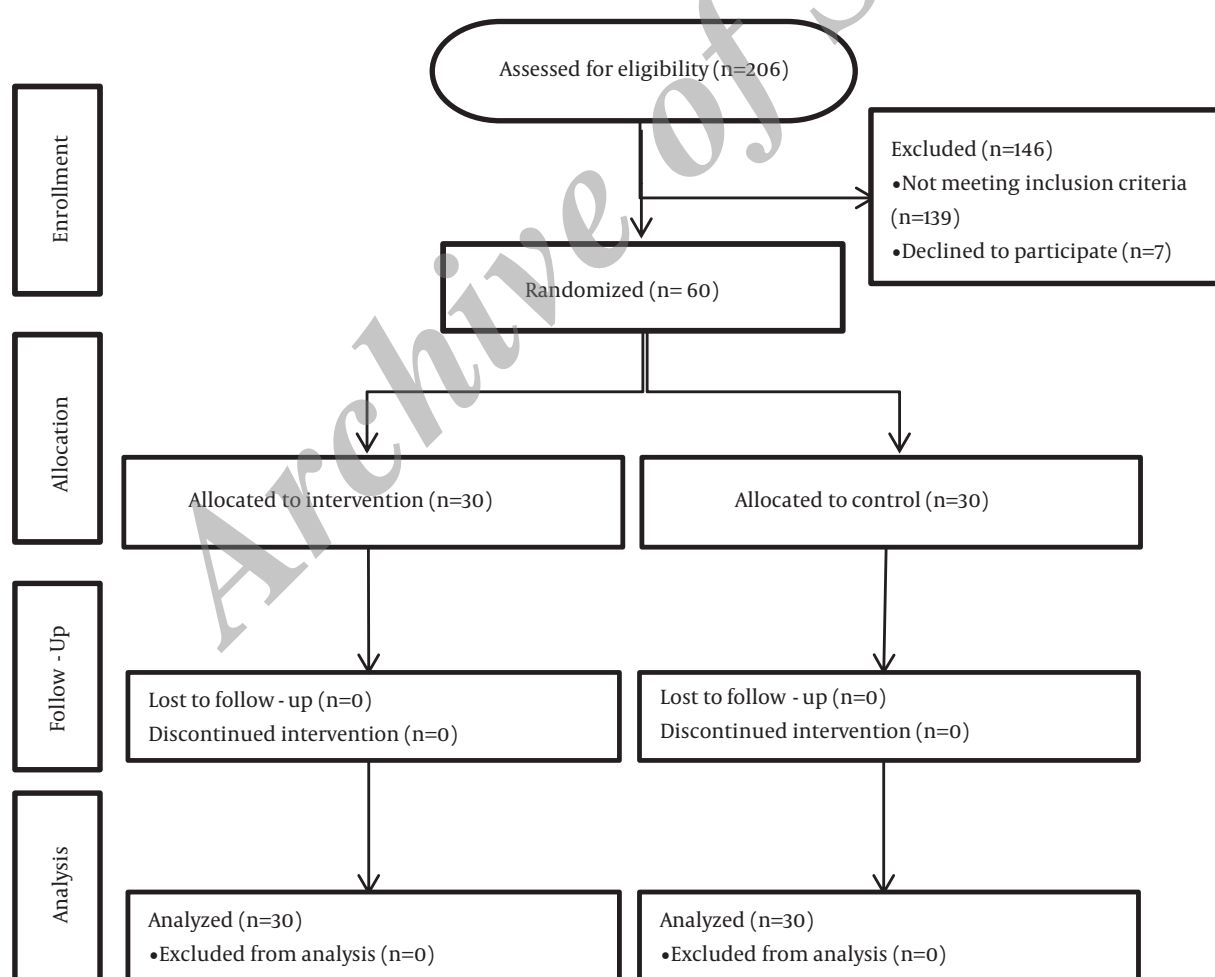


Figure 1. The Study Flow Diagram

The inclusion criteria were being oriented to time, place, and person, undergoing CABG a day before the study, having no hearing impairments, having no known anxiety disorder, having no history of cardiac surgery, having no known endocrine disorder, no need to a tracheal tube, temporary pacemaker or intraaortic balloon pump after the surgery. The exclusion criteria included a patient's reluctance to remain in the study, decreased consciousness, cardiac arrest and using tranquilizers or hypnotic-sedative agents during the study.

### 3.2. Instruments

The study instrument comprised of three parts. The first part included the demographic information such as age, gender, marital status, education level and the duration of surgery. The second part was a checklist for recording cardiovascular indices including HR (beats per minute), SBP (mmHg), DBP (mmHg), and MAP (mmHg); and the third part included a visual analogue scale for anxiety measurement (VAS-A). The checklist of cardiovascular indices was developed reviewing relevant literature, and its content validity was confirmed by the 10 faculty members in Qom University of Medical Sciences (QUMS). The VAS-A consists of a 10 cm horizontal line, scored from zero (no anxiety) to ten (worst anxiety) (17, 18). As a valid, reliable and sensitive instrument, VSA-A provides a precise measurement for anxiety (19, 20). Test-retest reliability for the VSA-A has been shown to be 0.96 (19).

### 3.3. Procedures

The participants with the inclusion criteria were identified and invited to the study by daily file review of patients' admitted to the CVSICU and consulting with their concerning physicians. The researcher referred to the patients at evening shift after 14:00 PM when they were at rest in the semi-Fowler's position, the researcher allocated them into the two groups according to the aforementioned list. The patients' demographic data were extracted from their hospital records. In the study setting between 14:30 PM to 15:30 PM, most of the patients were resting, had no visitors and received no medical procedure or nursing care. In the intervention group, the light music was played using a digital MP3 player and a headphone from 14:30 to 15:00, while they were in the semi-Fowler's position. This music contained the sounds of nature including sea and bird sounds with duration of 30 minutes. In the control group, patients were asked to sit in the semi-Fowler's position during this time and distractions such as telephones, radio, and television were avoided. The cardiovascular indices and the anxiety scores of the intervention group were measured immediately before (at 14:25), immediately after (at 15:00) and half an hour after the termination of the music (at 15:30) while the patients were in semi-Fowler's position. All the measurements and data collection in the control group were also performed at times and position similar to the

intervention group. A calibrated vital signs monitoring system (Sa'adat®, made in Iran) was used to measure the cardiovascular indices. All of the CABG surgeries in the study setting are performed by two physicians in the same way.

### 3.4. Ethical Considerations

The ethics committee of QUMS approved the study in the October, 2010 (grant No: P.34.12050). In addition, permissions were obtained from the hospital and CVSICU authorities. The researcher informed all of the patients about the course of the study, being free to participate or withdraw from the study. Patients were also assured of the data confidentiality, absence of any constraint to participate, and the lack of adverse effects of the intervention. Also, a written informed consent was obtained from each participant.

### 3.5. Data Analysis

Statistical analysis were performed using SPSS 11.5 software (SPSS, Inc., Chicago, Illinois, USA). The difference between the two groups regarding demographic data was assessed using an independent t-test and chi-square test. Repeated measures analysis of variance (RMANOVA) was used to compare the effects of music therapy on anxiety and cardiovascular indices at three consecutive measurements. A P value less than 0.05 was considered statistically significant in all tests.

## 4. Results

The statistical analysis showed no significant difference in the age ( $P = 0.118$ ), duration of surgery ( $P = 0.417$ ), gender ( $P = 0.604$ ), marriage ( $P = 0.999$ ), and education level ( $P = 0.589$ ) between the two groups (Table 1).

**Table 1.** Comparison of the Demographic Characteristics Between the Group Received Music Therapy and the Control Group<sup>a</sup>

Characteristics	Experimental Group	Control Group	P Value
Age, y	56.33 ± 13.52	60.91 ± 8.66	0.999 <sup>b</sup>
Duration of surgery, h	3.94 ± 0.43	3.81 ± 0.46	0.999 <sup>b</sup>
Gender			0.604 <sup>c</sup>
Female	15 (50)	12 (40)	
Male	15 (50)	18 (60)	
Marital status			0.999 <sup>c</sup>
Married	27 (90)	26 (86.67)	
Single	3 (10)	4 (13.33)	
Education status			0.589 <sup>c</sup>
Literate	18 (60)	21 (70)	
Illiterate	12 (40)	9 (30)	

<sup>a</sup>Data are presented as No. (%) or mean ± SD.

<sup>b</sup>The results of independent t-test.

<sup>c</sup>The results of chi-square test.

The RMANOVA showed that compared to the immediately before intervention, the mean anxiety scores immediately after and 30 minutes after the intervention, were significantly lower in the experimental group ( $P < 0.037$ ). As the Mauchly's test of sphericity was significant ( $P < 0.001$ ), we used the Greenhouse-Geisser approach to examine the difference among the measurement time-points regarding anxiety. The results of this test showed that the trend of anxiety score changes in the stages immediately before, immediately after and 30 minutes after the intervention was significant ( $F = 19.919$ ;  $P < 0.001$ ). The results of this study also showed that the interaction between the two groups and time was significant ( $F = 7.178$ ;  $P = 0.004$ ; Table 2 ; Figure 2).

However, in RMANOVA, no significant differences were observed in the mean HR, SBP, DBP, and MAP in three con-

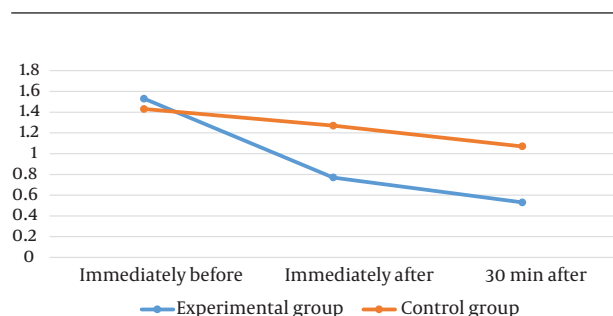
secutive measurements ( $P > 0.05$ ; Table 2). As the Mauchly's test of sphericity was significant ( $P < 0.001$ ), we used the Greenhouse-Geisser approach to examine the difference among the measurement time-points regarding HR, SBP, DBP, and MAP. The results of this test showed that the trend of HR changes in the stages immediately before, immediately after, and 30 minutes after the intervention was not significant ( $F = 0.462$ ;  $P = 0.538$ ). However, the trend of SBP ( $F = 6.202$ ;  $P = 0.005$ ), DBP ( $F = 6.071$ ;  $P = 0.005$ ) and MAP ( $F = 6.667$ ;  $P = 0.003$ ) changes in the stages immediately before, immediately after and 30 minutes after the intervention was significant. The results of this study also showed that the interaction between two groups and time in the terms of HR ( $F = 0.409$ ;  $P = 0.566$ ), SBP ( $F = 0.379$ ;  $P = 0.646$ ), DBP ( $F = 0.281$ ;  $P = 0.722$ ), and MAP ( $F = 0.370$ ;  $P = 0.652$ ) was not significant (Table 2 and Figures 3 - 6).

**Table 2.** Cardiovascular Indices and Anxiety Scores in the Experimental and Control Groups in the Stages Immediately Before, Immediately After, and 30 Minutes After the Study<sup>a</sup>

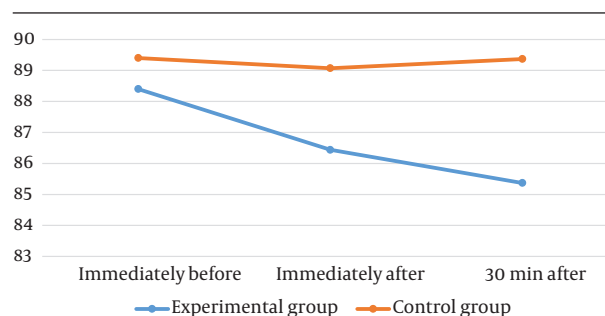
Variable	Immediately Before	Immediately After	30 min After	RMANOVA	
				P Value	F
<b>HR</b>				0.544	0.462
Experimental group	88.40 ± 11.90	86.44 ± 13.11	85.37 ± 21.54		
Control group	89.40 ± 13.77	89.07 ± 13.31	89.37 ± 26.73		
<b>SBP</b>				0.937	0.006
Experimental group	118.66 ± 24.03	115.36 ± 19.13	111.13 ± 19.72		
Control group	117.90 ± 14.06	115.10 ± 16.48	113.20 ± 16.01		
<b>DBP</b>				0.159	2.040
Experimental group	76.90 ± 18.00	73.70 ± 12.22	72.07 ± 11.45		
Control group	71.43 ± 13.01	67.77 ± 17.83	67.97 ± 16.71		
<b>MAP</b>				0.571	0.325
Experimental group	159.93 ± 34.29	156.63 ± 27.73	153.30 ± 25.61		
Control group	155.52 ± 18.17	152.42 ± 21.59	151.22 ± 19.99		
<b>Anxiety score</b>				0.037	4.578
Experimental group	1.53 ± 0.89	0.77 ± 0.72	0.53 ± 0.57		
Control group	1.43 ± 0.77	1.27 ± 0.44	1.07 ± 0.69		

Abbreviations: DBP, diastolic blood pressure; HR, heart rate; MAP, mean arterial pressure; RMANOVA, repeated measures analysis of variance; SBP, systolic blood pressure.

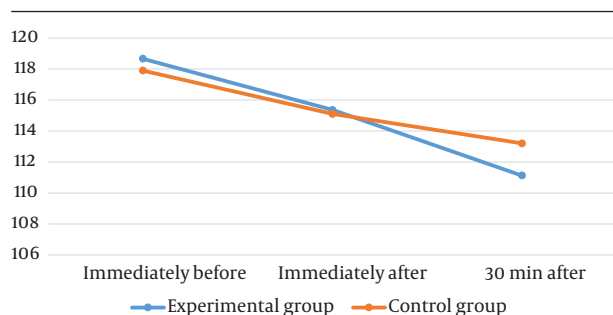
<sup>a</sup>Values are presented as mean ± SD.



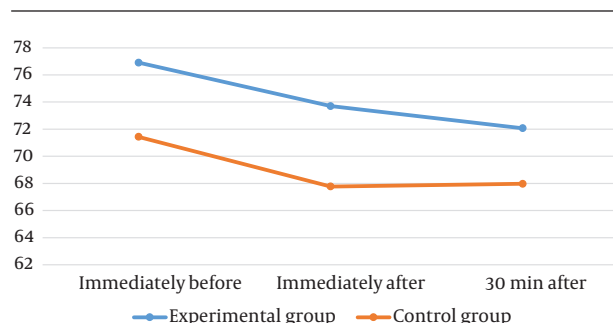
**Figure 2.** The Trend of Change in Anxiety Score During the Study



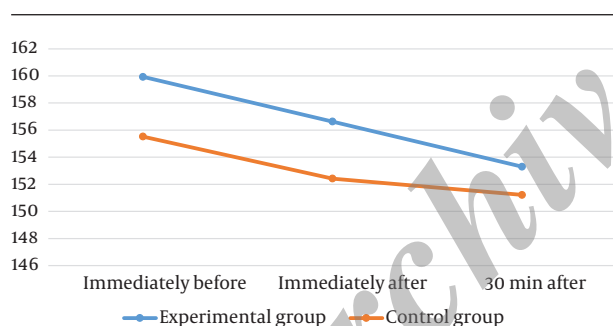
**Figure 3.** The Trend of Change in Heart Rate During the Study



**Figure 4.** The Trend of Change in Systolic Blood Pressure During the Study



**Figure 5.** The Trend of Change in Diastolic Blood Pressure During the Study



**Figure 6.** The Trend of Change in Mean Arterial Pressure During the Study

## 5. Discussion

This study showed that music therapy significantly reduced the mean anxiety score in the patients undergoing CABG. In line with the current study, Jafari et al. (21) and Sendelbach et al. (1) found that the music therapy can reduce anxiety among patients undergoing cardiac surgery. Dogan and Senturan also found that music therapy reduced patients' anxiety after coronary angiography (22). In contrast, Nilsson found that music therapy had no effect on anxiety among patients undergoing cardiac surgery (11). The incongruence in the results of Nilsson's study (11) with the current study may be related to the different type of participants. Because Nilsson recruited a combination of patients undergoing CABG and aortic valve replacement surgery and the latter patients usually

have higher levels of psychological disorders than the patients undergoing CABG (23). It is believed that music has complex effects on the physiological, psychological, and spiritual dimensions of human beings. The effect of anxiety is attributed to the attention occupying effects in the brain with meaningful, distractive auditory stimuli. Music intervention provides a patient with a familiar, comforting stimulus that can evoke pleasurable sensations while refocusing the individual's attention onto the music instead of on stressful thoughts or other environmental stimuli (11, 24, 25). The reduction of anxiety after music therapy might also be attributed to the calm atmosphere in which the method is applied (11, 24).

In the present study, music therapy had no effect on patients' HR, SBP, DBP, and MAP. In line with the findings of the present study, Sendelbach et al. (1) and Nilsson (11) also found that 20 - 30 minutes of music therapy could not improve the HR, SBP, and DBP and MAP of patients undergoing cardiac surgery. However, Emami Zeydi et al. reported that music therapy reduced HR, SBP and MAP among patients undergoing CABG (14). Moreover, Korhan et al. found that music therapy reduced the SBP and DBP among patients hospitalized in the ICU (26). Naderi et al. have also showed that listening to favorite music can reduce the patients' HR (27). It has been shown that rhythm and tempo of music can be used to synchronize or entrain body rhythms such as heart rate. Music with a fluid and regular rhythm of less than 80 beats per minute can be used to promote relaxation by causing body rhythms to slow down or "entrain" with the slower beat and regular, repetitive rhythm. However, individual responses to music can be influenced by personal preferences, the environment, education, and cultural factors (25). People have different socio-cultural backgrounds and like different kind of music (28, 29), this may effected the results of music therapy. The inconsistencies in the results of Emami Zeydi et al. (14), and Korhan et al. (26) with the current study might be related to the differences in methodology of these studies because in those studies patients listened to a favorite music while in the present study a fix type of music was played for all patients. Furthermore, perhaps the effects of music on physiological parameters might be assessed in longer periods because its effects might be mediated by the level of anxiety and the effects of anxiety on improving the patients' cardiovascular indices might begin 30 minutes after the intervention (14). In the Korhan et al. study, also the physiological indices were measured 90 minutes after music therapy (26).

The current study has several limitations. First, people like different kind of music, so some patients might not be interested in the music used in this study. Second, we did not measure cardiovascular indices longer than 30 minutes. Third, in patients with a history of CABG in their family, the level of anxiety might be lower or higher than other patients. To overcome these limitations, more researches are needed to address how favorite music affects the anxiety and cardiovascular indices. Measurement of



the cardiovascular indices more than 30 minutes after intervention is also recommended. Furthermore, it is worthwhile to investigate the effect of music therapy on anxiety and cardiovascular indices among patients with and without history of CABG in their family.

In conclusion, the findings of the present study showed that music therapy is an effective nursing intervention in decreasing anxiety among patients undergoing CABG. However, the intervention was not effective on cardiovascular indices. Accordingly, intensive care nurses can apply music therapy as a non-pharmacological and safe intervention to improve the patients' anxiety.

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## Footnotes

**Authors' Contribution:** Study concept and design: Saeide Heidari and Atye Babaii; acquisition of data: Atye Babaii, and Mohammad Abbasinia; analysis and interpretation of data: Mohammad Abbasi, Mahboobe Rezaei, and Mahdi Shamali; drafting of the manuscript: Saeide Heidari, Atye Babaii, and Mahdi Shamali; critical revision of the manuscript for important intellectual content: Saeide Heidari, Atye Babaii, Mohammad Abbasinia, and Mohammad Abbasi; statistical analysis: Mohammad Abbasinia, Mohammad Abbasi, and Mahboobe Rezaei; administrative, technical, and material support: Saeide Heidari, Atye Babaii, and Mohammad Abbasinia; study supervision: Saeide Heidari.

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