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Review

The Effect of Positions on Sleep-Wake Status of Preterm Babies: A Systematic Review

Pozisyonların Preterm Bebeklerin Uyku-Uyanıklık Durumu Üzerine Etkisi: Sistematik Derleme

Fatma BOZDAĞ[1], Serap BALCI[2]

[1]İstanbul Üniversitesi-Cerrahpaşa, Lisansüstü Eğitim Enstitüsü, Çocuk Sağlığı ve Hastalıkları Hemşireliği Doktora Programı, İstanbul, Türkiye
[2]İstanbul Üniversitesi-Cerrahpaşa Florence Nightingale Hemşirelik Fakültesi, Çocuk Sağlığı ve Hastalıkları Hemşireliği AD, İstanbul, Türkiye

Abstract

Background: This review, was carried out to examine the effects of different positions on sleep-wake states in preterm infants in a randomized controlled and quasi-experimental design nursing study results.

Materials and Methods: This study is a systematic review. For this purpose, 5 databases including PubMed, MEDLINE, Google Scholar, Science Direct and Cochrane were scanned by matching with the keywords "preterm, sleep, position, infant, sleep-wakefulness". All related English studies published in the literature between 1999-2022 were included in the evaluation.

Results: In this study, a total of 1033 records were reached as a result of scanning the databases. A total of 11 publications that met the inclusion criteria were included in the study and evaluated in terms of results. It has been determined that positions are generally given during invasive procedures, after care and feedings, in order to improve the sleep of preterm infants. Positions given include hammock, nesting, facilitated fetal tucking, right or left lateral, supine and prone positions.

Conclusions: It has been determined that the sleep-wake status of preterm infants is affected by positions. It has been determined that prone, hammock and facilitated fetal tucking positions can be given to improve the sleep-wake status of preterm infants receiving care in neonatal intensive care units.

Key Words: Infant, Position, Preterm, Sleep, Sleep-Wakefulness.

Corresponding author:

Fatma BOZDAĞ, PhD

Adress: İstanbul Üniversitesi-Cerrahpaşa, Lisansüstü Eğitim Enstitüsü, Çocuk Sağlığı ve Hastalıkları Hemşireliği Doktora Programı, İstanbul, Türkiye

email: fatosbozdag42@gmail.com

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Öz

Amaç: Bu derleme, farklı pozisyonların preterm bebeklerde uyku-uyanıklık durumu üzerine etkisinin randomize kontrollü ve yarı deneysel tasarımda olan hemşirelik çalışma sonuçlarını incelemek amacıyla gerçekleştirilmiştir.

Gereç ve Yöntem: Bu çalışma sistematik derleme niteliğindedir. Bu amaçla "preterm, sleep, position, infant, sleep-wakefulness" anahtar kelimeleri ile eşleştirilerek PubMed, MEDLINE, Google Scholar, Science Direct ve Cochrane olmak üzere 5 veri tabanı taranmıştır. Literatürde yayınlanmış 1999-2022 tarihleri arasında ilgili tüm ingilizce çalışmalar değerlendirme kapsamına alınmıştır.

Bulgular: Bu çalışmada veri tabanlarının taraması sonucunda toplam 1033 kayda ulaşılmıştır. Dahil edilme kriterlerine uygun toplam 11 yayın çalışma kapsamına alınmış ve sonuçlar açısından değerlendirilmiştir. Preterm bebeklerin uykusunun iyileştirilmesi için pozisyonların genellikle invaziv işlemler sırasında, bakım ve beslenmelerden sonra verildiği saptanmıştır. Verilen pozisyonlar arasında hamak, yuvalama, cenin, sağ veya sol lateral, supine ve prone pozisyonu bulunmaktadır.

Sonuç: Preterm bebeklerin uyku-uyanıklık durumunun pozisyonlardan etkilendiği saptanmıştır. Yenidoğan yoğun bakım ünitelerinde bakım almakta olan preterm bebeklerin uyku-uyanıklık durumunu iyileştirmek için prone, hamak ve cenin pozisyonunun verilebileceği belirlenmiştir.

Anahtar Kelimeler: Bebek, Pozisyon, Preterm, Uyku, Uyku-Uyanıklık.

Introduction

Preterm infants constitute the majority of Neonatal Intensive Care Units (NICU), and preterm infants in this environment are exposed to excessive noise, long-term bright lights, and frequent invasive and painful procedures (1). This environment interrupts and shortens the sleep time of preterm babies, whose sleep cycles have not yet developed, and causes an uncomfortable and stressful environment (2-4). However, adequate sleep is required for the growth of preterm babies and the development of neural pathways in the brain (5,6). The clinical consequences of sleep interruption have an adverse effect on growth and development, delaying hospital discharge (7).

It is tried to support the sleep of preterm infants with pharmacological and non-pharmacological interventions. However, pharmacological interventions have potential side effects. Pharmacologically, sedation is generally applied. It is known that these drug groups have serious side effects on the gastrointestinal system and respiratory system (8). Non-pharmacological modalities include positions, music therapy, non-nutritive sucking, touching, bedspreads, massage, cycled light, kangaroo care practices etc. (9-12). The positions included in these applications are very important for the development of preterm babies in the NICU (13). Inappropriate positions, cause motor and behavioral disorders, impaired cardiorespiratory response, sleep-wake disorders, chronic pain, sudden infant death syndrome (SIDS), increase in gastric residue and permanent posture disorders in the infant (14-19).

Thanks to the correct position, babies are allowed to heal themselves, and there are many studies proving that positions have a positive effect on the sleep of preterm babies (11,20-23).

Aim: This review, was carried out to examine the effects of different positions on sleep-wake states in preterm infants in a randomized controlled and quasi-experimental design nursing study results.

Research Question: In the systematic review, an answer was sought for the research question created in line with the following criteria determined according to PICOS.

P: Preterm newborns

I: Positioning

C: Comparison of sleep-wake level with different positioning methods

O: Sleep-wake level

S: Studies with randomized controlled and quasi-experimental design

What is the effect of different positions given to preterm newborns on the sleep-wake state of babies?

Material and Method

Scanning Strategy

This study is a systematic review. It was carried out as a retrospective review of research articles on the subject. For this purpose, 5 databases including PubMed, MEDLINE, Google Scholar, Science Direct and Cochrane were scanned by matching with the keywords “preterm, sleep, position, infant, sleep-wakefulness”. All related English studies published in the literature between 1999-2022 were included in the evaluation. In this systematic review, literature review, article selection, data extraction and evaluation of article quality were performed independently by one and the second researchers to reduce the risk of possible bias.

Selection of Studies

Inclusion Criteria: Inclusion criteria are that the study was published in an international journal between 1999-2022, the research article is in English, the sample group consists of preterm newborns, the full text of the article is available, and the studies are in a randomized controlled or quasi-experimental design.

Exclusion Criteria: Meta-analysis studies on the subject, review articles, articles whose abstracts can only be accessed, articles published in non-scientific journals, thesis studies, oral/poster presentations presented in congresses and case presentations were determined as exclusion criteria.

Getting Data

A data extraction tool developed by the researchers was prepared to obtain data in the study, and they were collected under a single title (characteristics and results of studies included in the systematic review). The names of the authors of the

included studies, the country in which they were conducted, the year the study was conducted, the sample, age group, duration of the intervention, etc. were prepared and coded. The reliability of the coded data was provided by comparing the coding of two researchers who are experts in their fields.

Evaluation of Methodological Quality of Studies

The methodological quality of the studies included in this systematic review was evaluated by checklists published by the Joanna Briggs Institute (24). Accordingly, the quality assessment of randomized controlled and non-randomized studies was done with 13 and 9-item checklists (25,26). Each item in this list is evaluated as "yes, no, unclear and not applicable". The situation determined for each study is given in Table 2-7.

Analysis of Data

The analysis of the outputs obtained from the studies within the scope of the review was carried out in line with the writing guide of "Preferred Reporting Items for Systematic Reviews and Metaanalysis (PRISMA)" (27).

Results

In this study, a total of 1033 records were reached as a result of scanning the databases. After selecting the title and summary using the planned screening strategy, 26 studies were examined. After removing the duplicates, 20 articles remained. When selection was made according to the inclusion criteria, a total of 9 articles were excluded because the sample of two articles did not consist of preterm infants, the risk of SIDS was evaluated in three articles, parameters other than sleep were evaluated in two articles, one article was a systematic review, and one article was a study protocol. The remaining 11 articles were included in the analysis. The flow chart of the study is given below (Figure 1).

Figure 1. PRISMA 2009 Flow Diagram

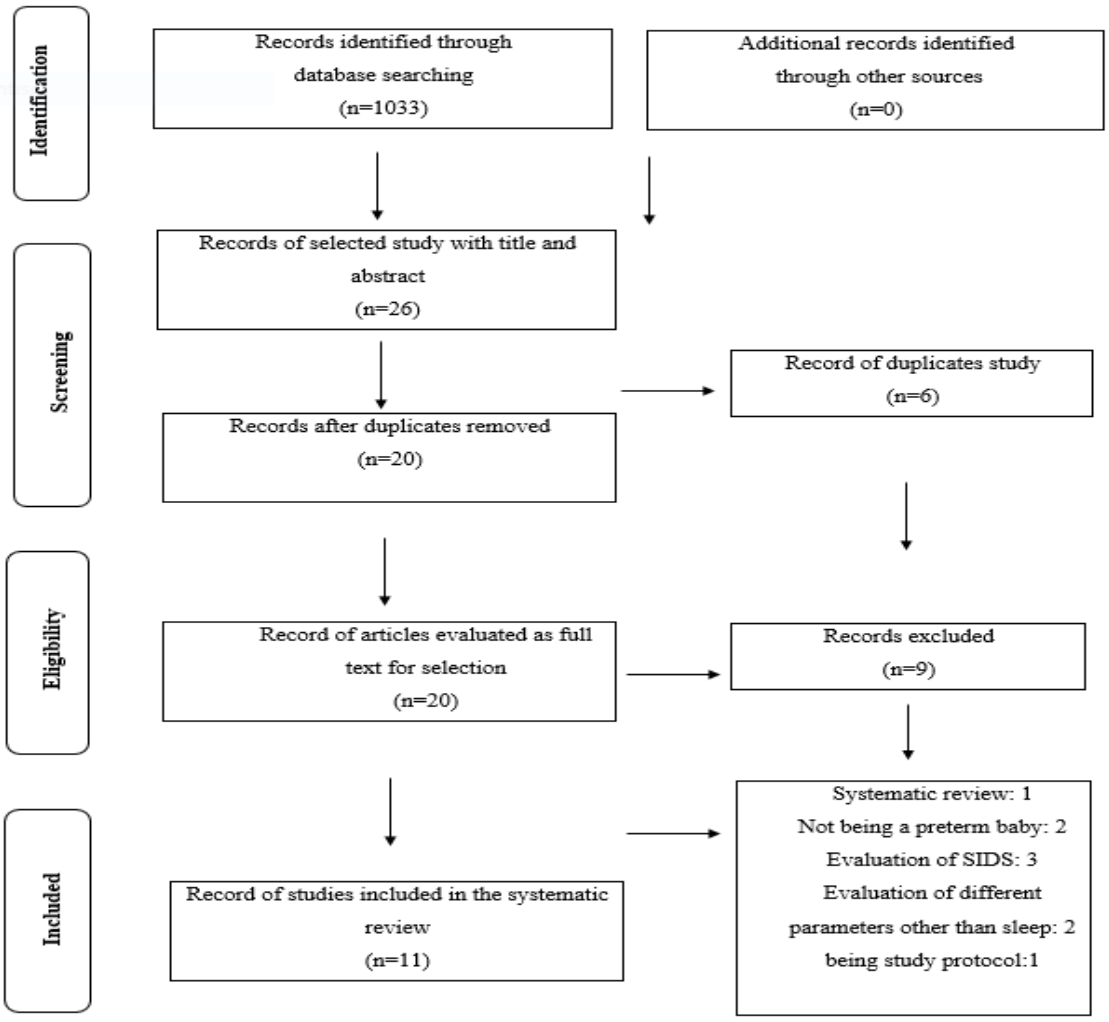

Table 2. Characteristics and Results of Studies Included in the Systematic Review

AUTHOR, YEAR, COUNTRY	Costa et al. 2019 Brazil	Ribas et al.2019 Brazil	Modesto et al. 2016 Brazil
AIM	It was aimed to compare the physiological parameters and sleep-wake states of preterm babies between the hammock and nesting position after diaper change.	It was aimed to compare the effects of hammock and nesting position on sleep-wake and pain states of preterm infants.	It was aimed to evaluate the frequency of positions of preterm infants during sleep and the effect of their positions on sleep and arousal.
SAMPLE	20 Preterm Newborns (32-37 GW) **Study Group:** Hammock Position (N=6) **Control Group:** Routine Nesting Position (N=14)	26 Preterm Newborns (30-37 GW) **Study Group:** Hammock Position (N=13) **Control Group:** Traditional (nesting) position (N=13)	Preterm babies born at 32 weeks of gestation (N=10) It was stated that preterm babies were followed in the supine, right lateral, left lateral and prone positions.
METHOD	Preterm babies were evaluated 6 times by the researchers in the hammock and nesting positions. 5 minutes before diaper change, 1 minute before, during diaper change, 1 minute after diaper change, 5 minutes after and 10 minutes later. It was stated that the sleep and wakefulness phases were analyzed according to the states defined by Pretchel.	Preterm infants were followed by the researchers in a hammock or traditional positioning for 2 hours a day for 5 days. It was stated that the results were evaluated with the Brazelton Neonatal Behavioral Rating Scale 10 minutes before and immediately after the intervention.	Preterm infants were followed by researchers in 4 different positions within 24 hours (supine, right lateral, left lateral and prone). It was stated that data were collected by polysomnographic recordings and Electroencephalography defined by Alice 5.
CONCLUSION	It has been reported that there is no significant difference between preterm babies followed in nesting and hammock positions, but it is easier for babies in the hammock group to fall asleep.	It has been reported that statistically significantly better sleep-wake status, higher SpO2, lower heart rate and respiratory rate were detected in preterm infants followed in the hammock position	It has been reported that preterm babies are mostly followed in the supine position. Statistically the longest time spent sleeping and the most frequent awakenings occurred in the supine position, while the number of arousals per hour was reported to occur in the supine position and the least in the prone position.
QUALITY SCORE	Yes:12 No:1	Yes:12 No:1	Yes:7 No:2

Table 3. Characteristics and Results of Studies Included in the Systematic Review

AUTHOR, YEAR, COUNTRY	Valizadeh et al. 2016 Iranian	Cândia et al. 2014 Brazil	Liaw et al. 2012 Taiwan
AIM	It was aimed to compare the sleep times of preterm infants between the facilitated fetal tucking and free positions.	It was aimed to evaluate the effect of prone position on physiological and behavioral responses of stress and position changes in preterm infants	It was aimed to evaluate the effects of caregiving, positioning and non-nutritive sucking on sleep-wake status of preterm infants receiving care in the NICU.
SAMPLE	32 Pretem Newborn (33-36 GW) Preterm infants were followed in 4 different positions in supine position (free posture), right or left lateral position (free posture), supine facilitated fetal tucking position and right or left lateral facilitated fetal tucking position.	16 Preterm Newborn (26-36 GW) It was stated that preterm babies were followed in the supine or lateral position for 40 minutes and then in the prone position for 30 minutes.	30 Preterm Newborn (27-37 GW) Preterm babies were followed by the researchers by giving them four different positions as right lateral, left lateral, prone and supine.
METHOD	Preterm babies were followed for 12 hours in each position between 08:00 and 20:00 for 4 days by the researchers. It was stated that the faces of preterm babies were recorded with 900 TVL closed circuit video cameras.	It has been reported that saliva samples are collected twice, 40 minutes after the lateral or supine position is placed, and 30 minutes after the prone position is placed in preterm babies. It was noted that heart rate, respiratory rate, peripheral oxygen saturation, and Brazelton sleep score were recorded before the first sampling, while the infants were placed in the prone position, and at the end of the procedure. Data were generally collected by the researchers by taking saliva samples between 06:00 and 07:30, when preterm infants are stable, and using the Brazelton Sleep Score.	It is stated that preterm babies are observed by nurses with an interval of 1 minute for 3 days. Data were collected by 6 trained nurses with a 1-minute interval. It is reported that nurses received training for 4 weeks.
CONCLUSION	It has been reported that statistically significantly more sleep and less wakefulness occur in preterm infants followed in lateral and facilitated fetal tucking position compared to preterm infants followed in supine and free positions.	It has been reported that salivary cortisol level, respiratory rate and Brazelton Sleep Score were found to be statistically significantly lower in preterm infants followed in the prone position.	It has been reported that the silent sleep times of preterm babies in the lateral and prone positions were found to be statistically significantly higher.
QUALITY SCORE	Yes:7 No:2	Yes:7 No:2	Yes:7 No:2

Table 4. Characteristics and Results of Studies Included in the Systematic Review

AUTHOR, YEAR, COUNTRY	Jarus et al. 2011 Israel	Bhat et al. 2006 England	Grunau et al. 2004 America
AIM	It was aimed to evaluate the effect of prone and supine position on sleep and behavioral status in preterm infants.	It was conducted to test the hypothesis that preterm infants with or without bronchopulmonary dysplasia, who are preparing for discharge in the NICU, will sleep longer and have less arousal and more central apnea in the prone position.	It is aimed to evaluate pain in prone and supine positions during blood collection in preterm infants.
SAMPLE	32 Pretem Yenidoğan (25-35 GW) It was stated that they were followed for 48 hours in the prone and supine positions.	Preterm babies with a mean gestational age of 27.9 weeks (N=24) It has been stated that preterm babies are followed for 3 hours in 2 different positions, prone and supine.	Preterm babies born before 32. weeks of gestation (N=38) **Prone Position:** 21 **Supine Position:** 17
METHOD	The position of preterm babies was changed to prone or supine every 3-4 hours after each feeding and they were followed by the researchers for a total of 24 hours in each position for 48 hours. It was stated that the data were collected with the actigraphy device and the Natural Observations of Newborn Behavior (NONB) Form.	Preterm infants were followed by the researchers for 3 hours in each position (prone and supine) after feeding for 2 days. It was stated that video-polysomnographic recordings were taken using the Alice 4 Sleep Study System.	It is reported that the data were collected by the researchers during and before routine heel blood collection. It was stated that the data were collected using the Natural Observations of Newborn Behavior (NONB) Form and video recording.
CONCLUSION	It has been reported that statistically significantly more sleep was detected in preterm infants in the prone position and more awakening in the supine position.	It has been reported that preterm babies sleep longer in the prone position. It was reported that awakening and waking per hour were statistically significantly higher in preterm infants followed in the supine position.	The duration of deep sleep was reported to be statistically significantly higher in preterm infants who were placed in the prone position, except during the heel draw blood.
QUALITY SCORE	Yes:7 No:2	Yes:7 No:2	Yes:7 No:2

Table 5. Characteristics and Results of Studies Included in the Systematic Review

AUTHOR, YEAR, COUNTRY	Chang et al. 2002 Taiwan	Goto et al. 1999 USA
AIM	It was aimed to evaluate the effects of prone and supine positions on behavioral status and stress responses in preterm infants followed up on mechanical ventilation.	It was aimed to evaluate the effect of positions on sleep and cardiorespiratory response in preterm infants when they are ready to be discharged.
SAMPLE	28 Preterm Newborn (25-36 GH) It has been stated that preterm infants were randomly assigned to the prone/supine or supine/prone position.	16 Preterm Newborn (27-36 GW) It has been reported that preterm infants are followed randomly in the prone and supine positions after each feeding. The preterm baby was randomly placed in the prone/supine or supine/prone position.
METHOD	It was stated that preterm babies were given the opportunity to stabilize 10 minutes before positioning, and then the data were collected by following each position for 2 hours. It was stated that the data were collected using the Anderson Behavioral Status Scoring System.	It has been reported that 6-hour recordings were taken by the researchers between 11:00 and 17:00, usually between two feedings. The preterm baby was randomly placed in the prone/supine or supine/prone position. It was stated that the data were collected by taking video-polysomnographic records.
CONCLUSION	The prone position is reported to improve sleep in preterm infants.	It has been reported that there is a significantly higher rate of awakening in preterm infants followed in the supine position than those followed in the prone position, but overall sleep status is not affected by the position.
QUALITY SCORE	Yes:7 No:2	Yes:7 No:2

Discussion

According to the results obtained from the analysis of 11 studies evaluated, it is seen that positions are generally given during invasive procedures, after care and feedings to improve sleep in preterm infants. Positions given include hammock, nesting, facilitated fetal tucking, right or left lateral, supine and prone positions.

Costa et al. (2019) found that although no difference was found between the hammock and the nesting position in terms of total sleep and waking, preterm babies in the hammock group fell asleep faster (20). In contrast, Ribas et al. (2019) reported better sleep-wake status, higher SPO2, lower heart rate and respiratory rate in preterm infants followed in the hammock position compared to preterm infants in the nesting position (11,20) (Table 2). Costa et al. (2019), while the sleep status of preterm infants was evaluated before, during and after diaper change, Ribas et al. (2019), on the other hand, it is noteworthy that preterm babies were evaluated for sleep during the hours when they were not disturbed (11,20) (Table 2). The difference in results may be due to the fact that care interrupts the sleep cycle. At the same time, the small sample size in both studies is another factor that causes uncertainty in the evaluation of the effect of hammock position on the sleep-wake state of preterm infants. It is thought that studies with more samples and in similar time periods are needed in order to reach more precise results and make comparisons.

Valizadeh et al. (2016) reported in their study that the facilitated fetal tucking and lateral position increases the sleep duration of preterm infants and decreases the frequency of awakenings (22) (Table 3). Giving preterm babies a facilitated fetal tucking position as in the mother's uterus may have improved their sleep quality by making them feel more secure (23).

In the studies, preterm babies were followed in four different positions as supine, prone, right and left lateral and more sleep, less waking and stress, higher SPO2, lower heart rate and respiratory rate are reported in the prone position (21,28,29)

(Table 2, Table 3). In all of these studies, there are differences in the measurement tools used to determine the sleep-wake status of preterm infants and in the total follow-up period (21,28,29) (Table 2, Table 3). Despite these differences, the fact that the prone position was determined to be more effective in the results of the study supports that the prone position has a higher effect on improving sleep in preterm babies compared to other positions. Likewise, in studies comparing the sleep-wake status of preterm infants only in prone and supine positions, it has been reported that sleep time is longer in the prone position, and alertness time is longer in the supine position (30-34) (Table 4, Table 5). In most of the studies, it is seen that the sleep-wake status of infants is evaluated after feeding when no intervention is made (30,31,34) (Table 4, Table 5). Grunau et al. (2004) evaluated preterm infants before and during heel blood collection and reported that the prone position supports deep sleep except during heel blood collection (32) (Table 4). It is thought that more studies evaluating the effects of positions on sleep-wake status during and after different invasive procedures in preterm infants will contribute to the literature. Along with all these, it is known that the prone position increases the risk of SIDS, and recent studies have reported that the prone position may lead to low blood pressure, cerebral oxygenation and impaired autonomic cardiovascular control in preterm infants (35-37). In another recent study, Shepherd et al. (2020) reported that the prone position reduces bradycardia, the frequency of desaturation and the duration of desaturation in very preterm preterm infants (38). The conflicting results of the studies in the literature show that preterm infants followed in the prone position in the NICU should be followed closely by nurses in terms of both SIDS risk and other undesirable negative results. In the NICU, the sleep of preterms is mostly interrupted during invasive procedures, care and feeding. When studies are examined, it is seen that prone position can be given to preterm babies before invasive procedures or after baby care. It is thought that the increase in sleep duration of preterm babies will contribute to their growth and development by protecting their energy.

Conclusion

It has been determined that the positions of preterm infants affect sleep-wake status. In NICUs, prone, facilitated fetal tucking and hammock positions can be given to preterm infants to improve sleep-wake status, especially after care, after feeding and during invasive procedures

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