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ORIGINAL RESEARCH INTENSIVE CARE

The effect of aromatherapy with rose water on the deep sleep status of premature infants admitted to NICU: A randomized clinical trial

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ABSTRACT

Introduction: Sleep, as a biological process, plays an essential role in the brain development and of sensory and motor systems. Studies show different psychological effects of complementary medicine including aromatherapy on patients. We investigated the effect of aromatherapy with rose water on the deep sleep status of premature infants admitted to neonatal intensive care unit (NICU).

Methodology: This randomized clinical trial study was conducted on 64 infants hospitalized in NICU. Infants were randomly divided into an intervention group and a control group. Two drops of rose water or two drops of distilled water were poured on gas and placed next to the heads of the babies, respectively. Activity level scale (ALS) was used to assess the sleep status.

Results: Out of 66 infants in this study, 30 were female and 36 were male. The average gestational age of the infants was 32.59 ± 1.99 weeks. The results showed that the duration of deep sleep (type A and B) in the intervention group was significantly longer than the control group during and after the intervention. (P = 0.001).

Conclusions: Considering the positive impact of rose water, it can be used to improve the sleep quality in premature babies in hospitals along with the main treatment.

Keywords: Infant; Intensive Care Units; Aromatherapy; Sleep Quality

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1. INTRODUCTION

Sleep, as a biological process, plays an essential role in brain development and infant development.[1] Sufficient sleep and maintaining the sleep cycle in infants is very important because it affects the development of the sensory system, movement, learning, long-term memory, appropriate responses to environmental stimuli, temperature regulation and maintaining the balance of brain structures.[2] Side effects of lack of sleep and sleep cycle disorder in infants include: increase in sympathetic tone, risk of obstructive sleep apnea, decrease in pain threshold, decrease in brain mass, disturbance in the development of primary senses, disorders of alertness, increased sensitivity to diseases, disturbance in psycho-social development, cognitive defects and physiological disorders.[3] Studies have shown that the sleep of premature babies is significantly less comfortable than that of full-term babies and they may suffer from sleep disorders and decreased quality of sleep in the first and second year of life.[4] Term infants spend 60% and pre-term infants spend 70% of their time sleeping. The sleep cycle in babies up to the age of 6 months includes three stages of active, restful and

uncertain sleep. A newborn baby sleeps irregularly for 12 to 18 h a day, and the sleep cycle lasts about 50 min. As the infant grows, the duration of active sleep decreases and restful sleep increases.[5] Active sleep affects the development of the sensory system both in the fetal period and in the newborn period. Good sleep plays an important role in the development of long-term memory and learning ability. Maintaining the capacity to adapt to environmental changes, learning to respond to environmental experiences and coping with new needs is influenced by sleep stages.[6] Infants who need hospitalization in an NICU are exposed to stimulating factors that disrupt the sleep cycle.[7] Since premature infants have an extremely vulnerable nervous system and spend the period of brain development in an environment outside the uterus, they are more affected by stimuli and are prone to such disorders.[8] The sense of smell is highly developed at birth. In this way, smell detection occurs between 28th and 29th weeks of pregnancy. The primary olfactory receptors appear in the eighth week of pregnancy and are fully developed by the end of the second trimester. The olfactory signal protein is expressed in the olfactory mucosa at 28 weeks of pregnancy and in the main olfactory bulb at 32−35 weeks of pregnancy.[9] One of the effective ways to reduce anxiety, stress, depression, insomnia, pain, fatigue and asthma is to use alternative medicine.[10] Aromatherapy is a type of alternative medicine that has been of interest to researchers as a new nursing care in recent years .[11] This treatment improves physical, emotional and spiritual health by using essential oils found in flowers, leaves, roots and stems of plants.[12] Compared to chemical substances, aromatherapy is a relatively effective treatment, which directly affects the brain. It does not accumulate in the body, but is discharged through the respiratory system, liver and kidney, and is non-invasive.[13] Rosa Damascena flower (Figure 1), which is known as rose flower in Iran, is one of the most important species of the rose family and the king of ornamental flowers.

Figure 1: Rosa Damascena flower (Picture credits: Wikipedia)

This flower is used in perfumes, in medicine and for flavoring in the food industry.[14] The scent of the rose with two elements, citronellol and phenethyl, is effective on the central nervous system, and as a result, it causes a hypnotic and relaxing effect. Rose is one of the most widely used medicinal plants recommended for the treatment of sleep disorders.[15] However, based on our search, the effect of the smell of rose on the sleep status of premature babies has not been investigated. Since the access to rose water is easy and inexpensive, this study was conducted to find the effect of aromatherapy with rose water on the deep sleep status of premature babies hospitalized in the NICU.

2. METHODOLOGY

2.1. Design and participants

This study was approved by institutional review board (IRB) (IR.ZAUMS.REC.1398.383) of Zahedan University of Medical Sciences. The study also was registered with the Iranian Registry of Clinical Trials (www.irct.ir) with the registration number IRCT20171007036599N4.

This randomized clinical trial (RCT) study was conducted on 64 premature infants admitted to the NICU of Ali Ibn Abi Talib Hospital, Rafsanjan, Kerman Province, Iran, in 2019, and followed the CONSORT 2010 checklist.[16] The inclusion criteria included: babies of 30−37 weeks of gestation, having stable symptoms, without severe respiratory distress, jaundice and congenital abnormalities, no history of drug abuse by the mother, no use of narcotic and sedative drugs, and an informed parental consent. In case of death, convulsions and changes in the clinical condition, the baby was excluded from the study. Sampling was done based on the available non-probability method and after the informed consent of the eligible people. The selected babies were equally assigned to two groups by randomization method of permutation blocks. Also, in addition to randomization, in order to eliminate the possible effects of confounding variables, two groups were matched in terms of age and gender. The sample size was based on the purpose and study similar to Keyhanmehr et al., and a total of 64 participants were selected.[17]

2.2. Instrument

Demographic information form and sleep behavior scale were used to collect data. The baby's demographic information form included fetal age, sex, Apgar score at min 1 and 5.

ALS sleep-wake behavior scale: In this instrument, six general sleep-wake conditions are defined for premature babies, which include: deep sleep, light sleep, sleepiness,

calm wakefulness, active wakefulness, and crying, which were examined by the researcher in this study. Three sleeping positions were noted. Each of these situations is defined based on its specific behavioral and physiological characteristics such as breathing pattern, presence or absence of rapid eye movements, eyes open or closed, facial expression, body movements, skin color, mouth movements.[18] Babies show each of these situations in two ways (A) and (B). In this tool, type A refers to the scattered and unorganized patterns of the baby's sleep and indicates that the baby has tension and stress, and level B is the level where the baby has an organized, strong and adjusted sleep. The validity of this tool has been approved in Iran by Rajaei et al.[19]

2.3. Intervention

Infants were placed in double-walled incubators. In the intervention group, two drops (0.1 ml) of Zahra organic rose water with 12 grade and in the control group two drops of distilled water with a dropper were poured on a sterile pad at a distance of 30 cm from the baby's head. The newborns were exposed to this treatment for 60 min. The sleep quality of the baby during 20 min during sleep and 20 min after placing the pad was determined at intervals of every two min according to the ALS tool by direct observation by the researcher and recorded in the table. All interventions were recorded by a video camera. In order to increase the validity of the data, the researcher watched the recorded video for a second time. Similar conditions were applied to the control and intervention groups. The study was conducted in two groups after feeding and routine nursing care at 3:00 PM to 5:00 PM to minimize confounding factors. During the study, the breathing rate and heart rate of the babies were monitored to protect the patient. In the baseline measurements, all demographic data including sex, fetal age and Apgar score were collected.

2.4. Statistical analysis

In order to compare the frequency, the average of 6 sleep states of premature babies in two groups, from Pearson's chi-square tests, independent t-test and according to the type of response variable (number of times of sleep types in different time intervals) and data repetition from Generalized Estimating Equations (GEE) were used to fit Poisson's linear logarithm regression model and evaluate intervention effects. All statistical tests were performed in SPSS Version 22.0 for Windows (SPSS Inc., Chicago, IL, USA). Confidence interval of 95% and a significance level of $P < 0.05$ was considered significant

3. RESULTS

Out of 66 infants in this study, 30 were female and 36 were male. The average gestational age of the infants was 32.59 ± 1.99 weeks. The results of Pearson's chi-square test showed that the two groups had the equivalent distribution in terms of gender ($P = 0.82$) and also the results of the parametric t test for two independent groups showed that the two groups had the same mean Apgar scores in terms of age ($P = 0.27$). The 1st min ($P = 0.22$) and the 5th min Apgar average ($P = 0.18$) had no statistically significant difference. According to the information of deep sleep A, in the intervention group, during the first 20 min, the second 20 min, and the third 20 min; and deep sleep A in the control group in the first 20 min, the second 20 min, and the third 20 min, the group effect was significant and time effect was insignificant. Due to the significance of the interaction between time and studied groups, the comparison of two groups was investigated separately at each time. Due to the large sample size ($n < 30$) and also checking the graphs to compare the average deep sleep A between two groups, parametric t-test was used for two independent groups at any time. Comparison of two groups at any given time in Table 1 and Graph 1 shows that 40 and 60 min are significant. Deep sleep B in the intervention group during the first 20 min, the second and the third 20 min, and deep sleep B in the control group in the first 20 min, the second 20 min, and the third 20 min in the two groups, although did not have a statistically significant difference, the quality of their deep sleep (type B) differed significantly over time, and the interaction between time and group was also significant. Therefore, the effect of the intervention was examined separately at each time and as can be seen in the Table 2 and Graph 2, the effect of group and time is not significant on its own, but the mutual effect of group and time is significant (Table 1 & 2; Figure 1).

Table 1: Comparative frequency of deep sleep (Type A) of premature infants before, during and after the intervention

Groups	Before intervention (First 20 min)	During intervention (Second 20 min)	After intervention (Third 20 min)	P-value
Intervention (Mean ± SD)	0.24 ± 0.82	2.18 ± 1.62	1.44 ± 1.62	0.22
Control (Mean ± SD)	0.66 ± 0.94	0.22 ± 0.61	0.41 ± 1.19	
P-value	0.06	< 0.001	< 0.004	

Table 2: Comparative frequency of deep sleep (Type B) of premature infants before, during and after the intervention

Groups	Before intervention (First 20 min)	During intervention (second 20 min)	After intervention (Third 20 min)	P-value
Intervention (Mean ± SD)	0.21 ± 0.69	1.94 ± 1.87	0.82 ± 1.64	< 0.001
Control (Mean ± SD)	0.22 ± 0.79	0.34 ± 1.33	0.13 ± 0.49	
P-value	0.94	< 0.001	0.02	v

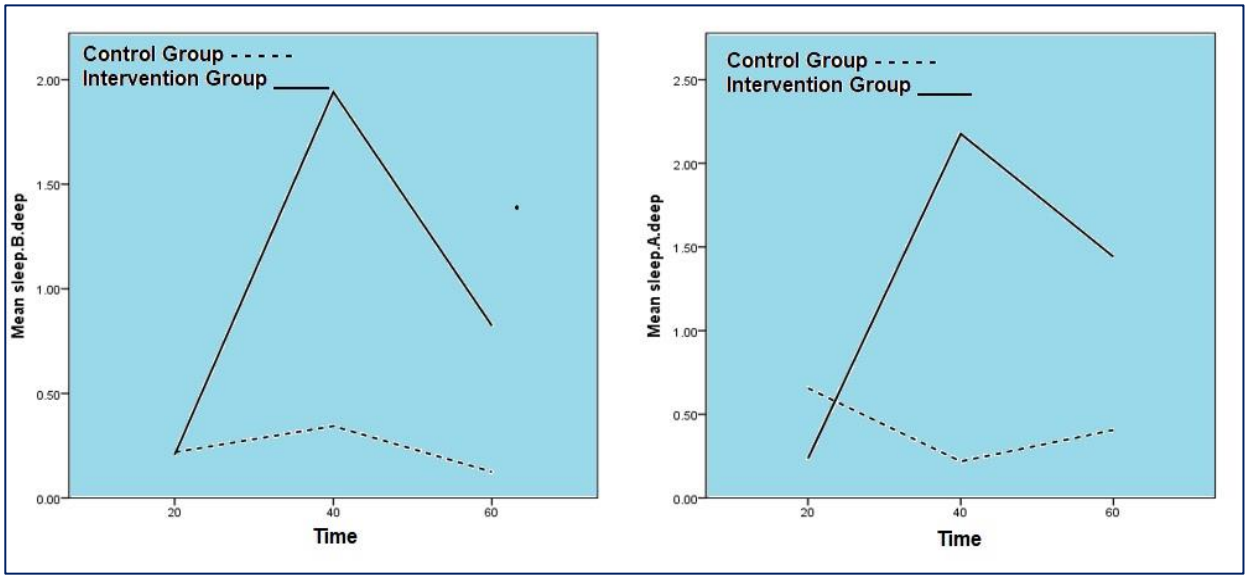

Figure 2: Comparing the time of different types of sleeps in the two groups

4. DISCUSSION

The results of our study showed that the amount of deep sleep (type A and B) in the intervention group was significantly higher than the control group during and after the intervention. In general, the results showed that aromatherapy is effective on sleep quality, which was consistent with previous studies. Arbianingsih conducted a research at the effect of lavender aromatherapy massage in reducing sleep disorders in infants and the results of the research showed its effectiveness in reducing sleep disorders in infants. In this research, sleep disorders in infants aged 6 to 12 months were investigated.[20]

The findings of Keyhanmehr's study on the effect of aromatherapy with rose oil on children's sleep quality showed that reduced frequency of resistance to sleep, difficulty waking up in the morning, nightmares and waking up during the night in children was found by inhaling rose oil.[17] In another study, which was conducted by Hajibagheri under the title of investigating the effect of aromatherapy with rose water on the sleep status of patients admitted to the intensive care unit, five areas of Pittsburgh's sleep quality index were examined. The results showed that the scent of rose water can improve the sleep quality of patients admitted to the ICU.[21]

All the above studies point to the positive effect of aromatherapy as an alternative treatment on improving sleep quality. In these three studies, the effect of aromatherapy on duration, quality and sleep disorders in different age groups was investigated. In the second and third studies, rose water was used to improve sleep quality and disorders. We also used rose water as a relaxing scent in our study. In the study we conducted, we adopted the ELS tool and observed the behavioral and physiological characteristics of infants to evaluate their sleep status. Abd Yazdan et al. showed that nesting and swaddling increases the total sleep time and peaceful sleep of premature babies admitted to the NICU.[22]

Ameri et al, showed in a study that placing the baby in the fetal position increased the percentage and average time of deep sleep, decreased the frequency and duration of light sleep, sleepiness, active wakefulness and crying in premature babies.[8] In our study, similar to Ameri's

study, the Els sleep and wake behavior scale was used for premature babies, and we focused on the sleep of premature babies so that we could achieve more accurate results. Two studies conducted on children with autism showed that aromatherapy does not have a significant effect on their sleep quality.[23,24]

5. LIMITATIONS

There were certain limitations in our study. Many factors, including the sound and light of the environment, are effective on the sleep of the baby. It is suggested that this study be conducted in single-person rooms, and in future studies, long follow-up periods should be studied to evaluate the continued effectiveness of the interventions.

6. CONCLUSION

The findings of the present study showed that the smell of the scent of rose water leads to an improvement in the sleep of the premature babies. The rose water is easily available, is inexpensive, and its use has no known side effects, and it is readily accepted by the parents. Hence, it is suggested to use non-pharmacological methods such as aromatherapy with rose water, to improve the quality of the sleep of the infants in hospitals.

7. Data availability

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

8. Funding

No funding was received for this research.

9. Conflict of Interest

The authors declare no competing interests.

10. Authors' contribution

All authors contributed equally in the concept, conduct of the study, data recording and analysis and in preparation of the manuscript of this study.

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