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Effects of music on physiological and behavioral responses of premature infants: A randomized controlled trial

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A B S T R A C T

Introduction: Despite persuasive theories about the beneficial effects of music and singing in developmental care for premature infants, few small studies are available in this regard. We conducted this study to investigate the physiological and behavioral responses of premature infants to recorded lullaby music and silence.
Methods: In a randomized controlled trial, 90 premature infants in the neonatal care unit of a hospital in Qom (Iran) were randomly allocated to intervention (lullaby and silence) or control groups. Lullaby music was played via headphones at a volume of 50–60 dB. In the silence group, headphones were placed on the infants' ears while no music was played. The three groups were surveyed for physiological responses including oxygen saturation, respiratory and heart rates, and behavioral states every five minutes before, during, and after the intervention.
Results: The three groups were not significantly different in terms of mean values of respiratory and heart rates, oxygen saturation, and behavioral states of infants. Similarly, no significant within group differences in respiratory and heart rates, oxygen saturation, and behavioral states were observed at different times.
Conclusion: Our findings did not support the beneficial effects of music for premature infants. However, music is a noninvasive, non-pharmaceutical, and relatively low-cost intervention that can be implemented at infants' bedside. Thus further research is warranted to determine whether the effects noted in previous studies can be consistently replicated in diverse settings and with diverse groups of preterm infants.

1. Introduction

Recent medical advancements such as in utero transfer, antenatal steroids, surfactant administration, and ventilator support have dramatically decreased mortality rates of premature infants.[1] However, these treatments have not improved long-term developmental outcomes in premature infants[2] and they still suffer from neurological disability and abnormal development[3] and they have higher rates of cerebral palsy, subnormal cognitive functioning, behavioral problems, hyperactivity, learning disabilities and attention deficit disorders compared to mature infants.[4]

Such neurobiological conditions can be caused by persistently high stress levels during medical treatments and care in neonatal intensive care unit (NICU).[4] The extra-uterine environment in the NICU will undoubtedly interfere with an infant's normal growth and development and makes the premature infant more susceptible to brain injury.[2] The sights and sounds of a modern NICU provide an inappropriate sensory environment for a premature infant. An infant in the NICU is exposed to average ambient noise levels of 50–88 dB (reaching a peak level of over 100 dB) from various sources including ventilators, monitor alarms, incubator fans and motors, conversations, radios, telephones, water faucets, and cabinet doors. Loud noise and abrupt peaks in sound levels can be highly stressing for the medically fragile premature infant. Consequently, conditions like hypoxemia, blood pressure instability, increased apnea and bradycardia, altered cerebral blood flow, and intraventricular hemorrhage are hence probable. These sounds may also interrupt sleep–wake cycles and prevent rapid eye movement sleep (REM) stage which is necessary for maturation and weight gain.[5]

Hence, besides focusing on medical procedures for survival, studies on premature infants in NICU have evaluated developmental

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care.[6] Developmental care comprises a range of medical and nursing interventions that suggested to decrease the stress imposed on premature infants in NICUs and to facilitate their optimal neurobehavioral development.[1] Light and noise management, music therapy, positioning/bundling, use of pacifiers and kangaroo care (skin contact with the mother or a caregiver) are different approaches to developmental care.[5]

Music therapy, a promising intervention in NICUs, uses evidence-based music techniques by a trained music therapist to achieve behavioral changes in an individual. Not only can music mask ambient sounds in NICUs, it can soothe infants and provide exposure to complex auditory stimuli that promote appropriate neurological development.[4]

In the recent decade, several studies have examined the effects of auditory stimuli on premature infants.[7] The effects of pop, jazz, and other types of music and lullabies on short-and long-term responses of premature infants have also been assessed. Some researchers have reported positive effects of music on long-term variables including non-nutritive sucking,[7] length of hospitalization,[8] and weight gain.[9,10] Music has also been found to positively affect on short-term responses such as oxygen saturation,[11,12] heart rate,[13] and behavioral scores.[9,14]

For example Chou et al. suggested that music therapy during endotracheal suctioning significantly increases oxygen saturation in premature infants.[11] According to a meta-analysis by Standley, music has important clinical benefits for premature infants. These benefits include increased oxygen saturation, reduced stress, enhanced bonding with family members, reinforced non-nutritive sucking, increased sucking ability, and sustained homeostasis during multimodal stimulation.[15] However, some studies have not confirmed the advantages of music therapy.[3,16]

Despite the existence of persuasive theories, only a number of small studies have supported music and singing as appropriate developmental care for premature infants in NICU.[3] Thus, we compared the effects of recorded lullaby music, silence, and no intervention on short-term physiological and behavioral parameters of stable premature infants during their stay in the neonatal care unit of a hospital in Iran.

2. Methodology

A double-blind randomized controlled trial was conducted to evaluate the effects of recorded lullaby music and silence on short-term physiological and behavioral responses of premature infants in the neonatal care unit. The sample size to achieve a power of 0.8, alpha level of 0.05, and the smallest effect size of 3 for physiological responses was 23 per group. As recommended by a biostatistician, the final group size was considered as 30 infants. All premature infants were randomly allocated to either the intervention or control groups.

3. Sample and setting

This study was carried out in the neonatal care unit of Izadi Teaching Hospital (Qom, Iran). The participants were 90 premature infants who had been transferred from the NICU to the neonatal care unit. Subjects had gestational ages of 28–37 weeks and Apgar scores $\geq$7 at the first and fifth minutes after birth, and their weights were appropriate for gestational age. None of the infants had received sedative medications such as phenobarbital. They did not have intraventricular hemorrhage, necrotizing enterocolitis, sepsis, acute lung diseases, congenital defects, neonatal anemia, acute illnesses, hypersensitivity to sound, and history of maternal drug or alcohol abuse. Only infants who were clinically and physically stable were included.

3.1. Infants' responses

Short-term physiological responses including oxygen saturation, respiratory rate, heart rate, and behavioral states of the infants were selected as dependent variables. These indexes are responsive to auditory stimuli and have been commonly used in studies on the effects of music on premature infants.

3.2. Experimental intervention

The lullaby group listened to lullaby music (Good Night Kid, produced by the national radio of Iran) via headphones for 20 min. The loudness of music was maintained at 50–60 dB, using the A-scale of a Cirrus (cr274) sound level meter. In the silence group, headphones were placed on the infants' ears for 20 min but no music was played. The control group, however, did receive any type of intervention besides routine care.

3.3. Procedure

The study protocol was approved by the ethics committee of Qom University of Medical Sciences (Qom, Iran). During December 2011–August 2012, parents of eligible infants were approached as they visited in the neonatal care unit. The purpose and procedure of the study were briefly described to the parents and formal written consents were obtained from those willing to participate.

After extracting the demographic characteristics of the infants from hospital records, their neonatal medical charts were reviewed to ensure the absence of any contraindications to the intervention. Infants were only included if they did not require any sort of nursing care during the 40 min that the researcher performed the experiment and it's follow up.

While the infants in lullaby and silence groups were placed in a supine position in an incubator, headphones (A4TECH model EST1987) attached to a MP3 player were put on both of their ears. Headphones could minimize ambient noise, guaranteed binaural hearing of the stimulus, and did not affect other infants. The control group did not receive any intervention.

Oxygen saturation level and heart rate were measured with an Oxypleth pulse oximeter (model A520, USA) whose sensors were attached to the infants' feet. All measurements were performed with the same device. Respiratory rate (breaths per minute) was calculated based on the number of neonates' chest movements in one minute. Behavioral states of infants were recorded using observations. Behavioral states graded on the behavioral state instrument (BSI). Six different behavioral states were distinguished: State1 quiet sleep, State 2 active sleep, State 3 drowsy, State 4 quiet awake, State 5 active awake and State 6 crying.[3] Heart rate, respiratory rate, oxygen saturation, and behavioral states of the infants were recorded every five minutes before, during, and after the intervention.

For all groups, the study protocol and measurement of variables started 30 min after the last feeding and other routine nursing care. The infants were placed in their incubators, the equipment was set up and baseline data was recorded five and 10 min after placing the earphones and sensors. Then, the lullaby music was played for the lullaby group. Data recording was repeated at the 5th, 10th, 15th and 20th minutes of intervention and at the 5th and 10th minutes post-intervention. After 20 min play of lullaby, the music was stopped without handling the infants. No music was played for the silence group. Physiological responses and behavioral states of the silence and control groups were recorded at defined times. All data was collected by a co-researcher who was blinded to the type of interventions.

Table 1
Demographic characteristics of the studied premature infants.

Characteristics	Lullaby group ($n = 30$)	Silence group ($n = 30$)	Control group ($n = 30$)	P value
Female/male (n)	16/14	8/22	16/14	0.05[a]
Caesarian section/normal vaginal delivery (n)	3/22	12/18	13/17	0.36[a]
Brest fed/formula fed (n)	3/27	6/24	2/28	0.26[a]
First minute Apgar score (mean ± SD)	0.71 ± 8.03	0.69 ± 8.06	0.78 ± 8.06	0.98[b]
Fifth minute Apgar score (mean ± SD)	0.67 ± 9.23	0.61 ± 9.2	0.62 ± 9.4	0.43[b]
Gestational age (weeks) (mean ± SD)	2.47 ± 33.50	2.29 ± 33.80	2.23 ± 33.63	0.88[c]
Age (days) (mean ± SD)	3.39 ± 5.00	3.66 ± 3.76	6.12 ± 6.30	0.10[c]
Birth weight (g) (mean ± SD)	388.92 ± 2086.03	306.38 ± 2158.73	298.32 ± 2116.23	0.69[b]

[a] Chi-square test.
[b] Analysis of variance.
[c] Kruskal–Wallis test.

Handling and treatments were avoided during the course of the study. If infants experienced any significant medical problems or handling during intervention and within the following 10 min, they were excluded from the study. Overall, six infants were excluded (one from the lullaby group for vomiting, two from the silence group for crying, and two from the control group for crying and handling). None of the infants had heart rates above 200 beats per minute or oxygen saturation less than 80%. Normal hearing of all infants was ensured by otoacoustic emissions (OAE) tests at their discharge from the hospital. One infant with abnormal OAE test result was excluded from study.

3.4. Limitations of data collection

Absence of a sound level meter to measure ambient noise and a monitor to record respiratory rate were the limitations of this study.

3.5. Data analysis

SPSS for Windows version 16.0 (SPPS Inc., Chicago, IL, USA) was used for data analysis. The characteristics of the sample were described through descriptive statistics. The normality of the data distribution was assessed by Kolmogorov–Smirnov tests. Analysis of variance (ANOVA), Chi-square, Kruskal–Wallis, Repeated Measures and Friedman tests were used to analyze the collected data. P values less than 0.05 were considered significant for all statistical tests.

4. Results

In the nine-month recruiting period, 90 (50 female and 40 male) infants in three groups of lullaby, silence, and control (30 infants in each group) were included. The mean gestational and chronological age of infants were 33.64 ± 2.31 weeks (range: 28–36) and 5.02 ± 4.63 days (range: 1–25), respectively. The mean birth weight of infants was 2120.33 ± 331.31 g (range: 1300–2700) and Apgar scores at the first and fifth minutes ranged from 7 to 10. While 33 babies were born by vaginal delivery, 57 were born by cesarean section. Moreover, 79 infants were breastfed but 11 received formula.

According to Kolmogorov–Smirnov test, oxygen saturation, behavioral states, gestational age, and age did not have normal distributions.

Based on chi-square test, ANOVA, and Wilcoxon tests, the three groups were not significantly different in terms of demographic variables (Table 1).

Kruskal–Wallis test and ANOVA showed no statistically significant differences between the three groups in mean oxygen saturation, respiratory and heart rates, and behavioral states 10 min before the intervention, at the end of the intervention (20 min after its beginning), and 10 min after completion of the intervention (Table 2).

In addition, repeated measures ANOVA did not indicate any significant differences in respiratory and heart rates in any of the three groups during the course of the study. Similarly, Freidman's test suggested no significant within group differences in oxygen saturation or behavioral states at different intervals (Table 3). Only respiratory rate in lullaby group displayed significant differences at different times of intervention ($P = 0.03$).

5. Discussion

In the current study, 20 min of lullaby music or silence did not cause significant differences in the mean values of oxygen saturation, respiratory rate, heart rate, and behavioral states of premature infants either immediately or 10 min after the intervention.

Table 2
Comparison of oxygen saturation, respiratory rate, heart rate and behavioral state of premature infants in lullaby, silence and control groups.

Dependent variable	Times	Lullaby group ($n = 30$) (mean ± SD)	Silence group ($n = 30$) (mean ± SD)	Control group ($n = 30$) (mean ± SD)	P value
Oxygen saturation	Before the intervention	4.27 ± 93.96	3.89 ± 92.83	3.96 ± 93.30	0.37[a]
	End of the intervention (20th minute)	93.33 ± 4.81	92.20 ± 4.43	93.56 ± 4.05	0.28[a]
	The 10th minute after the intervention	3.65 ± 93.76	4.16 ± 92.56	3.18 ± 93.16	0.39[a]
Heart rate	Before the intervention	15.22 ± 132.60	15.67 ± 137.57	13.92 ± 132.57	0.33[b]
	End of the intervention (20th minute)	130.20 ± 13.82	135.30 ± 15.00	132.77 ± 15.57	0.41[b]
	The 10th minute after the intervention	131.43 ± 10.79	139.63 ± 13.51	133.97 ± 15.34	0.057[b]
Respiratory rate	Before the intervention	50.83 ± 6.42	49.00 ± 8.82	49.16 ± 8.13	0.60[b]
	End of the intervention (20th minute)	48.53 ± 8.35	49.03 ± 7.29	50.20 ± 6.87	0.68[b]
	The 10th minute after the intervention	49.00 ± 8.18	49.87 ± 7.41	49.46 ± 8.20	0.91[b]
Behavioral state	Before the intervention	1.70 ± 0.74	1.56 ± 0.85	1.63 ± 0.92	0.54[a]
	End of the intervention (20th minute)	1.56 ± 0.72	1.83 ± 0.83	1.66 ± 0.88	0.39[a]
	The 10th minute after the intervention	1.66 ± 0.75	1.73 ± 0.98	1.66 ± 0.92	0.93[a]

[a] Kruskal–Wallis test.
[b] Analysis of variance.

Table 3
Comparison of oxygen saturation, respiratory rate, heart rate and behavioral state of premature infants in different minutes of intervention, in lullaby, silence and control groups.

	Before the intervention (mean ± SD)	Middle of the intervention (mean ± SD)	End of the intervention (mean ± SD)	10 min after the intervention (mean ± SD)	P value
Lullaby group					
Oxygen saturation	93.69 ± 4.27	93.70 ± 4.45	93.33 ± 4.81	93.76 ± 3.95	0.31[a]
Heart rate	132.60 ± 15.22	135.10 ± 14.12	130.20 ± 13.82	131.43 ± 10.79	0.81[b]
Respiratory rate	50.83 ± 6.42	47.23 ± 7.72	48.53 ± 8035	49.00 ± 8.18	0.03[b]
Behavioral condition	1.70 ± 0.74	1.50 ± 0.57	1.56 ± 0.72	1.66 ± 0.75	0.34[a]
Silence group					
Oxygen saturation	92.83 ± 3.89	92.43 ± 4.05	92.20 ± 4.43	92.56 ± 4.16	0.94[a]
Heart rate	137.57 ± 15.67	135.90 ± 13.73	135.30 ± 15.00	139.63 ± 13.51	0.14[b]
Respiratory rate	49.00 ± 8.82	47.60 ± 7.97	49.03 ± 7.29	49.86 ± 7.41	0.15[b]
Behavioral condition	1.56 ± 0.85	1.73 ± 0.98	1.83 ± 0.83	1.73 ± 0.98	0.22[a]
Control group					
Oxygen saturation	93.30 ± 3.96	92.60 ± 3.90	93.56 ± 4.05	93.16 ± 3.18	0.28[a]
Heart rate	132.57 ± 13.92	133.43 ± 14.96	132.77 ± 15.57	133.97 ± 15.34	0.80[b]
Respiratory rate	49.16 ± 8.13	49.73 ± 7.26	50.20 ± 6.87	49.46 ± 8.20	0.64[b]
Behavioral condition	1.63 ± 0.92	1.73 ± 0.94	1.66 ± 0.88	1.66 ± 0.92	0.98[a]

[a] Friedman test.
[b] Repeated measures analysis of variance.

Different baseline values of dependent variables in groups can be a confounding factor affecting the interpretation of the results. However, based on our initial evaluations, the three groups were matched in terms of mean oxygen saturation, respiratory and heart rates, and behavioral states at baseline.

Collabra et al. and Arnon et al. reported comparable findings.[16,17] Collabra et al. replayed Brahms lullaby music (65–76 dB, 20 min for four days) for premature infants. They found no significant differences in heart rate, respiratory rate, and oxygen saturation between music and control groups.[16] Arnon et al. compared the effects of live and recorded lullaby music (55–70 dB for 30 min). Music was replayed for premature infants without headphones. Significantly lower heart rate and behavioral scores were reported 30 min after live music compared to recorded music and the control group. However, there were no significant differences between recorded music group and the control group. Respiratory rate and oxygen saturation in the three groups were not significantly different.[17]

In a study by Hodges Wood, 15 min of live music (55–70 dB) did not significantly change behavioral scores, heart rate, and oxygen saturation in premature infants.[18] In a comparison between the effects of recorded Brahms lullaby music (60 dB, for 20 min, using headphones) and recorded noise of the NICU environment on physiological and behavioral responses of premature infants, Neal found no significant differences in oxygen saturation levels and heart rate. In fact, 10 min after the intervention, oxygen saturation significantly decreased and heart rate significantly increased in both groups. No significant differences or changes in behavioral states were reported.[3]

Burke et al. reported decreased heart rate of premature infants after listening to recorded lullaby.[19] Chou et al. applied recorded lullaby (60 dB) during endotracheal suctioning and found music to increase oxygen saturation in premature infants.[11]

Farhat et al. and Amiri et al. used headphones to play 20 min of lullaby music (65–75 dB) for premature infants for eight days. They placed headphones without music on the ears of the control group.[20,21] Farhat et al. observed no changes in heart rate but reported significant increases in respiratory rates during intervention compared to baseline.[20] On the other hand; Amiri et al. indicated that oxygen saturation in the lullaby group significantly increased during the intervention compared to baseline. However, significant reductions in oxygen saturation were detected in the control group.[21]

Keshavars et al. played Quran recitation (50–60 dB, 20 min) for premature infants via headphones. They suggested that during and after the intervention, oxygen saturation was significantly higher and respiratory rate was significantly lower in the Quran group compared to the control. Nevertheless, no significant differences in the mean heart rate during intervention were established between the two groups.[22] In our study, on the Repeated Measures and Friedman tests, respiratory and heart rates, oxygen saturation, and behavioral states of the three groups had no significant differences at various time intervals. Only respiratory rate in the lullaby group displayed significant differences. In contrast, Keshavars et al. reported significant differences in the mean values of oxygen saturation, respiratory and heart rates in the experimental group.[22]

6. Conclusion

Our findings showed that compared to silence or routine care, lullaby music failed to induce significant alterations in the mean values of oxygen saturation, respiratory and heart rates, and behavioral states of infants. However, changes in the mentioned parameters were within the normal range among the studied premature infants. The current study suggests that controlled interventions, like lullaby music and silence, have no adverse effects on physiological and behavioral responses of premature infants. Further research in this field is recommended.

Authors' contributions

Narges Eskandari and Zahra Alipour were responsible for most of the study including data collection, data derivation, statistical analysis, interpretation of results, preparation of tables, and manuscript drafting and writing. Hoda Ahmari Tehran and Seyed Kamal Eshagh Hossaini participated in the design and coordination of the study. Sareh Sangi participated in data collection.

Sources of support

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Conflict of interests

None to declare.

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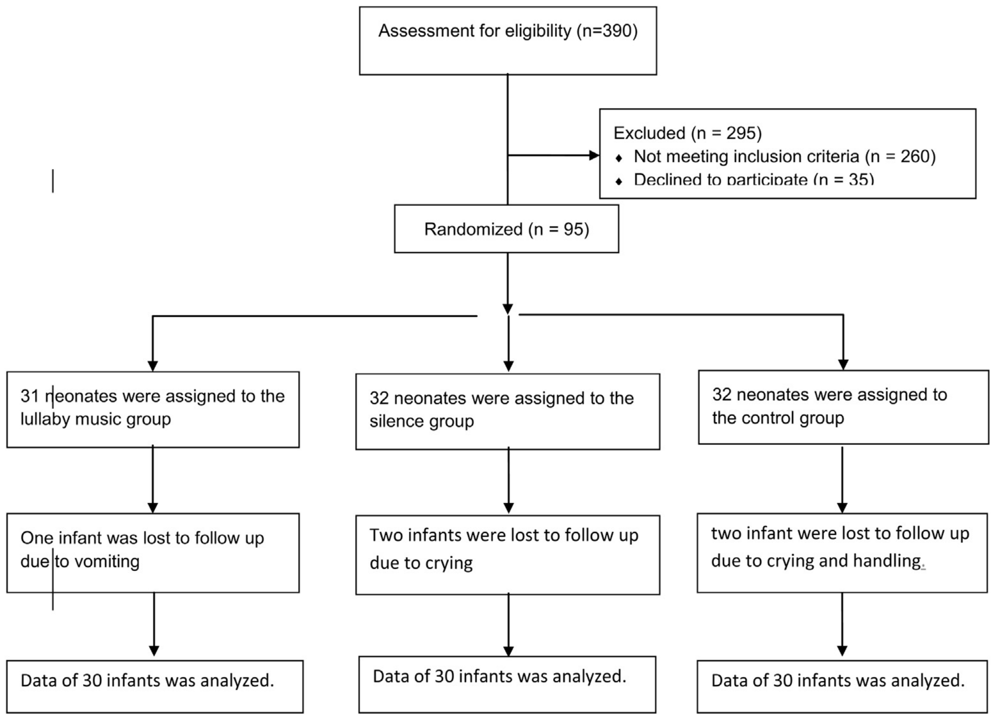
Appendix A. CONSORT flow diagram.



References

1. Sizun J, Westrup B. Early developmental care for preterm neonates: a call for more research. *Arch Dis Child Fetal Neonatal Ed* 2004;**89**:384–9.
2. Lubbe W. *Best practice guidelines for neurodevelopmental supportive care of the preterm infant/by Welma Lubbe*. Doctoral dissertation; 2010.
3. Neal DO. *Music as a health patterning modality for preterm infants in the NICU*. Minnesota University. Doctoral dissertation; 2008.
4. Gooding Lori F. Using music therapy protocols in the treatment of premature infants: an introduction to current practices. *Arts Psychother* 2010;**37**:211–4.
5. Schwartz FJ, Ritchie R. Music Listening in Neonatal Intensive Care Units [online] (2007). [Accessed 22 march 2012]. Available from: http://www.sleepia.com/shop/02_sound/pdf/Music%20Listening%20in%20Neonatal%20Intensive%20Care%20Units.pdf.
6. Standley JM. Music therapy for the neonate. *Newborn Infant Nurs Rev* 2001;**1**:211–6.
7. Standley JM. The effect of contingent music to increase non-nutritive sucking of premature infants. *J Pediatr Nurs* 2000;**26**:493–9.
8. Cevasco AM. The effects of mothers singing on full- term and preterm infants and maternal. *J Music Ther* 2008;**45**:273.
9. Schwartz FJ. Perinatal stress reduction, music, and medical cost savings. *J Prenat Perinat Psychol Health* 1997;**12**:19–29.
10. Caine J. The effect of music on the selected stress behaviors, weight, caloric formula intake, and length of hospital stay of premature and low birth weight neonates in a newborn intensive care unit. *J Music Ther* 1991;**28**:180–92.
11. Chou LL, Wang RH, Chen SJ. Effect of music therapy on oxygen saturation in premature infants receiving endotracheal suctioning. *J Nurs Res* 2003;**11**:209–16.
12. Cassidy JW, Standby JM. The effect of music listening on physiological responses of premature infants in the NICU. *J Music Ther* 1995;**32**:208–27.
13. Coleman J, Pratt R, Stoddath R, Gerstmann D, Abel H. The effects of male and female singing and speaking voices on selected physiological and behavioral measures of premature infants in the intensive care unit. *Int J Arts Med* 1998;**5**:4–11.
14. Chapman JS. Influence of varied stimuli on development of motor patterns in the premature infant. In: Anderson G, Raff B, editors. *Newborn behavioral organization: nursing research and implications*. New York: Alan Liss; 1979. p. 6180.
15. Standley JM. A meta-analysis of the efficacy of music therapy for premature infants. *J Pediatr Nurs* 2002;**17**:107–13.
16. Collabra JA, Wolfe RO, Shoe Marks HE. The effect of recorded sedative music on physiology & behavior of premature infants with respiratory disorders. *Aust J Music Ther* 2003;**14**:3–19.
17. Arnon S, Shapsa A, Forman L, Regev R, Bauer S, Litmanovitz I, et al. Live music is beneficial to preterm infants in the neonatal intensive care unit environment. *Birth* 2006;**33**:131–6.
18. Hodges Wood A. *Effect of music therapy on premature infant in the neonatal intensive care unit Alabama Univ*. Doctoral dissertation; 2008.
19. Burke M, Walsh J, Oehler J, Gingras J. Music therapy following suctioning: four case studies. *Neonatal Netw* 1995;**14**(7):41–9.
20. Farhat A, Amiri R, Karbandi S, Esmaily H, Mohammadzadeh A. The effect of listening to lullaby music on physiologic response and weight gain of premature infants. *J Neonatal Perinat Med* 2010;**3**(2):103–7.
21. Amiri RA, Farhat AS, Karbandi S, Esmaeli H, Mohammadzadeh A, Looye ES. Effect of lullaby music listening on SPO2 in premature infants. *J Birjand Univ Med Sci* 2009;**15**(4):12–8.
22. Keshavars M, Eskandari N, Jahdi F, Ashaieri H, Hoseini F, Kalani M. The effect of holly Quran recitation on physiological responses of premature infant. *Koomesh* 2010;**11**(3):169–77.