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The Effect of Holy Quran Recitation on the Physiological Responses of Premature Infants during Phlebotomy: A Randomized Clinical Trial

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Abstract

Background: One of the painful procedures in the Neonatal Intensive Care Unit (NICU) is phlebotomy. However, the use of non-pharmacological approaches could be helpful in reducing the pain. This study aimed to determine the effect of Quran recitation on the physiological parameters of premature infants during and after phlebotomy.

Materials and Methods

This randomized, double-blind clinical trial was performed on premature infants admitted to the NICU at Dr. Ganjavian hospital in Dezful, Iran. The infants were randomly divided in two equal groups (n=28). A Quran recitation was started five minutes before blood sampling in the case group and it continued to play for another 20 minutes. The physiological symptoms were documented in both groups starting 10 minutes before blood sampling and continued until 20 minutes after it. The data was analyzed using SPSS software (version18.0).

Results: The primary outcomes of this study were the measurement of the heart rate, respiratory rate, and oxygen saturation. The results showed that the heart rate slowed significantly in the intervention group ($p<0.05$). There was a significant difference in the oxygen saturation between the groups ($p<0.05$). The respiratory rate showed a significant difference between the groups ($p=0.039$) only 20 minutes after blood sampling.

Conclusion

The findings indicated that Quran recitation can help improve physiological parameters and can be used as a routine standard method in NICU.

Key Words: Iran, Infant, Holy Quran, Phlebotomy, Physiological responses.

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1- INTRODUCTION

A preterm infant is defined as an infant born before completing 37 weeks of the gestational period (1, 2). Of the 4 million babies born in the USA each year (3), around 500,000 (12.7%) are premature (4), which is the cause of a third of all infant deaths (5). Premature infants are transferred from a safe uterine environment to the risky, stressful, and painful Neonatal Intensive Care Unit (NICU) immediately after birth (6). Neonates admitted to the NICU receive 10 to 14 painful procedures on an average every day and around 134 painful procedures in the first two weeks of life. These procedures include a variety of diagnostic, therapeutic, and care methods, such as endotracheal suction, blood sampling, heel lance blood samples, and environmental stress. Venipuncture and heel lance blood samples are more preferable methods (7–9).

In the past, people believed that newborns, especially premature infants, did not feel pain, which is why nothing was done for pain relief despite the very painful nature of the procedures (10, 11). Early studies suggested that infants did not possess a cortex developed enough to perceive or localize pain (12). However, now it has been proved that they have a well-developed nervous and chemical operating system (13), and they can also perceive, experience, and remember pain (14). In addition, pain is a stress, and the stress of pain results in problems like cardiac arrhythmia, increased metabolism, complications, and delay in recovery, even if these are insignificant (7, 15). Repeated exposure to pain at birth and before the development of the nervous system may cause long-term effects on children, such as behavioral and physiological changes, change in response to stress (6, 8, 16), mental health problems, and mental disorders (8, 16). Many clinical studies have demonstrated that failure to treat pain leads to short-term complications and long-term physiological, behavioral, cognitive sequelae, including altered pain processing, attention deficit disorder, impaired visual-perceptual ability or visual-motor integration, and poor executive functions (17). Pain is a subjective and multidimensional phenomenon (18). The experience of pain in the neonatal period can lead to impaired neurological, attention, and learning development and also behavioral disorders in children (8, 13). Babies, unlike older children, cannot express pain, but they show some visible and measurable behavioral and physiological actions, such as facial contortions, raised eyebrows, squeezed eyes, crying, increased heart rate, and decreased blood oxygen saturation, in response to painful stimuli (7). The combination of pain, stress, and separation from parents, coupled with environmental stimuli and multiple caregivers may have a negative effect on the health of babies. These factors may change the baby's vital signs, such as heart rate and blood oxygen saturation levels, lead to wide fluctuations in blood pressure, and increase restlessness (19). Clinicians use various criteria to measure pain in infants, which can lead to different interpretations.

One of these criteria is physiological parameters. Raeside showed that the most effective physiological parameter for measuring pain is the heart rate, while blood pressure, oxygen saturation, and respiratory rate are not good indicators of pain and cannot be used independently (20). Pain relief reduces physiological instability, stress, and hormonal, metabolic, and behavioral responses associated with painful procedures (13). The most effective strategy for pain relief is limiting the number of painful procedures and using drugs or non-pharmaceutical methods to relieve the pain (13). However, consumption of anesthetic drugs and opioids or sedatives is not

recommended because of their dangerous side effects (7, 21). Several studies have shown non-pharmaceutical methods to relieve pain in infants, such as non-nutritive sucking, swaddling, and rocking or holding (12). Music is one of the several environmental and non-medical care methods which nurses use to improve the health and well-being of patients (8, 22). It has been showed that live music improves sleep and heart rate, and recorded music improves the heart rate of hospitalized premature infants (23). One of the most important forms of complementary medicine is music. One of the most pleasant types of music is the recitation of the Holy Quran, which has its own soothing rhythm (24–26). In the Holy Quran, the wording of the verses is arranged in such a way that when it is recited without any accompanying musical instruments, it has its own rhythm, weight, order, harmony, and a pleasant tone (24). However, not all studies have associated the recitation of the Quran with positive medical results. For example, Hojat et al. reported that the recitation of the Quran had no effect on the adequacy of dialysis compared with silence and Arabic and Iranian music (27).

However, few studies have been conducted on the effect of the recitation of the Quran on neonatal pain. Keshavarz et al. conducted a study in 2009 to evaluate the impact of Quran recitation on the physiological responses of premature infants hospitalized in the Intensive Care Unit and reported a significant increase in oxygen saturation and reduction in heart and respiratory rates (24). According to our literature review, the effects of Quran recitation on the physiological symptoms of premature infants have not been investigated during blood sampling. Studies have only evaluated the impact of Quran recitation on premature babies in stable conditions. This study was conducted to determine the effect of Quran recitation on the physiological parameters during phlebotomy in premature infants admitted to the NICU.

2- MATERIALS AND METHODS

2-1. Study design and Ethical consideration

This study was a randomized double-blind clinical trial. The trial was approved by the Dezful University of Medical Sciences and registered in the Iranian Registry of Clinical Trials (IRCT.2014112320053N1). We received the ethical code from Dezful University of Medical Sciences. This code is DUR-130, which is registered with IRCT. The trail was performed on premature infants admitted to the NICU at Dr. Ganjavian Hospital in Dezful city, Khuzestan Province, Iran, in January to March 2015.

2-2. Participants

The sample size formula of the repeated measures analysis of variance was applied to calculate the suitable sample size. By setting Type I error and the power at 0.05 and 80% respectively, the calculated sample size for each group was 28 (**Figure.1**). The sample size was arrived at with the following formula:

$$n = \frac{2\sigma^2\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2}{d^2}$$

Since Iran is an Islamic country, the participants of these two groups came from religious families. Therefore, there was not much difference between the case and control groups regarding family background. The objectives and the importance of the study were explained to the parents. They were assured that participation in the study would have no impact on the care services. They were also assured that their information would remain confidential and anonymous. Either the parents or other legal guardians signed the written consent.

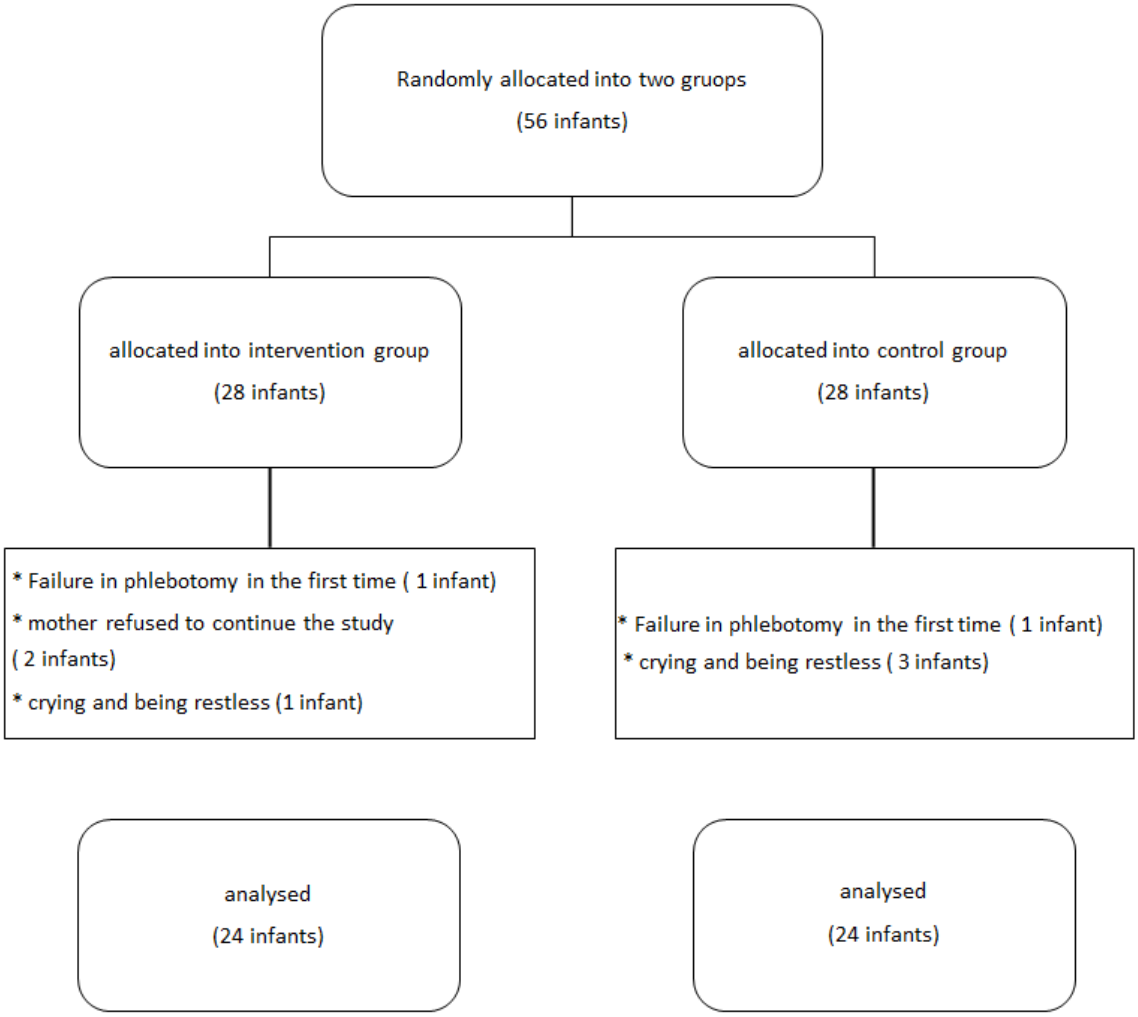

Fig.1: Enrollment, allocation and follow up flowchart.

2-3. Methods

Fifty-six premature infants aged between one and seven days and who had undergone oxygen therapy in hospital were enrolled for the study. The infants were randomly assigned to one of the two groups, control or intervention. Yasin Sura and verses 1 to 67 of the Rahman Sura of the Holy Quran recited by Sheikh Saad Al-Ghamdi were played for the babies in the intervention group in the morning shift (This research was carried out under the supervision of a spiritual leader and these verses were chosen according to his judgment (http://ahlolbait.com, Ahlolbait School of Thoughts Research and Publication Institute); the recitation was relayed via two small speakers on both sides of the head using headphones and MP3 players. The sound meter was set at about 50–55 dB (28). The Quran recitation was played for about five minutes before blood sampling and was continued until 20 minutes thereafter. The total length of the time for which the babies listened to the recitation was 25 minutes. The Quran recitation was not played for the babies in the control group. Also, the researchers did not interfere in the control group for pain relief, because no such measure is currently used in the neonatal wards of Ganjavian hospital, Dezful, Iran.

To eliminate the confounding effect of the headphones used for the intervention group, the same headphones were used for the control group, but with no sound. The ward nurses collected the blood samples by the venipuncture method. The infants lay on their back on the table during blood sampling. The researchers monitored the infants 10 minutes before, during, and up to 20 minutes after the blood sampling. The primary outcomes of the study were the measurement of the physiological symptoms, including heart rate, respiratory rate, and oxygen saturation. The normal heart rate of a newborn is between 95 and 160 beats per minute (bpm). The normal respiratory rate of a newborn is between 30 and 60 breathes per minute (4). The oxygen saturation for preterm and term infants (0–28 days old) is 93–100% and for term infants (2–6 months old), 97–100% (29). Room temperature was maintained in the range of 27–28°C. Hence, the physiological symptoms were recorded in both groups every five minutes, starting from 10 minutes before blood sampling and up to 20 minutes after it. If any abnormal sign or any exclusion criterion was noticed in the infants, the intervention was stopped immediately and the participant excluded from the study.

Fortunately, none of the babies showed any acute physiological changes during the study. Only a few babies were agitated and they were excluded from the study. Eight infants were excluded from the study. Two cases were excluded due to the failure of the phlebotomy in the first attempt. Another two were excluded because their mothers decided to withdraw from the study. Four neonates were excluded because they cried all the time and were restless. Finally, 48 infants were investigated. Figure.1 illustrates the randomization chart. Samples were collected from hospitalized premature infants in Ganjavian Hospital in Dezful University of Medical Sciences in southeast Iran.

2-4. Inclusion criteria and exclusion criteria

The inclusion criteria were a birth weight of 1,500–2,500 gr, gestational age of 29–36 weeks, normal hearing, and the need for blood sampling. The exclusion criteria were abnormal physiological responses, such as the heart rate at more than 200 or blood oxygen saturation at less than 80%, need for medical intervention, including the need for respiratory support (continuous positive airway pressure [CPAP] and mechanical ventilation), need for sedation, failure in phlebotomy in thefirst attempt, or any problem in physiological responses. By observing any abnormal sign or any of the exclusion criteria in the infants, the intervention was stopped immediately and the participant was excluded from the study.

2-5. Measuring tools and measurement

The instruments used in this study were a registration form, an MP3 player, a sound-level meter, and a monitor. The content validity method was used to determine the scientific validity of the information registration form. The registration form consisted of two parts: demographic characteristics and physiological signs.
The demographic characteristics included the type of delivery, the birth date, gender, gestational age (in weeks), the chronological age (day), and birth weight (gr). These were filled out using the neonates' medical records. The physiological signs were the heart rate (bpm), respiration rate (breath per minute), and blood oxygen saturation (percent).

A BCI (Bryant Christie Inc., Advisor Vital Signs Monitor, USA) monitoring device was used to measure the signs. Oxygen saturation and heart rate sensors were applied to the anterior surface of the radial pulse. To record the respiration rate, three triangular electrodes were applied to the

neonates' chests. The electrodes were fixed to the chest by adhesive tape so as to not displace it. An MP3 player (ME-664 model, Marshal Electronic, Iran) was used to play the Quran recitation. All the infants underwent oxygen therapy in an oxyhood (Utah Medical Products Inc., Ireland). In the first week after birth and before the intervention, the infants' hearing was tested for transiently-evoked otoacoustic emissions (TEOAE) by an audiologist using Accuscreen (Madsen Co., Denmark).

Only the infants with normal hearing were enrolled in this study. The same sound system, MP3 player, and monitor were used for all the infants to get valid and reliable measurements. A pilot study was carried out on 10 infants. The Cronbach's alpha of the pilot study was calculated. The Cronbach's alpha was used to assess the reliability of the output variables of the monitor. Hence, data for each variable was recorded for all the 10 infants at seven different points of time. According to the results, the reliability of each variable was higher than 0.9, which represented the reliability of the device.

2-5. Randomization and blindness

The infants were selected by simple random sampling. They were randomly assigned to the two groups: control and intervention. The researcher used a dice to randomly allocate each infant to either the intervention or the control group. If the number was even, the infant was assigned to the control group and if it was odd, to the intervention group. This process continued until the researchers had the desired sample size. This study was a double-blind clinical trial. The nurses who were responsible for collecting the blood samples were not aware of the group allocation. The researchers entered the data in the statistical package. Therefore, the statistician was not aware of the group allocation. Also, the nurses and the statistician were not aware of the aim of the study.

2-6. Statistical methods

The information was entered into the SPSS package version 18.0. The Kolmogorov-Smirnov test was used to determine the normality of the continuous variables. The statistical tests that were applied included the chi-square test (to test the gender and types of delivery between the two groups), the student's t-test for the two independent samples (for continuous baseline characteristics between the two groups), and repeated measures analysis of variance (to test the differences between the two groups during the study time). The significance level was set at $P<0.05$.

3- RESULTS

In this study, 56 infants were randomly assigned to the intervention (n=28) and control (n=28) groups. Forty-eight subjects finished the study (24 infants in each group). The type of delivery, gender, gestational age, chronological age, birth weight, and one and five-minute APGAR scores have been summarized in **Table.1**. According to the results of the Chi-square test (for gender, and delivery type) and t-test (for age, birth weight, and APGAR score) in **Table.1**, the characteristics of the infants were not statistically different between the intervention and control groups ($P>0.05$). This study aimed to assess the impact of Quran recitation on the heart rate, respiration rate, and blood oxygen level during blood sampling. The heart rate, respiratory rate, and blood oxygen levels in newborns were measured at the baseline (i.e. 10 minutes before blood sampling) and compared between the two groups by using the t-test. The results are shown in **Table.2**. According to these, there was no significant difference in the heart rate between the two groups 10 minutes before sampling. The respiratory rate was also similar in the intervention and control groups. No significant difference was observed in the blood oxygen saturation at the baseline either.

Therefore, the subjects of the two groups had similar traits before the intervention. After the Quran recitation (the intervention), the heart rate, respiratory rate, and blood oxygen levels were recorded five minutes before, during, and five, 10, 15, and 20 minutes after the sampling. These results have been presented in **Table.2.** Using t-test, the six measurements of the heart rate have been compared between the two groups in **Table.2**. According to the results, after the intervention, the heart rate was significantly lower in the intervention group in all the six measurements ($P<0.05$). The six measurements of the respiratory rate after the intervention have also been shown in **Table.2**.

Although the respiratory rate per minute was lower in the intervention group in all the six measurements, the difference was statistically significant only for 20 minutes after the blood sampling ($P=0.039$). The blood oxygen levels in the two groups and their comparison have been shown in **Table.2** as well. According to these, the blood oxygen level was higher in the infants in the intervention group. This difference was not statistically significant five minutes before blood sampling. However, the differences during and 10, 15, and 20 minutes after blood sampling were significant ($P<0.05$).

The blood oxygen level in the infants was higher in the intervention group than the control group five minutes after blood sampling too. However, the observed difference was not statistically significant ($P=0.7$). The effect size for intervention was calculated for each point of measurement. Since we had an intervention group, Glass's delta method was used to calculate the effect size. The result of this analysis is shown in the last column of **Table.2**. The magnitude above 0.8 implies a large effect size, figures between 0.5 and 0.8 imply medium effect size, and those below 0.2 show a small effect size. Therefore, according to the results in **Table.2**, the effect size of intervention on the respiratory rate was small for all the measurement points. The effect of intervention was medium to large on the heart rate. For further investigation, repeated measures analysis of variance was applied. In this analysis, the six measurements were evaluated simultaneously. The results have been summarized in **Table.3**. According to the results of repeated measures analysis of variance, the heart rate was significantly different at the different measurement points (within group factor) ($P<0.001$). The mean heart rate in all the measurements was significantly different between the two groups ($P=0.006$).

The results have been illustrated in **Figure.2a**. According to **Figure.2a**, the heart rate in the intervention group was lower than that in the control group in all the measurements. **Table.3** shows that the mean respiratory rate per minute was not similar in the two groups for the different measurements ($P=0.005$). However, the difference was not significant.

According to **Figure.2b**, the respiratory rate per minute was lower in the intervention group. According to **Table.2**, the mean respiratory rate was significantly different only 20 minutes after blood sampling ($P=0.039$). The mean blood oxygen levels were not statistically different at the different points in time ($P=0.329$) (**Table.3**). The differences have been illustrated in **Figure.2c**. The profiles of the intervention and control groups were close to the horizontal line. The mean blood oxygen level of the infants in the intervention group was significantly higher when compared to the control group ($P=0.008$).

Table-1: Baseline characteristics of infants in two groups, and the comparisons between the two groups

Variables		**Groups**		**Significant**	
Gender, Number (%)	Sub-group	Intervention	Control	Test statistic	P-value
	Female	12 (%50.0)	16 (%66.7)	1.371	0.242
	Male	12 (%50.0)	8 (%33.3)		
Type of delivery, Number (%)	Normal	11 (%45.8)	15 (%62.5)	0.010	0.922
	Caesarean	13 (%54.2)	9 (%37.5)		
Gestational age (mean ± SD) (week)		33.8±2.38	34.3±2.50	-0.828	0.412
Chronological age (mean ± SD) (day)		3.3±1.83	3.2±1.47	0.174	0.863
Birth weight (mean ± SD) (gr)		2087.5±377.41	2025.8±453.36	0.512	0.611
Apgar 1 min (mean ± SD)		7.5±1.14	8.0±1.38	-1.252	0.217
Apgar 5 min (mean ± SD)		8.3±0.94	8.6±1.79	-0.908	0.369

SD: Standard deviation.

Table-2: Infants' comparison in two groups at the baseline and at different time points during the study

Variables	Measurement Time	Intervention group	Control group	P-value	95% CI of Difference		Effect Size
		Mean ± SD	Mean ± SD		Lower	Upper	
Heart rate (Beat/min)	Baseline	134.5 (16.70)	143.9 (19.45)	0.077	-20.0	1.1	-
Respiratory rate (RR/min)	Baseline	57.5 (12.44)	55.4 (11.28)	0.546	-4.8	9.0	-
Blood oxygen levels (%)	Baseline	95.3 (3.27)	94.8 (3.51)	0.612	-1.5	2.5	-
Heart rate (Beat/min)	5min before	130.2 (17.85)	141.6 (16.75)	0.027	-21.5	-1.4	-0.68
	During sampling	136.7 (19.95)	156.2 (21.10)	0.002	-31.5	-7.6	-0.93
	5min after	136.2 (19.79)	148.5 (19.62)	0.037	-23.7	-0.8	-0.62
	10min after	131.7 (15.40)	145.3 (18.75)	0.008	-23.6	-3.7	-0.73
	15min after	130.9 (15.42)	145.8 (18.27)	0.004	-24.7	-5.1	-0.82
	20min after	132.6 (16.87)	143.5 (18.37)	0.039	-21.1	3.4	-0.59
Respiratory rate (RR/min)	5min before	56.8 (10.79)	57.6 (9.57)	0.800	-6.7	5.2	-0.08
	During sampling	57.4 (11.16)	60.5 (9.99)	0.312	-9.3	3.0	-0.31
	5min after	59.9 (10.24)	61.0 (10.78)	0.702	-7.3	4.9	-0.11
	10min after	57.0 (10.91)	58.5 (9.86)	0.629	-7.5	4.6	-0.15
	15min after	56.0 (10.84)	57.9 (9.11)	0.529	-7.7	4.0	-0.20
	20min after	55.2 (10.02)	57.6 (9.02)	0.039	2.9	-8.3	-0.27
Arterial blood oxygen level (%)	5min before	96.0 (2.34)	94.6 (3.39)	0.099	-0.3	3.1	0.42
	During sampling	95.7 (2.68)	93.5 (3.45)	0.017	0.4	4.0	0.64
	5min after	95.8 (3.45)	93.8 (3.40)	0.054	-0.03	4.0	0.58
	10min after	96.4 (2.00)	94.2 (3.36)	0.008	0.6	3.8	0.66
	15min after	96.2 (3.45)	93.4 (4.67)	0.023	0.4	5.2	0.60
	20min after	96.2 (2.30)	94.2 (2.65)	0.009	0.5	3.4	0.74

SD: Standard deviation.

Table-3: Repeated measures analysis of variance

Variables	Within groups (times of measurements)		Between groups (test and control group)	
	Statistic*	P-value	Statistic	P-value
Heart rate per minute	7.70	<0.001	8.27	0.006
Respiratory rate per minute	3.95	0.005	0.46	0.499
Blood oxygen level (%)	1.16	0.329	7.62	0.008

*The Huynh-Feldt correction was used because the assumption of sphericity has not being met.

4- DISCUSSION

Music therapy as a treatment modality was introduced in the NICU in the last decade to improve the health and development of babies (30). A type of music is recitation of the Holy Quran. Muslims consider that one of the most beautiful aspects of the Quran is its pleasant music and rhythm (26). Since premature babies need special care and attention and they also face painful procedures at the time of admission, non-medical solutions can be beneficial for them. Therefore, this study was conducted to study the effects of the Holy Quran recitation on the physiological indicators of pain in premature infants aged between one and seven days. Ten minutes before the blood sampling, when the Quran had not been played for the groups, no statistically significant difference was observed in the physiological signs (heart rate, respiration, and blood oxygen saturation) between the two groups. There was no significant difference in the respiration rate and the blood oxygen saturation between the two groups even five minutes before the blood sampling after the Quran recitation was played. Karimi et al. showed that music had no significant effect on the blood oxygen saturation five minutes before blood sampling (31), which is similar to the results of this study. The results of the measurement at this time point did not show any clearly positive or negative effects of playing the Quran on the physiological indicators because it was just the beginning of the recitation. A study by Cavaiuolo et al. showed that the heart rate was reduced during blood sampling and the blood oxygen saturation increased in response to Mozart (32). Schwilling et al. also reported that exposure to live music had beneficial effects on the physiological parameters of stable preterm infants in the NICU. Also, after music, the number of apneas, oxygen de-saturations, and the number of bradycardia episodes reduced significantly (33). Also, Taheri et al. showed that lullaby music had more effect on reduced heart rate than the Quran recitation did (34). Ullsten et al. also revealed a significantly calmer breathing pattern in the lullaby intervention versus the control condition (35). Unlike the results of the above mentioned studies, Alipour et al. concluded in a clinical trial that lullaby had no effect on the physiological indicators (heart rate, respiratory rate, and oxygen saturation) in premature infants (36). The findings from these studies suggest the need for further research to compare Quran recitation with other types of music. The mean heart rate in the intervention group was significantly lower than that in the control group five minutes after sampling. However, there was no statistically significant difference in the mean respiratory rate and blood oxygen saturation between the two groups. Garunkstiene et al. showed that the infants' heart rate decreased significantly for the live and recorded lullabies but not for the control condition, and no changes were observed in the oxygen saturation

level (37). Amini et al. also showed that lullaby reduced the heart rate and respiratory rate. These effects extended in the period after the exposure. Also, classical music reduced the heart rate, but oxygen saturation did not change (38). According to Teckenberg-Jansson et al., music therapy combined with kangaroo care is associated with reducing the heart and respiratory rates and with increasing the percentage of oxygen saturation in the skin. This combination was more effective than kangaroo care alone (39). According to the results of this study, it seems that if Quran recitation was combined with a simultaneous treatment like kangaroo care, it could be more effective in maintaining the physiological status. This kind of combination is recommended.

The mean heart rate, respiratory rate, and blood oxygen saturation were statistically significant between the two groups 20 minutes after blood sampling. In the meantime, Keshavarz et al. revealed that the recitation of the Quran significantly affected the mean heart rate, respiratory rate, and oxygen saturation 30 minutes after blood sampling (24). Also, Jabraeili et al. showed that there was a significant difference in the neonates' oxygen saturation between when Brahms' lullaby was played and when Mum's Lullaby was played as compared to the control group in the 15 minutes after intervention (2). Majidi et al. reported a significant difference in the respiratory and pulse rates after the intervention in the test group compared with the control group (40). Taheri et al. showed that lullaby could significantly reduce the heart rate and increase the blood oxygen saturation of neonates (41). Wirth et al. proved that standardized acoustic stimulation with recorded lullabies and taped maternal voice led to a decrease in the heart and respiratory rates (42). In general, the results showed that Quran recitation was effective on the heart rate and blood oxygen saturation during and after the intervention at all the evaluated time points, but it was effective on the respiratory rate only 20 minutes after the intervention. Infants cannot express pain; however, in response to painful stimuli, they show some visible and measurable behavior, such as grimacing, raising the eyebrows, squeezing the eyes, crying, increased heart and respiration rates, and decreased blood oxygen saturation (13). The findings of this study showed that Quran recitation reduced the heart and respiratory rates and increased oxygen saturation. Oh et al. also concluded that music reduced pain responses, such as crying and moving arms, among neonates (43). In addition, Marofi et al. reported that playing piano melodies was more effective compared to breastfeeding on the severity of the heel stick pain in neonates admitted to NICU (44). According to these studies, it could be concluded that music, including melodies, lullabies, live performances, and recitation of the Quran can be quite effective for pain relief in neonates. However, further research is needed to determine which one of these has a greater effect on pain relief or stabilization of the physiological indicators.

4-1. Limitations of the study

Among the limitations of this study are convenience sampling and the small sample size. Another limitation is that the Quran recitation was not compared with other sounds, for example, lullaby, mother's voice, light music, and the like.

5- CONCLUSION

The findings of this study indicate that Quran recitation can help improve the physiological parameters of preterm infants during their hospitalization period and can be used as a routine standard method in NICU. From the results, it can be said that Quran recitation led to a decrease in the heart rate and an increase in the oxygen saturation level during and

after blood sampling at all the evaluated time points, but it was effective on the respiratory rate only 20 minutes after the intervention. Therefore, to positively influence the Quran recitation on the respiratory rate, prolonged Quran recitation is recommended. It seems that the results of this research will help increase the quality of nursing care. Quran recitation is a non-invasive, non-pharmaceutical, and relatively low-cost intervention that can be implemented at the infant's bedside. Researchers suggest that more studies are needed on the effect of Quran recitation on other physiological responses, stress, sleep pattern, feeding, and weight gain.

6- CONFLICT OF INTEREST: None.

7- ACKNOWLEDGMENTS

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