

**IMPLEMENTATION OF INFANT MASSAGE THERAPY TO INCREASE OXYGEN SATURATION IN NEONATES: A SCOPING REVIEW****Dede Jubaedah*, Siti Yuyun Rahayu Fitri, Ai Mardhiyah**

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*dede22003@mail.unpad.ac.id**ABSTRACT**

Stress and pain in premature babies can cause a decrease in oxygen saturation and changes in respiratory rate. Touch stimulation is one of the most advanced senses used by medical practitioners to soothe babies. Objective: This review aims to see the effectiveness of implementing infant massage therapy in increasing oxygen saturation in neonates. Method: A literature search was conducted on: PubMed, ScienceDirect, and CINAHL. The collected data is then extracted, synthesized, and presented as tables and narratives. The search strategy uses the keywords ("baby massage" OR "massage therapy") AND ("Neonatal") AND (Oxygen Saturation)). The articles used are from 2017 to 2023. Results: 757 neonates participated in 10 studies from 4 countries that met this review's criteria. The literature research design used was Quasi-experimental (n=4) and Randomized Controlled Trial (n=6). Conclusions: In this review, it was found that implementing massage therapy can increase the average percentage of oxygen saturation. This review also found that several studies agreed that massage therapy would be more effective when combined with the prone position. However, study results are still found to be inconsistent with these results. This may occur due to several factors including heterogeneity of implementation, differences in clinical conditions, and the lack of studies that specifically examine the effectiveness of implementing infant massage therapy on increasing oxygen saturation in neonates.

Keywords: baby massage; massage therapy; neonatal; oxygen saturation

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INTRODUCTION

Every year 1 in 10 babies are born prematurely worldwide, which means there are 15 million premature births every year (WHO., 2018). Preterm birth leads to an increased risk of mortality and morbidity in both the short and long term (Vogel et al., 2018). Although many preterm babies occur in developed countries, the mortality rate of preterm babies born in lower-middle-income countries is eight times higher (Zhang et al., 2023). Longer hospitalization and high care costs for premature babies are problems that are often found because premature babies experience immaturity in the growth of major organs, problems regulating behavior, difficulty eating, and slow growth (White-Traut et al., 2021). Parents of premature babies experience increased conditions of stress, anxiety, and symptoms of depression, as well as decreased self-confidence in caring for children (Baía et al., 2016; Garfield et al., 2019). This can lead to a decrease in the optimal interaction between parents and babies so that the baby's growth and development can worsen (Baía et al., 2016; Garfield et al., 2019). Therefore, early treatment of preterm infants is essential in both developed and developing countries.

Premature babies are more likely to experience difficulties and complications because their organs do not have much time to develop in the womb. The lungs of premature babies have immature tissue. The most common problem resulting from this condition is respiratory distress syndrome. Furthermore, intensive care is needed by premature babies to overcome this condition. Babies admitted to neonatal intensive care units (NICUs) and separated from their mothers for weeks and often months are exposed to stressful environments and painful invasive treatments necessary for their survival. Stress and pain in premature infants can lead to decreased oxygen saturation and changes in respiratory rate (Mohamed et al., 2018). Therefore, finding new approaches to reduce stress in preterm infants in the NICU is an important topic in the field of nursing care. Improving health and normal growth in premature babies is influenced by the unique role of nurses where positive neurological development in premature babies must always be maintained by neonatal nurses (Dussi & Ferrari, 2021).

In recent years, many neonatal units have begun to introduce a series of care measures based on somatic (stimulation of the somatosensory system), kinesthetic (stimulation by movement), and sensory (stimulation of the senses: visual, auditory, tactile stimulation, smell and taste), intending to facilitate the neuromotor and emotional development of premature infants (Abdallah et al., 2013). Touch stimulation is one of the most advanced senses used by medical practitioners to soothe premature babies, and it is essential for their development & growth (Vargas-Porras et al., 2020). The heart rate in premature babies who were given moderate pressure was reported to be lower and appeared more relaxed as indicated by the results of assessing their waking and sleeping status and assessing their behavior (Pepino & Mezzacappa, 2015).

There are generally two types of infant touch: care-giving touch and massage therapy. Care-giving touch is the process of daily care of infants in the NICU and includes feeding, nappy changing, and examination. In contrast, therapeutic infant massage is a methodological means of stimulating infants (Álvarez et al., 2017). Several studies have shown various benefits of massage therapy for preterm infants, such as weight gain, immune enhancement, cognitive improvement, neurodevelopment, and shorter hospitalization (Zhang et al., 2023). Motor and physical development in newborn babies can be improved with low-cost and non-pharmacological but effective interventions, through massage therapy (White-Traut et al., 2021).

Based on the relevant literature that we have researched, it is reported that there is a positive effect of massage therapy on various indicators such as increasing body weight, level of immunity, cognitive ability, etc. However, there is still controversy regarding whether massage therapy can improve oxygen saturation (Elsagh et al., 2019) in preterm infants. In addition, due to safety concerns in touching infants, a minimal touch policy was established in the NICU which resulted in massage therapy not being performed in most NICUs with infants experiencing respiratory problems. Thus, further review of existing research is needed regarding the effectiveness of massage therapy, especially in improving and maintaining oxygen saturation. The aim of this review is to see the effectiveness of implementing infant massage therapy in increasing oxygen saturation in neonates.

METHOD

Eligibility Criteria

The following inclusion criteria were used to select studies: 1) original article, 2) published in English, 3) study design was quasi-experimental and randomized controlled trial, 4) study reported quantitative outcome measures, 5) article with neonate sample, 6) 10 years of

published articles (2013– 2023). Exclusion criteria included: 1) dissertations, book chapters, and meeting abstracts, and 2) articles not from accredited journals.

Data Sources and Search Strategies

The protocol for the review was designed using the Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018). Three databases were used, namely: PubMed, ScienceDirect, and CINAHL. Search terms were grouped in three main categories: massage therapy, neonates, and related to increased oxygen saturation. The search strategy used the keywords (("baby massage" OR "massage therapy") AND ("Neonatal") AND (Oxygen Saturation)).

Data Extraction

Three reviewers (DJ, SYRF, and AM) independently reviewed and extracted articles that met the inclusion criteria for full-text review. The full-text articles that have been selected are then identified to see the characteristics of the research in the extraction table based on research objectives, research design, research methods, research population, and results. The extracted data were then reviewed using a descriptive approach to summarise key findings.

RESULTS

The initial search identified 791 articles. Reviewers have carried out a selection by removing 403 duplicate articles, and then screening 388 article titles and abstracts to match the inclusion and exclusion criteria. After a full-text review, 113 articles were found that did not match the title. The full-text review was then scrutinized and the remaining 10 articles met all eligibility criteria (Figure 1).

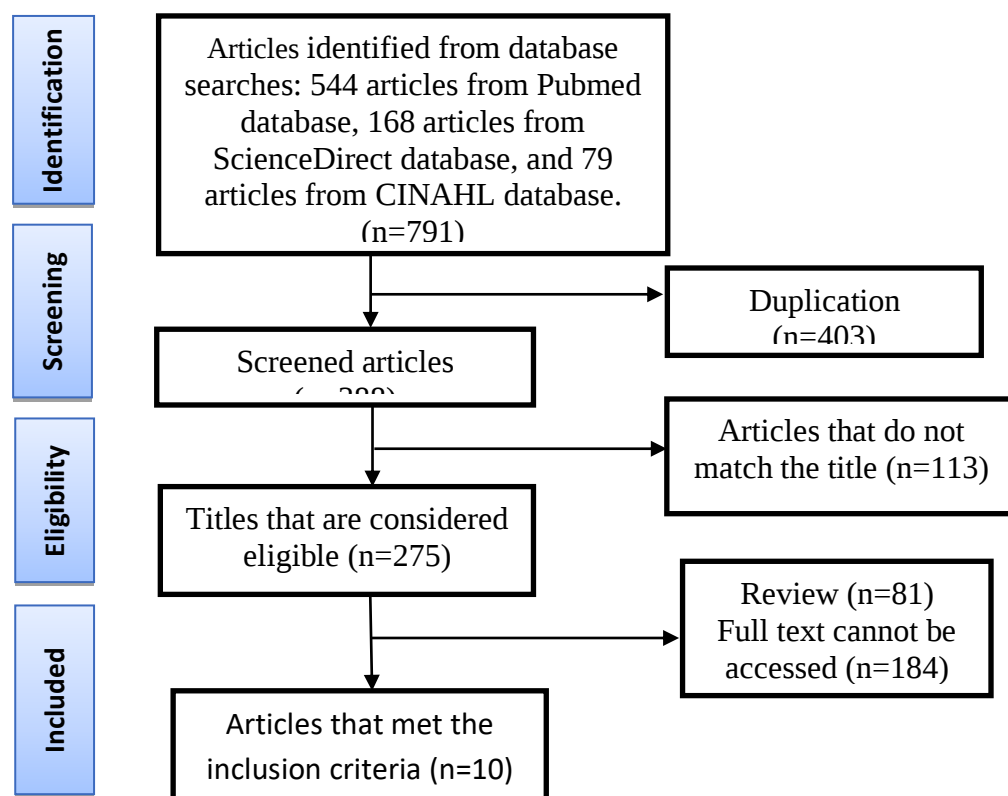


Figure 1. Article Selection Process

The ten articles reviewed were divided into two research designs, namely: Quasi-experimental (n=4) and Randomised Controlled Trial (n=6). A total of 757 neonates were involved in these studies. Studies based in Iran (n=5) (Elsagh et al., 2019; Jazayeri et al., 2021; Ramezani et al., 2017; Roshanray et al., 2020; Seyyedrasooli et al., 2017), Egypt (n=3) (Elataief et al., 2017; Essa et al., 2022; Rashed et al., 2023), United Arab Emirate (n=1) (Balushi & Hanson, 2019), and Turkey (n=1) (Dur et al., 2020). Studies vary based on intervention characteristics, desired outcomes, and how desired outcomes are measured. Therefore, in the following section, we will briefly discuss the characteristics of the intervention, assessment of results, and synthesis of results.

Neonate Characteristics

In the articles reviewed, there were two characteristics of neonate studies, namely: preterm infants with gestational age of 33-37 weeks with birth weight ranging from 900-2000 grams (Balushi & Hanson, 2019; Dur et al., 2020; Elataief et al., 2017; Elsagh et al., 2019; Essa et al., 2022; Ramezani et al., 2017; Rashed et al., 2023; Seyyedrasooli et al., 2017), and healthy full-term neonates (38-42 weeks) with birth weight 2500-4000 grams (Jazayeri et al., 2021; Roshanray et al., 2020).

Implementation of Infant Massage

The infant massage methods used vary widely such as: abdominal massage of "I Love You" method (Seyyedrasooli et al., 2017), head-to-toe massage with 2 stimuli (tactile and kinesthetic) (Balushi & Hanson, 2019); Elataief et al., 2017; Essa et al., 2022; Jazayeri et al., 2021; Ramezani et al., 2017, massage with superficial stroking method (Elsagh et al., 2019) massage with effleurage technique (Roshanray et al., 2020), and Yakson touch (Dur et al., 2020; Rashed et al., 2023). (Table 1)

Effectiveness of Infant Massage on Increasing Oxygen Saturation

Most of the studies showed positive results of infant massage implementation on improving oxygen saturation (Dur et al., 2020; Elataief et al., 2017; Elsagh et al., 2019; Essa et al., 2022; Jazayeri et al., 2021; Rashed et al., 2023; Seyyedrasooli et al., 2017). Three of them found no significant changes in respiratory rate and blood oxygen saturation level in neonates after infant massage (Balushi & Hanson, 2019; Ramezani et al., 2017; Roshanray et al., 2020) (Table 1)

Table 1.
Article Review

and Authors	Objectives	Design	Methods	Patients (n)	Results
<i>Effect of Massage Therapy on Vital Signs of Premature Infant at Neonatal Intensive Care Units in Sohag city</i> (Elataief et al., 2017)	To determine the effect of massage therapy on the vital signs of premature infants in the Neonatal Intensive Care Unit.	<i>Quasi-experimental</i>	The study was conducted in preterm infants with low birth weight. Infants were divided into the intervention group, which received massage therapy, and the control group, which received routine hospital care.	60	Significant results were obtained on respiratory frequency after comparing before and after the intervention. Massage therapy has the effect of increasing oxygen saturation and improving breathing.
<i>of Abdominal Massage and Non-Nutritive Sucking on Physiological Parameters of</i>	To evaluate the effect of abdominal massage and non-nutritive suction on physiological parameters of preterm infants.	<i>Randomized Controlled Trial</i>	The study was conducted on premature babies for 5 consecutive days in the neonatal intensive care unit at Emam Reza Hospital in Kermanshah, randomly assigned to three groups: • abdominal massage	42	The results showed that there were significant differences between one another in the physiological parameters of the average score of respiratory frequency, heart rate, and oxygen saturation (p < 0.05).

and Authors	Objectives	Design	Methods	Patients (n)	Results
<i>Preterm Infants</i> drasooli et al., (2017)			group with the "I Love You" method • non-nutritive suctioning, and • The control group only received routine care		
<i>The Effects of Massage on Oxygen Saturation of Infants with Respiratory Distress Syndrome Treated with Nasal Continuous Positive Airway Pressure</i> (Ramezani et al., 2017)	To assess the effect of massage on oxygen saturation of infants with respiratory distress syndrome.	<i>Quasi-experimental</i>	Massage is carried out using the field massage technique once a day for 15 minutes for 5 consecutive days. Measurement of respiratory rate, oxygen saturation, and heart rate are 5 minutes before and after massage. Mixed models were used to analyze the data.	45	Respiratory frequency (P=0.004) and heart rate (P=0.03) after massage were reported to decrease compared to before massage, but oxygen saturation (P=0.13) was found to be no significant difference.
<i>Comparison of Massage and Prone Position on Heart Rate and Blood Oxygen Saturation Level in Preterm Neonates Hospitalized in Neonatal Intensive Care Unit</i> (Elsagh et al., 2019)	To examine the effect of neonatal massage in the prone position of premature babies on Heart Rate (HR) and Oxygen Saturation values.	<i>Randomized Controlled Trial</i>	The study was conducted on premature infants hospitalised. Subjects were randomly assigned to an intervention group (prone position and massage), and a control group. The intervention (prone position and massage) was performed for five consecutive days.	75	There were significant differences in the HR and SaO2 values obtained at several different times in the prone position, massage and control groups using RM ANOVA (F10,360 = 10.376, p<0.001). In the intervention group, HR decreased and SaO2 increased, where RM ANOVA (F5,360 = 2.323, p<0.001).
<i>Effect of Neonatal Massage on Weight Gain and Physical Responses Among Preterm Babies in Selected Hospital in Fujairah, United Arab Emirate</i> (Balushi & Hanson, 2019)	To assess the effect of neonatal massage on weight gain and physical responses in preterm neonates.	<i>Quasi-experimental</i>	The study was conducted on neonates in the Neonatal Intensive Care Unit. Researchers divided respondents into control and experimental groups using the consecutive sampling method. The experimental group received massage intervention for 10 days with a massage duration of 15 minutes every day.	43	There was a positive effect of neonatal massage on neonatal weight gain of 266.68 grams after 10 days of intervention. In the intervention group, weight gain was 54.1%, while in the control group, it was 17.7%. Heart rate and respiratory rate were significantly different (P < 0.05), while there were no significant differences in temperature, oxygen saturation, and body activity values.
<i>Comparative Effect of Mother's Hug and Massage on Neonatal Pain Behaviors Caused by Blood Sampling</i> (Roshanray et al., 2020)	To compare the effect of maternal hug and massage on pain behaviour during and after blood sampling in neonates.	<i>Randomized Controlled Trial</i>	The study was conducted on neonates who were randomly assigned to the mother's hug group, massage group, or control group. Researchers measured behavioral responses in neonates in three conditions, namely before, immediately, and after 5 minutes of blood sampling. Behavioral responses were observed using the Neonatal	135	The reduction in pain and heart rate was shown by the mother's hug group compared to the massage and control groups (p<0.001) in the research results. Meanwhile, the respiratory rate and oxygen saturation level during blood sampling showed no significant changes (p > 0.05). In the maternal hug group, the decrease in crying duration was shown to be greater than in the massage group and control group (p<0.001).

and Authors	Objectives	Design	Methods	Patients (n)	Results
			Infant Pain Scale (NIPS). Pulse oximetry is used to measure heart rate, respiratory rate, and oxygen saturation. Meanwhile, a stopwatch is used to measure how long a baby cries from start to stop.		
<i>The Effect of Yakson and Gentle Human Touch Methods on Pain and Physiological Parameters in Preterm Infants During Heel Lancing</i> (Dur et al., 2020)	To see the impact of the Yakson and Gentle Human Touch (GHT) method on pain and find out how it affects physiological parameters in premature babies when the heel lancing procedure is performed.	<i>Randomized Controlled Trial</i>	A total of 90 premature babies were the research samples, which were divided into three groups, namely the Yakson, GHT and control groups, with 30 babies in each group. The Neonatal Infant Pain Scale (NIPS) is used as an instrument to evaluate pain responses. The study took place in the NICU.	90	The results showed that during and after heel lancing there was a significant decrease in premature babies in the Yakson and GHT groups regarding pain scores and heart rate compared to the control group ($p < 0.001$).
<i>Comparison of The Effect of Foot Reflexology and Body Massage on Physiological Indicators and Bilirubin Levels In Neonates Under Phototherapy</i> (Jazayeri et al., 2021)	To compare the effect of foot therapy and body massage on physiological indicators and bilirubin levels in babies undergoing phototherapy.	<i>Randomized Controlled Trial</i>	The study was conducted on babies with jaundice at the Imam Hussein Children's Medical Center. Samples were randomly assigned to the reflexology group, the body massage group, and the control group. The frequency of massage is once a day for 15 minutes. For respondents in the reflexology group, the area massaged was the feet. For respondents in the body massage group, the body area was given a massage using circular movements. Meanwhile, the control group was not given treatment.	51	The results of the study indicated that the average percentage value of arterial oxygen saturation and bilirubin levels in the intervention group showed a significant increase compared to the control group ($p < 0.05$). The average values of heart rate and respiratory frequency were not significant between the three groups ($p > 0.05$).
<i>Effect of Prone Position and Massage on O₂ Saturation and Heart Rate in Preterm and Small For Gestational Age Newborn</i> (Essa et al., 2022)	To assess the effect of prone position and massage on oxygen saturation and heart rate in premature and small neonates.	<i>Randomized Controlled Trial</i>	There were three groups of newborns selected randomly. Each group consisted of 52 babies. The first group is babies in a prone position without being given a massage. In the second group, babies were in a prone position and given a massage. The final group was a control where the baby was in the supine position and was not given any intervention.	156	The results of the study indicate that in the values of oxygen saturation and heart rate there are significant differences in newborns in groups 1 and 2 compared to newborns in group 3, where heart rate decreased while SaO ₂ increased.
<i>Effect of Yakson Touch Technique on Selected Health Outcomes Among Preterm Neonates in The Neonatal Intensive Care Units</i>	To evaluate the effect of the Yakson touch technique on selected health outcomes in premature neonates in the NICU.	<i>Quasi-experimental</i>	The study was conducted on premature neonates. They were divided into two groups: - Intervention group (with Yakson Touch) - Control group (usual care)	60	There was a significant increase in the mean score of vital signs and oxygen saturation of premature neonates in the study group after the intervention compared to before the intervention. The average behavioral state score of premature neonates in the

and Authors	Objectives	Design	Methods	Patients (n)	Results
(Rashed et al., 2023)					study group decreased after intervention compared with before intervention. The duration of hospitalization of premature neonates in the study group was less than control group.

DISCUSSION

Previous studies reported positive effects of massage therapy such as weight gain, immune enhancement, cognitive improvement, neurodevelopment, and shorter hospitalization. However, they did not specifically focus on oxygen saturation levels. All ten studies reviewed used massage therapy as an intervention for neonates. Most of the studies mentioned that after massage therapy intervention, the average percentage of oxygen saturation increased significantly. Elsagh et al. (2019) in their research gave massage to babies, where for the first 5 minutes the baby was in the prone position and then given a massage using a superficial rubbing technique. Next, in the second 5 minutes, the baby is positioned supine and then given extension and flexion positions in the arms and legs. Then in the third 5 minutes, the baby is positioned prone and a massage is given. The study showed that massage improved oxygen saturation. Another massage technique tested by Seyyedrasooli et al. (2017), namely abdominal massage performed with warm researcher's hands and smeared with olive oil. Twice a day for 5 days the massage was performed at 9 am and 9 pm before breastfeeding (to reduce the risk of regurgitation) with the "I Love You" method and the Vaymal technique ("I Love U": The letter I is made on the baby's left side, while the letter L is made upside down by rubbing the baby's stomach along the base of the baby's ribs from the right side then to the left then down. Next, the letter U is made upside down by rubbing from the bottom right of the baby's stomach upwards around the navel and then downwards to the left. The average scores of respiratory frequency, heart rate and oxygen saturation were reported to be significantly different in the study results ($p < 0.05$).

Supported by another study, confirming that there was a statistically significant difference in oxygen saturation in preterm infants after massage therapy [SMD = 2.00, 95% CI (1.17 to 2.83), $P < 0.001$] (Zhang et al., 2023). The results of the study show a comparison of the average oxygen saturation per day in premature babies. The average oxygen saturation on the first day in the experimental group was 2.99 times higher than the control group and the value increased to 3.6 times on the fifth day. Massage is carried out within 5 days. Similar findings were conducted by Elataief et al. (2017), showing that the first day assessment in the infant massage intervention group and the control group had no significant difference ($p > 0.05$) regarding oxygen saturation, while on day seven there was a highly significant difference ($p < 0.0$) in oxygen saturation between the infant massage intervention group and the control group. Massage therapy shows that the pressure used on the baby will increase the vagal activity of the heart, thus increasing cardiac output which leads to improvement of tachycardia. A similar explanation was put forward by Verklan et al. (2020) who suggested that massage of the skin causes more oxygen to enter the lungs and oxygen transport increases. This process ultimately leads to an increase in the average oxygen saturation.

In contrast, the study of Ramezani et al. (2017) conducted the same massage technique, namely head-to-toe massage with 2 stimuli (tactile and kinesthetic) did not find a significant difference in infant oxygen saturation before and after massage for 5 days of intervention. Following the studies of Balushi & Hanson (2019) and Roshanray et al. (2020) revealed no significant changes in respiratory rate and blood oxygen saturation levels in infants after

massage. The inconsistency between these studies could be due to differences in the frequency of touch, age of the subjects, and clinical conditions. In addition to the different results above, this review found that several studies agree that massage therapy is more effective when combined with the prone position. Elsagh et al. (2019) showed a significant difference in oxygen saturation in the massage group with the prone position. Alinejad-Naine (2014) in his literature review, reported that the prone position causes better ventilation and lung capacity so that it can improve respiratory chest muscles. Essa et al. (2022) also clearly stated that infants of the massage therapy group in the prone position had significantly higher oxygen saturation compared to the supine position. On the other hand, the increased body temperature in the prone position caused hyperventilation and increased respiratory rate which consequently decreased CO₂ in the infant's blood. Meanwhile, she reported there was no specific description of the change in SaO₂.

CONCLUSION

This review found that the implementation of massage therapy can increase the average percentage of oxygen saturation. This review also found that some studies agreed that massage therapy would be more effective if combined with the prone position. However, there were still studies that were inconsistent with these results. This may be due to several factors including heterogeneity of implementation, differences in clinical conditions, as well as the lack of studies that specifically examined the effectiveness of the implementation of infant massage therapy on improving oxygen saturation in neonates.

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