

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

**Dr.Aparna kale¹, Dr.Dhanraj Babu², Mrs. Seema Geduggol³, Mrs.Shilpa Satralkar⁴,
Dr.Suresh Ray⁵,Mrs. Sudaivi kadam⁶,Saloni Devkule,⁷ Srutika Nangare⁸ Gaurav
Mohite⁹**

Corresponding Author- Dr.Aparna B .Kale

Email ID – aparna.kale@bharativedyapeeth.edu

1. Professor and Head, Department of Pediatric Nursing, Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
2. Professor and Head, Department of Foundation of Nursing, Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
3. Clinical Instructor, Department of Obstetrics & Gynaecology Nursing ,Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
4. Assistant Professor, Department of Mental Health Nursing, Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
5. Incharge Principal, Department of Community Health Nursing ,Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
6. Clinical Instructor, Department of Community Health Nursing, Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
7. Student, Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
8. Student, Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.
9. Student, Bharati Vidyapeeth (Deemed to be University) College of Nursing, Sangli, Maharashtra, India – 416416.

ABSTRACT

OBJECTIVES

1. To assess the existing cardiorespiratory parameters during sleep apnea among the experimental group and control group.
2. To assess the cardio-respiratory parameters after giving tactile stimulation in the experimental group.
3. To compare the pre- and post-test score of cardiorespiratory parameters among the experimental group and control group.
4. To compare the post-test score of cardiorespiratory parameters among the experimental group and control group.

MATERIALS AND METHODS

In this study, a quantitative research approach was used to assess the effectiveness of tactile stimulation on cardiorespiratory parameters during apnea among premature babies by a post-test only control group design. The study

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

was conducted in selected hospitals of Sangli, Miraj and Kupwad Corporation area. A total of 30 samples were selected, with 15 babies in the experimental group and 15 babies in the control group. A non-probability purposive sampling technique was used. Demographic data were analyzed using frequency and percentage. Inferential statistics were used to compare the post-test scores between the control and experimental groups.

RESULTS

The study consisted of 30 premature babies, with 15 subjects in the experimental group and 15 subjects in the control group. The experimental group received tactile stimulation during episodes of apnea, while the control group received routine care. The mean and standard deviation of cardiorespiratory parameters showed improvement in the experimental group after tactile stimulation. The calculated t-value was statistically significant ($p < 0.05$), indicating that tactile stimulation was effective in improving cardiorespiratory parameters among premature babies during apnea. According to the post-test findings, there was a significant difference between the experimental and control groups. The findings suggest that tactile stimulation is an effective nursing intervention for improving cardiorespiratory parameters during apnea episodes in premature infants.

CONCLUSION

The study revealed that tactile stimulation is an effective intervention in improving cardiorespiratory parameters during apnea episodes in premature infants admitted to NICUs. Premature infants who received tactile stimulation demonstrated a significant improvement in heart rate, oxygen saturation, and respiratory rate compared with those who received routine care. This intervention is simple, non-invasive, economical, and can be effectively incorporated into neonatal nursing practice to improve the quality of care and reduce complications associated with apnea in premature infants.

Keywords: Tactile stimulation, Apnea, Premature baby, NICU, Cardiorespiratory parameters.

How to cite this article: Kale A, Babu D, Geduggol S, Satralkar S, Ray S, Kadam S, Devkule S, Nangare S, Mohite G. A Study to Assess the Effectiveness of Tactile Stimulation on Cardiorespiratory Parameters During Apnea Among the Premature Baby in NICU from Selected Hospitals of Sangli Miraj Kupwad Corporation Area. *Int J Drug Deliv Technol.* 2026;16(63s):385-392. DOI: 10.25258/ijddt.16.63s.41

Source of support: Nil.

Conflict of interest: None

BACKGROUND OF STUDY

Apnea of prematurity (AOP). Brain damage and poor neurodevelopmental outcomes are linked to severe and recurring apneas. A percentage of newborns still experience apneas in spite of medication and respiratory support, and they frequently require tactile stimulation, mask and bag ventilation, and/or more oxygen. The nurse's response time determines how long the apnea and the accompanying bradycardia and hypoxia last. To give a summary of the current understanding of the impact of mechanical and manual tactile stimulation on AOP, we conducted a thorough study of the literature. Apnea of prematurity (AOP) is a common clinical condition affecting more than 50% of infants born before 32 weeks of gestation. It is

characterized by a cessation of breathing for more than 20 seconds, often accompanied by bradycardia and oxygen desaturation. According to the American Academy of Pediatrics, the incidence of apnea increases with decreasing gestational age and birth weight, making it a significant concern in neonatal intensive care units (NICUs). Previous studies have reported that tactile stimulation is often used as a first-line intervention during apneic episodes.

NEED OF STUDY

Premature infants, particularly those born before 37 weeks of gestation, often experience sleep apnea due to an underdeveloped central nervous system. This condition, known as Apnea of Prematurity (AOP), is

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

characterized by intermittent pauses in breathing that can lead to hypoxia and bradycardia, potentially resulting in severe complications such as developmental delays, organ dysfunction, and even mortality. Tactile stimulation, a non-invasive method involving gentle touch or vibration, has shown promise in triggering respiratory reflexes and stabilizing heart rate and oxygen saturation levels in preterm infants.

PROBLEM STATEMENT

A study to assess the effectiveness of tactile stimulation on cardiorespiratory parameters during apnea among premature babies admitted to NICUs of selected hospitals in the Sangli–Miraj–Kupwad Corporation area.

MATERIALS AND METHODS

STUDY DESIGN

A quantitative experimental research design was adopted to evaluate the effectiveness of tactile stimulation on cardiorespiratory parameters during apnea among premature neonates.

STUDY POPULATION AND SAMPLE

The study population consisted of premature neonates experiencing apnea admitted to selected NICUs. A total of 50 neonates were selected using purposive sampling. Based on power analysis, 25 neonates were assigned to the experimental group and 25 to the control group.

ELIGIBILITY CRITERIA

Inclusion Criteria

- Premature neonates diagnosed with apnea.
- Mothers willing to provide written informed consent.

Exclusion Criteria

- Critically ill neonates on ventilator support or nasal CPAP.
- Premature neonates receiving sedative medications.

VARIABLES

The independent variable was tactile stimulation.

The dependent variables included:

- Heart rate
- Respiratory rate
- Oxygen saturation (SpO₂)
- Duration of apnea

DATA COLLECTION TOOL

Data were collected using a structured observation schedule consisting of two sections:

Section I: Demographic variables including date of birth, sex, and gestational age.

Section II: Observation checklist assessing heart rate, respiratory rate, oxygen saturation, and duration of apnea before and after intervention.

VALIDITY

The instrument was validated by a panel of 20 experts comprising 15 nursing faculty members, four neonatologists, and one statistician. Necessary modifications were incorporated based on expert suggestions before finalization.

INTERVENTION

Written informed consent was obtained from mothers before data collection. Baseline demographic information and cardiorespiratory parameters were recorded. The experimental group received tactile stimulation by gentle stimulation of the palms, hands, soles, feet, back, and chest for 5–15 seconds during apnea episodes. Cardiorespiratory parameters were reassessed five minutes after intervention. The control group received routine NICU care without tactile stimulation.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Institutional Ethics Committee. Permission was secured from participating hospitals, and written informed consent was obtained from mothers. Confidentiality and voluntary participation were ensured throughout the study.

STATISTICAL ANALYSIS

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

Data were analyzed using descriptive and inferential statistics. Frequencies and percentages were used to describe demographic variables, while means and standard deviations summarized continuous variables. Paired *t*-tests were used to compare pre-test and post-

DATA INTERPRETATION ORGANIZATION OF DATA:

SECTION 1

Analysis of demographic of apnea babies in terms of frequency and percentage

SECTION 2

Analysis of data related to assessment of the cardiorespiratory parameters during apnea in pre test in control and experimental group.

SECTION 3

Analysis of data related to comparison of the cardiorespiratory parameters among babies with apnea in control and experimental group.

SECTION 1

Analysis of Demographic Data of Apnea Babies in Terms of Frequency and Percentage

Table No. 1: Frequency and Percentage Distribution of Demographical Variables

n = 25 + 25

| Demographic Variables | Category | Experimental | Experimental % | Control | Control % |
|----------------------------|----------|--------------|----------------|---------|-----------|
| Gender | Male | 11 | 44 | 12 | 48 |
| | Female | 14 | 56 | 13 | 52 |
| Gestational Age (in weeks) | 34–35 | 8 | 32 | 8 | 32 |
| | 36–37 | 17 | 68 | 17 | 68 |

test values within groups, and unpaired *t*-tests were used to compare post-test outcomes between the experimental and control groups. Statistical significance was set at $p < 0.05$.

Table no 1. Out of 25 babies in the experimental group, 11 (44%) were male and 14 (56%) were female. In the control group, 12 (48%) were male and 13 (52%) were female.

2. Regarding gestational age, in the experimental group 8 (32%) babies belonged to the 34–35 weeks category and 17 (68%) belonged to the 36–37 weeks category. Similarly, in the control group 8 (32%) babies were in the 34–35 weeks category and 17 (68%) were in the 36–37 weeks category.

SECTION 2

Analysis of data related to assessment of the cardiorespiratory parameters during apnea

Table No. 2: Assessment of the existing cardiorespiratory parameters during apnea in experimental group and control group . n=25 + 25

| Cardiorespiratory parameters | Experimental group | S. D. | Control group | S. D. |
|------------------------------|--------------------|-------|---------------|-------|
| Heart rate | 152.36 | 6.36 | 150.4 | 8.11 |
| Respiratory rate | 11.48 | 1.78 | 13.96 | 2.92 |
| SPO2 | 83.12 | 4.01 | 87.24 | 3.28 |
| Duration of apnea | 3.96 | 0.79 | 7.76 | 0.78 |

In experimental group, Mean of heart rate was 152.36 and S.D of 6.36, Mean of respiratory rate was 11.48 and S.D of 1.78, Mean of SPO2 was 83.12 and S.D 4.01, Mean of duration of apnea was 3.96 and S.D of 0.79

In control group, mean of heart rate was 150.4 and S.D of 8.11, Mean of respiratory rate was 13.96 and S.D of 2.92, Mean of SPO2 was 87.24 and S.D 3.28, Mean of duration of apnea was 7.76 and S.D of 0.78

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

Table no. 3: Assessment of the cardiorespiratory parameters after giving tactile stimulation in experimental group and control group. n = 25+25=50

| Cardiorespiratory parameters | Experimental group | | Control group | |
|------------------------------|--------------------|------|---------------|------|
| | Mean | S.D. | Mean | S.D. |
| Heart rate | 140.32 | 3.15 | 149.48 | 6.9 |
| Respiratory rate | 25.68 | 5.51 | 17.04 | 4.37 |
| SPO2 | 96.64 | 1.89 | 89.84 | 1.97 |

In experimental group, Mean and S.D. of heart rate was 140.32 and 3.15, Mean and S.D. of respiratory rate was 25.68 and 5.51, Mean and S.D. of SPO2 was 96.64 and 1.89

In control group, Mean and S.D. of heart rate was 149.48 and 6.9, Mean and S.D. of respiratory rate was 17.04 and 4.37, Mean and S.D. of SPO2 was 89.84 and 1.97

From table no. 2 and 3 it is concluded that, Mean of heart rate was decreases in the post- test i.e. after giving stimulation among babies as compared to pre- test in experimental group. Mean of respiratory rate and SPO2 was increases in the post- test i.e. after giving stimulation among babies as compared to pre- test in experimental group.

SECTION 3

Analysis of data related to comparison of the cardiorespiratory parameters among babies with apnea

Table No. 4: Comparison of the pre and post test score of cardiorespiratory parameters in experimental group. n=25+25

| Parameter | Test | Mean | S.D. | t-value | p-value |
|------------------|-----------|--------|------|---------|----------------------------|
| Heart rate | Pre-test | 152.36 | 6.36 | -13.16 | 0.00001<0.05 (Significant) |
| Heart rate | Post-test | 140.32 | 3.15 | | |
| Respiratory rate | Pre-test | 11.48 | 1.78 | 13.28 | 0.00001<0.05 |

| | | | | | (Significant) |
|------------------|-----------|-------|------|-------|----------------------------|
| Respiratory rate | Post-test | 25.68 | 5.51 | | |
| SPO2 | Pre-test | 83.12 | 4.01 | 17.35 | 0.00001<0.05 (Significant) |
| SPO2 | Post-test | 96.94 | 1.89 | | |

According to pre- test Mean and S.D. of heart rate was 152.36 and 6.36 and post- test Mean and S.D. of heart rate was 140.32 and 3.15, t- value it was -13.16 and p- value it was 0.00001

According to pre- test Mean and S.D. of respiratory rate was 11.48 and 1.78 and post- test Mean and S.D. of respiratory rate was 25.68 and 5.51 and t- value it was 13.28 and p- value it was 0.00001

According to pre- test Mean and S.D. of SPO2 was 83.12 and 4.01, Mean and S.D. of SPO2 was 96.94 and 1.89 and t- value it was 17.35 and p- value it was 0.00001.

Table No. 5: Comparison of the pre and post test score of cardiorespiratory parameters in control group. n=25

| Parameter | Test | Mean | S.D. | t-value | p-value |
|------------------|-----------|--------|------|---------|-----------------------------|
| Heart rate | Pre-test | 150.4 | 8.11 | -1.17 | 0.25>0.05 (Not significant) |
| Heart rate | Post-test | 149.48 | 6.9 | | |
| Respiratory rate | Pre-test | 13.96 | 2.92 | 3.37 | 0.002<0.05 (Significant) |
| Respiratory rate | Post-test | 17.04 | 4.37 | | |
| SPO2 | Pre-test | 87.24 | 3.28 | 3.69 | 0.001<0.05 (Significant) |

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

| | | | | | |
|------|------------|-------|------|--|--|
| SPO2 | Pos t-test | 89.84 | 1.97 | | |
|------|------------|-------|------|--|--|

Result: From above table results following results were obtained, In control group (pre-test & post-test) According to pre- test Mean and S.D. of heart rate was 150.4 and 8.11, post- test Mean and S.D. of heart rate was 149.48 and 6.9, t- value it was -1.17 and p- value it was 0.25 According to pre- test Mean and S.D. of respiratory rate was 13.96 and 2.92, post-test Mean and S.D. of respiratory rate was 17.04 and 4.37, t- value it was 3.37 and p- value it was 0.002 According to pre- test Mean and S.D. of SPO2 was 87.24 and 3.28, Post-test Mean and S.D. of SPO2 was 89.84 and 1.97, t- value it was 3.69 and p- value it was 0.001.

Table No. 6: Comparison of the post test score of cardiorespiratory parameters in experimental group and control group. n=25+25

| Parameter | Group | Mean | S.D. | t-value | p-value |
|------------------|--------------------|--------|------|---------|-----------------------------|
| Heart rate | Experimental Group | 140.32 | 3.15 | -6.04 | 0.00001 <0.05 (Significant) |
| Heart rate | Control group | 149.48 | 6.9 | | |
| Respiratory rate | Experimental Group | 25.68 | 5.51 | 6.14 | 0.00001 <0.05 (Significant) |
| Respiratory rate | Control group | 17.04 | 4.37 | | |
| SPO2 | Experimental Group | 96.64 | 1.89 | 12.45 | 0.00001 <0.05 (Significant) |
| SPO2 | Control group | 89.84 | 1.97 | | |

Result: According to post- test in experimental and control group following results were obtained.

In experimental group mean and S.D. of heart rate it was 140.32 and 3.15, in control group it was 149.48 and 6.9, t- value it was -6.04 and p- value it was 0.00001 < 0.05

In experimental group mean and S.D. of respiratory rate it was 25.68 and 5.51, in control group it was 17.04 and 4.37, t- value it was 6.14 and p- value it was 0.00001 < 0.05

In experimental group mean and S.D. of SPO2 it was 96.64 and 1.89, in control group it was 89.84 and 1.97, t- value it was 12.45 and p- value it was 0.00001 < 0.05

According to post-test, there is significant difference between mean of cardiorespiratory parameters in experimental and control group.

Table No. 7: Comparison of duration of apnea in experimental and control group. n=25+25

| Group | Mean | S.D. | t-value | p-value | Significance |
|--------------------|------|------|---------|---------------|--------------|
| Experimental group | 3.96 | 0.79 | -17.13 | 0.00001 <0.05 | Significant |
| Control group | 7.76 | 0.78 | | | |

Above table shows comparison of duration of apnea in experimental and control group. Mean of duration of apnea in experimental group it was 3.96 and S.D. it was 0.79, In control group mean of duration of apnea it was 7.76 and S.D. it was 0.78, t- value it was -17.13, p- value it was 0.00001. There is significant difference between mean of duration of apnea in experimental and control group.

As the calculated p value is less than 0.05 level of significance. Hence tactile stimulation is effective to maintain cardiorespiratory parameters.

DISCUSSION

The analysis of the demographic data of the study samples gave an idea about the general characteristics of the premature baby with apnea in NICU in selected

hospitals. The following are the major findings of the study.

In the present study the findings of the study have been discussed with reference to objective and hypothesis

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

In the demographic data it found that experimental group female is 56% and male is the 44%, in the control group female is 52% and male is 48%

In the demographic data it found that maximum gestational age in experimental and control group is 34 to 37 weeks gestational age 34% and 36% respectively

In the present study assessment was done on cardiorespiratory parameters among the babies with apnea with help of cardiorespiratory parameters tool

In experimental group, the mean cardiorespiratory parameters before giving the tactile stimulation was heart rate 152.36%, respiratory rate 11.48%, spo2 83.12% and duration of apnea 3.96%, after giving tactile stimulation was heart rate 140.32%, Respiration rate 25.68%, spo2 96.64 respectively.

In control group, the mean cardiorespiratory parameters pretest is heart rate 150.4%, respiration rate 13.96%, saturation 87.24%, and duration of apnea 7.76. In posttest of control group.

In control group heart rate, it was 150.8 and 3.33, t-value it was 6.11 and p-value it was 0.0002 Respiratory rate in control group it was 14.2 and 4.15, t-value it was -5.18 and p-value it was 0.0008 and spo2 in control group it was 88.8 and 1.92, t-value it was -6.58 and p-value it was 0.000.

A similarly study supported the present result i.e.A study done by the Heizer N, Goyer I, Porcheret F, Denis M, Faucon C, Jokic M, Brossier D. in the year 2020 with the aim is to evaluate the efficacy and safety of caffeine in treating.

IMPLICATION

NURSING PRACTICE

- Based on the findings, hospitals can develop standard protocols incorporating tactile stimulation techniques for managing apnea in NICUs.
- Nurses can be trained to promptly identify apnea episodes in premature infants by continuous monitoring of cardiorespiratory parameters.
- The study supports the need for training nursing staff in effective tactile stimulation methods.

NURSING EDUCATION

- The study supports integrating tactile stimulation techniques and management of neonatal apnea into

neonatal and pediatric nursing courses.

- Training students to recognize early signs of apnea and initiate appropriate interventions fosters critical thinking and faster clinical judgment.
- Encourages nursing students to engage in clinical research and evidence-based practice.

NURSING ADMINISTRATION

- Nursing administrators can develop and implement SOPs for tactile stimulation as an initial intervention for apnea in premature babies.

NURSING RESEARCH

- Highlights importance of tactile stimulation as an effective intervention.
- Encourages further research and evidence-based practice.

LIMITATIONS

- Small sample size.
- Study confined to selected hospitals.
- External factors may act as confounding variables.

CONCLUSION

The study revealed that tactile stimulation is an effective intervention in improving cardiorespiratory parameters during apnea episodes in premature infants admitted to NICUs. Premature infants who received tactile stimulation demonstrated a significant improvement in heart rate, oxygen saturation, and respiratory rate compared with those who received routine care. This intervention is simple, non-invasive, economical, and can be effectively incorporated into neonatal nursing practice to improve the quality of care and reduce complications associated with apnea in premature infants.

REFERENCES

1. Scafidi FA, Field TM, Schanberg SM, Bauer CR, Vega-Lahr N, Garcia R, Poirier J, Nystrom G, Kuhn CM. Effects of tactile/kinesthetic stimulation on the clinical course and sleep/wake behavior of preterm neonates. *Infant Behav Dev.* 1986;9(1):91–105.
2. Osborn DA, Henderson-Smart DJ, Cochrane Neonatal Group. Kinesthetic stimulation for treating apnea in preterm infants. *Cochrane Database Syst Rev.* 1996;(1).
3. Lin CH, Wang ST, Lin YJ, Yeh TF. Efficacy of nasal intermittent positive pressure ventilation in

"A STUDY TO ASSESS THE EFFECTIVENESS OF TACTILE STIMULATION ON CARDIO RESPIRATORY PARAMETERS DURING APNEA AMONG THE PREMATURE BABY IN NICU FROM SELECTED HOSPITALS OF SANGLI MIRAJ KUPWAD CORPORATION AREA"

- treating apnea of prematurity. *Pediatr Pulmonol*. 1998;26(5):349–353.
4. Bhatia J. Current options in the management of apnea of prematurity. *Clin Pediatr (Phila)*. 2000;39(6):327–336.
5. Daulatzai MA. Role of sensory stimulation in amelioration of obstructive sleep apnea. *Sleep Disord*. 2011;2011:596879.
6. Martin RJ, Wang K, Koroglu O, Di Fiore J, Kc P. Intermittent hypoxic episodes in preterm infants: Do they matter? *Neonatology*. 2011;100(3):303–310.
7. Eichenwald EC, Committee on Fetus and Newborn. Apnea of prematurity. *Pediatrics*. 2016;137(1):e20153757.
8. Cramer SJ, Dekker J, Dankelman J, Pauws SC, Hooper SB, Te Pas AB. Effect of tactile stimulation on termination and prevention of apnea of prematurity: a systematic review. *Front Pediatr*. 2018;6:45.
9. Dekker J, Hooper SB, Martherus T, Cramer SJ, van Geloven N, Te Pas AB. Repetitive versus standard tactile stimulation of preterm infants at birth: a randomized controlled trial. *Resuscitation*. 2018;127:37–41.
10. Mageed AS, Olama KA, Rahman SA, El-Gazzar HE. The effect of sensory stimulation on apnea of prematurity. *J Taibah Univ Med Sci*. 2022;17(2):311–319.
11. Guinsburg R, de Almeida MF, Finan E, Perlman JM, Wyllie J, Liley HG, Wyckoff MH, Isayama T. Tactile stimulation in newborn infants with inadequate respiration at birth: a systematic review. *Pediatrics*. 2022;149(4):e2021055067.
12. Prevalence and Risk Factors of Apnea in Preterm Neonates Admitted to the French Hospital. Available from: https://www.researchgate.net/publication/364387913_Prevalence_and_Risk_Factors_of_Apnea_in_Preterm_Neonates_Admitted_to_the_Frenc
13. Cramer SJE, Dekker J, Croughan MK, et al. The effect of vibrotactile stimulation on hypoxia-induced irregular breathing and apnea in preterm rabbits.