

Effectiveness Of Swaddle Bathing On Neonatal Stability In Premature Infants: A Literature Review

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Abstract

Premature infants are susceptible to stress and homeostasis disorders due to physiological immaturity. One routine care procedure that can be a stressor is bathing. Swaddling involves wrapping the infant in a towel and bathing them in warm water, while conventional bathing uses a wet washcloth. This study aims to evaluate the effectiveness of swaddling compared to conventional bathing in reducing stress and maintaining physiological stability in premature infants. The authors conducted a systematic literature search in Google Scholar and PubMed for randomized controlled trials (RCTs) and quasi-experimental studies on premature infants receiving swaddling and conventional bathing interventions. Ten articles were selected that met the criteria for further analysis. The results of the swaddle bath intervention studies consistently showed significant advantages in maintaining body temperature (mean post-bath 36.8°C), stabilizing heart rate and respiration, and reducing crying duration by up to 60% compared to conventional bathing ($p < 0.05$). In addition, this technique increased infant comfort and minimized energy expenditure due to stress. Swaddling bathing is an effective, safe, and developmental care-oriented intervention. This method is recommended as standard practice in the care of premature infants in the NICU.

Keywords: *Premature Infants, Physiological Function, Neonatal Stress, Swaddle Bath*

Background

Preterm birth is a global health problem that remains a major challenge in the clinical practice of neonatology. Each year, more than 15 million babies worldwide are born before 37 weeks of gestation, representing one in ten births being premature (Wahyuni et al., 2024). Countries with medium to low health systems, such as Iran, record high rates of premature births, reaching 12.9% of total births (Paran et al., 2016; Erkut and Yildiz, 2022; Rudhiati and Murtiningsih, 2022). This increasing trend has a direct impact on significant neonatal morbidity and mortality (Wahyuni et al., 2024).

Premature babies are particularly vulnerable to environmental stressors due to their physiological immaturity. The transition from the intrauterine to the extrauterine environment is often stressful, potentially disrupting the long-term development of the baby's brain and nervous system (Paran et al., 2020; Mokhtari Naseri et al., 2021; Mohamed and Elashry, 2022). One routine procedure that can be a source of stress is bathing a baby. Conventional bathing procedures, such as sponge baths or tub baths without swaddling, often cause discomfort, including increased crying, hypothermia, and oxygen desaturation (Paran et al., 2016; Mokhtari Naseri et al., 2021; De Freitas et al., 2020).

In response, atraumatic care approaches such as swaddling baths were developed, involving swaddling babies in a physiological position during a warm bath. This technique has been shown to stabilize body temperature, reduce stress,

and increase infant comfort (De Freitas et al., 2020; Kanonturk & Gozen, 2020; Mohamed & Elashry, 2022). Several studies have shown positive results from the use of this method, previous studies were generally limited by small sample sizes, varied methodologies, and focused primarily on specific physiological or behavioral outcomes rather than providing a comprehensive evaluation. In addition, literature reviews on this topic remain limited and have not specifically synthesized evidence comparing swaddle baths with conventional bathing in premature infants. Therefore, this study aims to comprehensively analyze the effectiveness of swaddle baths compared with conventional baths on the physiological and behavioral responses of premature infants, providing updated evidence to support safer and developmentally appropriate care practices in the Neonatal Intensive Care Unit (NICU).

Methods

This study is a systematic review of the literature conducted to identify, evaluate, and synthesize research results related to the effectiveness of the swaddle bath method compared to conventional bathing on the physiological responses of premature infants. The literature reviewed includes articles published from 2020 to 2025. The literature search was conducted in major electronic databases, namely PubMed and Google Scholar. Keywords used in the search were adapted from previous relevant literature, including "Physiological function", "Swaddle Bath", "Preterm Infant", "Neonatal Stress". A total of 15,914 articles were identified from PubMed and Google Scholar databases. After the screening process, 10 articles met the inclusion criteria: articles published between 2020–2025, written in English, involving preterm infants, focusing on swaddle bathing interventions, and using Quasi-experimental or Randomized Controlled Trial (RCT) designs. These study designs were included because they provide stronger evidence regarding intervention effectiveness. Exclusion criteria included repository articles, inaccessible full texts, literature reviews, meta-analyses, non-experimental studies, articles published before 2020, studies not involving preterm infants, and studies unrelated to swaddle bathing. The validity and methodological quality of the included studies were assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools. The article selection process is presented in the selection flow diagram (see Figure 1).

In addition to the literature review, the authors incorporated clinical observations from swaddle bath practices in a hospital setting to enhance understanding of the practical context. Furthermore, the authors engaged in discussions with an experienced NICU nursing team who routinely perform swaddle bathing for premature infants, in order to critically evaluate the relevance, applicability, and consistency of the reviewed evidence with current clinical practice. This process strengthened the contextual validation of the findings and supported a more comprehensive interpretation of the evidence for clinical application.

Results

A systematic review of several scientific articles that met the inclusion criteria found consistent evidence regarding the effectiveness of swaddle bathing in transforming premature infant care.

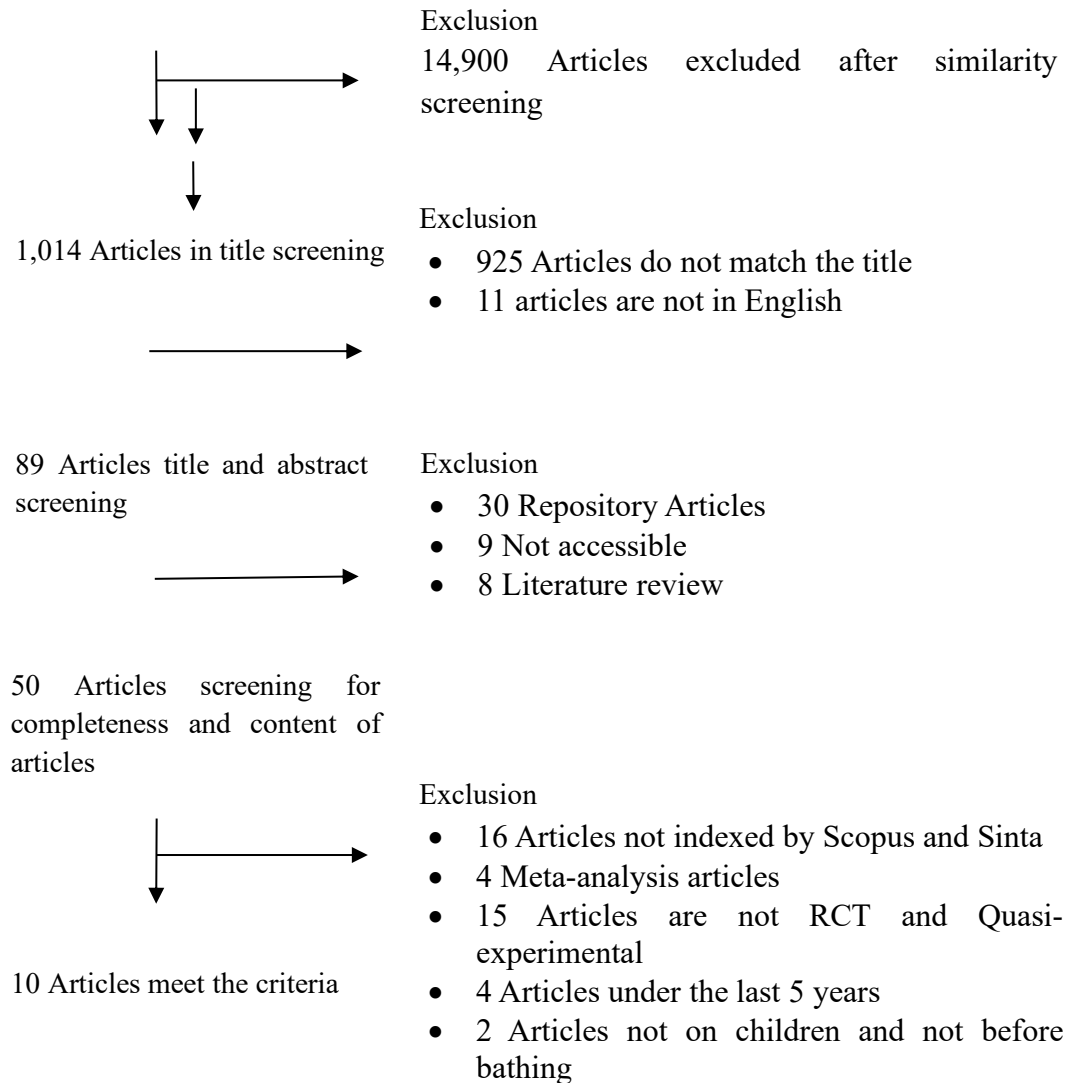


Figure 1. Selected studies for Swaddle bathing in premature infants

Table 1. Extraction Results from The Analyzed Studies

No	First Author (Year), Country	Design (Sample)	Form of Treatment		Outcome Study	Research result	Research Recommendations
			Intervention Group	Control Group			
1.	(Huang et al., 2022), United States of America	RCT (60 Premature Babies)	Bathing with a Swaddle	Traditional Bathtub	Body temperature, respiratory rate, heart rate, oxygen saturation level, crying time, and newborn stress scale score.	- Swaddling baths significantly maintained the stability of respiratory rate, heart rate, and oxygen saturation compared to traditional baths ($p < 0.05$) - The crying duration of infants in the swaddle bath group was significantly shorter (32 ± 24.7 seconds) compared to the traditional bath group (94.43 ± 41.6 seconds)	Swaddling is the recommended method for bathing techniques in neonatal intensive care units.
2	(Mediani et al., 2022), Malaysia	QE (36 premature babies)	Bathing with a Swaddle	Traditional Bathtub	Physiological responses (body temperature, heart rate, respiration, oxygen saturation) and comfort responses (duration of crying)	- Swaddling baths have a significant effect on reducing body temperature after 1 minute and 15 minutes of bathing, and respiratory rate after 30 minutes of bathing ($p < 0.05$). - The crying duration of the swaddling bath group was shorter compared to the conventional bath group with a p-value < 0.05.	This study recommends further exploration of ways to reduce anxiety in premature infants. Further research is recommended to analyze stress levels in premature infants.
3	(Tambunan, 2024),	QE	Bathing with a Swaddle	Sponge bath	Neonatal body temperature	This study determined that	It is recommended that further research

	Indonesia	(32 neonates)			stability, infant behavioral responses, vital signs stability	there were significant differences in maintaining the stability of respiratory rate, heart rate, oxygen saturation, body temperature, and pain scale at 5 minutes post-bath with a p value <0.05 in both groups.	be conducted to add crying time and stress levels to the swaddling and sponge bathing methods.
4	(Edraki et al., 2021), United States of America	RCT (50 premature babies)	Bathing with a Swaddle	Conventional bath	Body temperature and crying time.	The average drop in body temperature was less in swaddled newborns compared to those bathed conventionally. Furthermore, crying time was shorter in the experimental group compared to the control group.	Further research is recommended on the effect of swaddling on other behavioral responses caused by stress, sleep patterns, eating patterns, and sucking.
5	(Paran et al., 2020), Iran	RCT (50 premature babies)	Bathing with a Swaddle	Conventional bath	Baby behavior: Facial grimaces, yawning, tongue extension, eyes open/closed, fussiness/crying	There were significantly lower incidences of yawning, tongue extension, eye opening, and fussiness in the experimental group compared to the control group. Furthermore, the percentage of closed eyes was higher in the experimental group compared to the control group (P=0.006).	It is recommended to conduct further research to compare the effect of swaddling vs. other baths on neonatal behavioral responses, such as baby sleep quality, mother-baby relationship attachment, and parental pressure.
6	(Rudhiati and Murtiningsih, 2022), English	QE (50 premature babies)	Swaddling Bath	Bathing with a conventional tub and sponge	Baby's vital stability (body temperature, heart rate, and oxygen saturation)	The results of the study showed that there were significant differences in maintaining stability in temperature, heart rate, and oxygen saturation after swaddling compared to	Further research can further explore the effects of swaddle baths on physiological and behavioral changes in premature infants more comprehensively and other infant conditions such as hyperbilirubinemia

						conventional bathing (p = 0.019, p = 0.041, p = 0.024, respectively).	and low birth weight babies.
7	(Mokhtari Naseri et al., 2021), English	RCT (80 premature babies)	Swaddled while bathing in the bath	Conventional Bath	Infant behavioral responses to stress	The results of this study showed that the average stress behavior for babies who were bathed in a bathtub without swaddling (56.84 ± 21.79) was significantly higher than babies who were bathed with swaddling (17.12 ± 7.67) ($P < 0.001$). The crying time of babies in the group without swaddling (15.57 seconds) was longer than the group with swaddling (5 seconds) ($P < 0.001$).	No author recommendations
8.	(De Freitas et al., 2020), United States of America	RCT (15 premature babies)	Swaddling bath	Conventional Bath	Physiological stability (temperature, heart, respiration, oxygen saturation) and stress/comfort behavior of premature infants during bathing	The results of this study showed no significant difference in physiological stability in the two groups.	No author recommendations
9.	(De Freitas, et al 2020), United States of America	QE (43 premature babies)	Swaddling Bath	Conventional bath	Body temperature, heart rate, oxygen saturation, salivary cortisol, and the baby's sleep-wake state	The results showed no significant differences in the infants' physiological state before and during the 20 minutes after bathing. Although salivary cortisol levels increased after bathing with both methods, the increase was not statistically significant.	Future research needs to explore environmental temperature and bath water temperature)
10.	(Mohamed and Elashry, 2022),	QE (90 neonates)	Swaddling bath	Traditional bath	Physiological stability and comfort level	The study revealed that, after 10 minutes of	No author recommendations

Egypt

swaddling compared to traditional bathing there was less change between respiratory rate and total comfort score $r = - 0.319$ and p-value at 0.033

Study quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools for RCT and Quasi-Experimental studies.

Discussion

Results of a Study Review of Swaddle Bath Techniques for Premature Babies

A systematic review of ten primary studies involving 384 preterm infants (gestational age 28–37 weeks, birth weight 1200–2500 grams) showed that the swaddle bath method was consistently more effective in maintaining vital sign stability than conventional bathing. The average post-bath body temperature in the swaddle bath group was 36.8°C, significantly higher than the conventional bath group, which experienced a decrease to 36.4°C, approaching the threshold for mild hypothermia (Edraki et al., 2021; Rudhiati and Murtiningsih, 2022; Tambunan, 2024). In addition, heart rate and respiratory rate were also more stable, with an average of 165x/minute and 50.38x/minute respectively, showing a statistically significant difference (Huang et al., 2022; Mediani et al., 2022). Infant behavior during the bathing procedure, such as crying, hiccups, and tense facial expressions, are indicators of stress. This suggests that this method is not only physiologically effective but also supports the baby's emotional well-being (Mokhtari Naseri et al., 2021; Tambunan, 2024). Premature babies who are bathed using the swaddled bathing method experience lower levels of stress compared to those who are bathed traditionally (Huang et al., 2022). Bathing with swaddling has a stress-free effect on babies (Mokhtari Naseri et al., 2021). Based on the collected data, swaddle bathing can be categorized as an effective, transformative intervention in maintaining physiological homeostasis, reducing stress, and increasing the comfort of premature infants. These findings support the implementation of the swaddle bath technique as a standard of care in neonatal care practices oriented towards the principles of developmental and trauma-informed care (De Freitas et al., 2020; Mohamed and Elashry, 2022; Tambunan, 2024).

Effectiveness of Swaddle Bath in Preventing Neonatal Hypothermia

Hypothermia is a common complication in premature infants due to immaturity of the thermoregulatory system, a large body surface area to body weight ratio, and minimal subcutaneous fat. Swaddle baths have been shown to be effective in preventing excessive heat loss. Research by Erkut and Yildiz (2022), Studies have shown that swaddling creates a womb-like thermal environment, reducing heat loss through evaporation and convection. By maintaining body position and limiting limb movement, this technique reduces stress and energy expenditure, thereby helping to maintain a stable body temperature. Another study also reported that swaddling baths accelerate body temperature recovery after

environmental stressors such as bathing (Mokhtari Naseri et al., 2021). Thus, swaddling during bathing is a simple intervention that supports the physiological stability of premature babies.

Application of Swaddle Bath Positioning in Premature Baby Bathing Techniques

Swaddling a premature baby emphasizes not only the use of swaddling clothes during bathing, but also proper and stable body positioning to support comfort and physiological stability. Positioning techniques that maintain physiological flexion and midline position have been shown to reduce stress and support sensorimotor regulation, in accordance with the principles of developmental care (Franck et al., 2022). The baby's head is placed slightly higher than the body to support the airway to remain open (See figure 2).

The practice of swaddling involves swaddling the baby in a semi-flexed position and slowly immersing it in warm water up to the shoulders, with the head slightly elevated. Each part of the body is cleaned gradually without fully removing the swaddling cloth to minimize heat loss through evaporation (De Freitas et al., 2020). This approach reflects the principles of developmental care by promoting thermal regulation, reducing stress responses, and supporting infant comfort during bathing procedures. Proper positioning during swaddle bathing also helps infants adapt more smoothly to post-bath conditions and may contribute to better physiological regulation and behavioral stability (Mohamed & Elashry, 2022 ; Huang et al., 2022 ; Erkut and Yildiz, 2022; Kan onturk and Gozen, 2020). Based on a strong evidence base, this intervention is recommended as a standard practice in neonatal care, in line with the principles of developmental and trauma-informed care that are oriented towards the individual needs of the infant and are evidence-based.

Table 2. Implementation and Implementation of Swaddle Bathing

Implementation Instructions	Indications & Contraindications
- Wash your hands properly to prevent nosocomial infections (Tambunan, 2024) - Prepare bath water with a temperature of 37°C–38°C and a water depth of about 10 cm in the bathtub (De Freitas et al., 2020; Edraki et al., 2021). - Prepare the necessary tools such as a thin swaddling cloth, clean towel, cotton balls, warm water, clean clothes, and cream/lotion (Mohamed & Elashry, 2022). - Gently remove the baby's clothes and diaper and place the baby on a clean, flat surface (De Freitas et al., 2020). - Swaddle the baby in a thin cloth, in a physiologically flexed position. Place the baby's arms across the chest and wrap tightly, but not too tightly. The baby's head should remain exposed and uncovered (Huang et al., 2022; Rudhiati and Murtiningsih, 2022). - Gently clean your baby's body by uncovering one area at a time, then swaddling them again before moving on to the next area. Start at the head and work	Indication - Medically stable neonates, including premature and full-term infants. - Babies who require mild thermal or respiratory support. - Infants with mild physiological instability or high risk of thermoregulatory dysfunction
	Contraindications - There is a central intravenous line or sensitive medical equipment that is not water resistant (De Freitas et al., 2020). - Sensory hyperexcitability or extreme resistance to swaddling (Mokhtari Naseri et al., 2021; Franck et al., 2022). - Active skin infection or open wound (Mohamed and Elashry, 2022).

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- your way down (Mokhtari Naseri et al., 2021; Mohamed and Elashry, 2022).
- g. Clean your baby's face and eyes with a cotton ball soaked in warm water. Wipe from the inner corner to the outer corner (Edraki et al., 2021).
 - h. The recommended bath duration is no more than 8 minutes to prevent hypothermia (Edraki et al., 2021; Mediani et al., 2022).
 - i. After bathing, gently lift the baby, and leave the swaddling cloth on to maintain comfort and prevent heat loss (Paran et al., 2020; Erkut & Yildiz, 2022).
 - j. Place the baby in a warm bed, then immediately dry with a clean towel without rubbing too hard.
 - k. Gently pat the baby's body dry and make sure all parts are dry, especially the skin folds (De Freitas et al., 2020; Mohamed and Elashry, 2022).
 - l. Position the baby on his stomach for a moment, then apply cream or lotion as needed to keep the baby's skin moist (Kan Onturk and Gohzen, 2020).
 - m. Dress the baby in clean clothes and diapers, making sure the clothes are not too tight and the baby stays warm (Huang et al., 2022; Mediani et al., 2022).
 - n. Clean up the tools that have been used and wash your hands again.
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Figure 2. Swaddle Bath Technique
Source: The Royal Children's Hospital Melbourne, nd

Conclusion

The swaddle bath technique is consistently more effective than conventional bathing methods in maintaining physiological stability and reducing stress in premature infants. This method maintains body temperature, oxygen saturation, and

other vital signs, while minimizing crying and discomfort during the bathing procedure. As a simple and safe intervention, the swaddle bath supports the principles of developmental and atraumatic care, centered on infant comfort. With a strong evidence base, this intervention is worthy of recommendation as part of standard clinical practice for premature infant care. To optimize clinical implementation, further research is recommended exploring the ideal timing of implementation, its impact on sleep quality and mother-infant bonding, and the integration of this technique into routine, evidence-based NICU care protocols.

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