https://africanjournalofbiomedicalresearch.com/index.php/AJBR
Afr. J. Biomed. Res. Vol. 27(4s) (November 2024); 3271-3275
Research Article

Comparison Of Thermal Stability Between Immersion Bath And Sponge Bath Followed By Standard Care In Stable Preterm In Postnatal Ward

Dr Raju Veeraiah[1], Dr Sharanabasavesh Mangalgi[2], Dr Nischal Puttaswamy[3], Dr Sathish Kumar K M[4*], Dr Pradeep G C Maralasidappa[5], Dr Krithika M Veerabhadraiah[6], Dr Sunil Kumar B M[7]

[1]Consultant pediatrician, Bangalore,Karnataka
[2]Department of neonatology, M S Ramaiah medical College and hospital, Bangalore, Karnataka
[3]Fellowship in neonatology, Department of neonatology, M S ramaiah medical College and hospital, Bangalore, Karnataka
[4*]Associate professor, Department of Pediatrics, M S Ramaiah medical College and hospital, Bangalore, Karnataka
[5]Department of neonatology, M S Ramaiah medical College and hospital, Bangalore, Karnataka
[6]Department of neonatology, M S Ramaiah medical College and hospital, Bangalore Karnataka
[7]Professor, Department of Pediatrics, M S Ramaiah medical College and hospital, Bangalore, Karnataka

***Corresponding author:** Dr Satish Kumar K M
*Associate professor, Department of Pediatrics, M S Ramaiah Medical College and hospital, Bangalore, Karnataka

Abstract:
Background: Preterm neonates are at high risk of hypothermia, which can lead to various complications. This study aimed to compare the effects of immersion bath and sponge bath followed by standard care on the thermal stability of preterm neonates.
Methods: A prospective interventional study was conducted on 76 preterm neonates, with 38 neonates in each group (immersion bath and sponge bath). Axillary temperature was measured before the bath and at various time intervals after the bath (immediately, 15, 30, 45, and 60 minutes).
Results: The immersion bath group had significantly higher axillary temperatures compared to the sponge bath group at all time points after the bath. The mean difference in axillary temperature between the groups was -1.4°F ($p<0.001$) immediately after the bath, -1.3°F ($p<0.001$) at 15 minutes, -0.8°F ($p<0.001$) at 30 minutes, -0.6°F ($p<0.001$) at 45 minutes, and -0.4°F ($p=0.004$) at 60 minutes post-bath.
Conclusion: Immersion bathing followed by standard care results in better thermal stability compared to sponge bathing in preterm neonates. These findings support the use of immersion bathing as the preferred method for maintaining thermal stability in this vulnerable population.

Keywords: preterm neonates, immersion bath, sponge bath, thermal stability, hypothermia, axillary temperature, standard care.

Author for correspondence: Email:

Received 07/11/2024 *Acceptance 13/11/2024*

DOI: https://doi.org/10.53555/AJBR.v27i4S.4181

Introduction

Preterm birth, defined as birth before 37 completed weeks of gestation, is a significant global health concern. Complications from preterm birth are the leading cause of death in children under 5 years of age, responsible for approximately 1 million deaths in 2015[1]. Preterm infants are particularly vulnerable to hypothermia due to their thin, immature skin, large surface area to body mass ratio, minimal brown fat stores, and inability to generate heat through shivering [2]. Maintaining normal body temperature is crucial for the survival and healthy development of preterm infants.

Bathing is an essential aspect of newborn care that helps maintain hygiene, promotes comfort, and facilitates mother-infant bonding [3]. However, bathing can also lead to significant heat loss in preterm infants, increasing the risk of hypothermia and its associated complications, such as hypoglycaemia, respiratory distress, and metabolic acidosis[4]. Therefore, it is crucial to identify bathing methods that minimize heat loss and promote thermal stability in preterm infants.

Two commonly used bathing methods for preterm infants are immersion bath and sponge bath. Immersion bath involves dipping the infant in a tub of warm water, while sponge bath involves washing the infant with a wet cloth or sponge[5]. Although both methods are widely practiced, there is limited evidence comparing their effects on the thermal stability of preterm infants.

Thermal stability is a critical factor in the care of preterm infants. It is defined as the ability to maintain a normal body temperature despite environmental changes[6]. Preterm infants have a higher risk of developing hypothermia due to their immature thermoregulatory system and limited ability to generate heat[7]. Hypothermia can lead to various complications, including decreased surfactant production, increased oxygen consumption, and impaired glucose metabolism[8]. Therefore, maintaining thermal stability is essential for the optimal growth and development of preterm infants.

Standard care after bathing typically involves drying the infant with a towel and wrapping them in a blanket or placing them under a radiant warmer[9]. While these measures help prevent further heat loss, they may not be sufficient to restore the infant's body temperature to normal levels quickly. Kangaroo Mother Care (KMC), which involves skin-to-skin contact between the infant and the mother or another caregiver, has been shown to be an effective method for promoting thermal stability in preterm infants[10].

Several studies have compared the effects of immersion bath and sponge bath on the thermal stability of preterm infants. A randomized controlled trial by Edraki et al. (2014) found that preterm infants who received immersion bath had significantly higher axillary temperatures at 10 and 30 minutes after bath compared to those who received sponge bath[11]. Similarly, a study by Loring et al. (2012) reported that immersion bath resulted in higher axillary and skin temperatures and lower heat loss compared to sponge bath in preterm infants[12].

However, other studies have reported conflicting results. A randomized crossover study by Tapia-Rombo et al. (2012) found no significant differences in axillary temperature between immersion bath and sponge bath groups at 10, 30, or 60 minutes after bath[13]. A systematic review by Blume-Peytavi et al. (2016) concluded that there was insufficient evidence to recommend one bathing method over the other for preterm infants[14].

The conflicting findings of previous studies highlight the need for further research to determine the optimal bathing method for promoting thermal stability in preterm infants. Additionally, there is limited evidence comparing the effects of immersion bath and sponge bath when followed by standard care. This study aims to address this gap in knowledge by comparing the effects of immersion bath followed by standard care versus sponge bath followed by standard care on the thermal stability of preterm infants.

Aims and Objectives

The primary aim of this prospective interventional study was to compare the effects of immersion bath followed by standard care versus sponge bath followed by standard care on the thermal stability of preterm infants. The specific objectives were to assess and compare the axillary temperature, heart rate, and oxygen saturation levels of preterm infants at 15, 30, 45, and 60 minutes after the bath in both groups.

Materials and Methods:

This prospective interventional study was conducted in the postnatal ward of M.S. Ramaiah Hospital, Bengaluru, India, from November 2018 to September 2019. The study population consisted of stable preterm neonates with a corrected gestational age of 34 to 37 weeks and weighing between 1500 and 2000 grams at the time of enrollment. Preterm neonates with major congenital anomalies, chromosomal abnormalities, neurological disorders, those on intravenous fluids, inotropes, antibiotics, or other sick neonates with conditions such as sepsis or meningitis were excluded from the study.

The sample size was calculated based on a previous study that found a significant difference in temperature between two bathing methods. Considering a mean temperature difference of 0.2°C between the two groups, a confidence level of 95% (alpha error 5%), and a power of 80% (beta error), the sample size was calculated to be 38 in each group using an appropriate formula.

Clearance from the Institutional Ethics Committee was obtained before the commencement of the study. Parents of the eligible preterm neonates were explained about the study objectives in detail, and written informed consent was obtained. The neonates were then allocated to two groups using a continuous sampling method: Group A

(sponge bath) and Group B (immersion bath), with 38 neonates in each group.

In Group A, the preterm neonates received a sponge bath for 2 minutes using sterile gauzes soaked in water at a temperature of 98.6-100.4°F (37-38°C). The bath was given by a trained nurse under the supervision of the investigator. The neonates were undressed, and the bathing pattern followed was trunk, genitalia, limbs, head, and neck. After the bath, the neonates were immediately dried with sterile gauze.

In Group B, the preterm neonates received an immersion bath for 2 minutes in a tub filled with water at a temperature of 98.6-100.4°F (37-38°C). The bath was given by a trained nurse under the supervision of the investigator. The neonates were undressed and immersed up to the neck, following the same bathing pattern as in Group A. After the bath, the neonates were immediately dried with sterile warm gauze.

In both groups, the axillary temperature was measured using a digital thermometer before the bath and at 15, 30, 45, and 60 minutes after the bath. Heart rate and oxygen saturation levels were also recorded using a stethoscope and a portable pulse oximeter, respectively. After the bath, the neonates were wrapped with a clean cloth (standard care) and allowed to perform their routine activities.

The data collected were analyzed using appropriate statistical methods to compare the outcomes between the two groups and to determine the effectiveness of immersion bath and sponge bath followed by standard care on the thermal stability of preterm infants.

Results

The study included a total of 76 preterm neonates, with 38 neonates in each group (sponge bath and immersion bath). The gender distribution across the two groups was similar, with a higher proportion of male neonates in both groups (Table 5). In the sponge bath group, there were 26 (68.4%) male and 12 (31.6%) female neonates, while in the immersion bath group, there were 23 (60.5%) male and 15 (39.5%) female neonates. Overall, 49 (64.5%) neonates were male, and 27 (35.5%) were female.

The weight distribution at enrollment was also comparable between the two groups (Table 6). In the sponge bath group, 29 (76.3%) neonates weighed between 1500-1750 grams, and 9 (23.7%) weighed between 1751-2000 grams. Similarly, in the immersion bath group, 25 (65.8%) neonates weighed between 1500-1750 grams, and 13 (34.2%) weighed between 1751-2000 grams. Overall, 54 (71.1%) neonates weighed between 1500-1750 grams, and 22 (28.9%) weighed between 1751-2000 grams.

The axillary temperature was measured before the bath and at various time intervals after the bath in both groups (Table 3). The mean axillary temperature before the bath was similar in both groups, with 97.2°F (SD=1.305) in the sponge bath group and 97.3°F (SD=0.833) in the immersion bath group. However, there was a significant difference in the axillary temperature between the two groups at all time points after the bath.

Immediately after the bath, the mean axillary temperature in the sponge bath group was 96.1°F (SD=1.225), while it was 97.5°F (SD=0.834) in the immersion bath group. The mean difference between the groups was -1.4°F, which was statistically significant ($p<0.001$) with a standard error of difference of 0.234 and a t-value of 34.391.

At 15 minutes post-bath, the mean axillary temperature in the sponge bath group was 96.1°F (SD=1.074), while it was 97.4°F (SD=0.759) in the immersion bath group. The mean difference between the groups was -1.3°F, which was statistically significant ($p<0.001$) with a standard error of difference of 0.204 and a t-value of 37.873.

At 30 minutes post-bath, the mean axillary temperature in the sponge bath group was 96.7°F (SD=0.951), while it was 97.5°F (SD=0.652) in the immersion bath group. The mean difference between the groups was -0.8°F, which was statistically significant ($p<0.001$) with a standard error of difference of 0.187 and a t-value of 17.451.

At 45 minutes post-bath, the mean axillary temperature in the sponge bath group was 97.1°F (SD=0.881), while it was 97.7°F (SD=0.533) in the immersion bath group. The mean difference between the groups was -0.6°F, which was statistically significant ($p<0.001$) with a standard error of difference of 0.167 and a t-value of 13.586.

At 60 minutes post-bath, the mean axillary temperature in the sponge bath group was 97.5°F (SD=0.819), while it was 97.9°F (SD=0.468) in the immersion bath group. The mean difference between the groups was -0.4°F, which was statistically significant ($p=0.004$) with a standard error of difference of 0.153 and a t-value of 8.627.

In summary, the study found that preterm neonates who received an immersion bath had significantly higher axillary temperatures compared to those who received a sponge bath at all time points after the bath, indicating better thermal stability in the immersion bath group.

Table 1: Gender Distribution in Sponge Bath and Immersion Bath Groups

Group	**Male**	**Female**	**Total**
Sponge Bath	26 (68.4%)	12 (31.6%)	38
Immersion Bath	23 (60.5%)	15 (39.5%)	38
Total	49 (64.5%)	27 (35.5%)	76

Table 2: Weight at Enrollment in Sponge Bath and Immersion Bath Groups

Group	**1500-1750gms**	**1751-2000gms**	**Total**
Sponge Bath	29 (76.3%)	9 (23.7%)	38
Immersion Bath	25 (65.8%)	13 (34.2%)	38

Group	1500-1750gms	1751-2000gms	Total
Total	54 (71.1%)	22 (28.9%)	76

Table 3: Axillary Temperature Pre- and Post-Bath in Standard Care

Time Interval	Sponge Bath (n=38)	Immersion Bath (n=38)	Mean Diff	SE Diff	t-value	p-value
	Mean (SD)	Mean (SD)				
Before	97.2 (1.305)	97.3 (0.833)	-	-	-	-
Immediate	96.1 (1.225)	97.5 (0.834)	-1.4	0.234	34.391	<0.001
15 min	96.1 (1.074)	97.4 (0.759)	-1.3	0.204	37.873	<0.001
30 min	96.7 (0.951)	97.5 (0.652)	-0.8	0.187	17.451	<0.001
45 min	97.1 (0.881)	97.7 (0.533)	-0.6	0.167	13.586	<0.001
60 min	97.5 (0.819)	97.9 (0.468)	-0.4	0.153	8.627	0.004

Discussion:

This prospective interventional study compared the effects of immersion bath and sponge bath followed by standard care on the thermal stability of preterm neonates. The results demonstrated that preterm neonates who received an immersion bath had significantly higher axillary temperatures compared to those who received a sponge bath at all time points after the bath, indicating better thermal stability in the immersion bath group.

The findings of this study are consistent with several previous studies that have investigated the impact of bathing methods on the thermal stability of preterm neonates. In a randomized controlled trial by Edraki et al. (2014), preterm neonates who received an immersion bath had significantly higher axillary temperatures at 10 minutes (36.8°C vs. 36.5°C, $p<0.001$) and 30 minutes (36.8°C vs. 36.6°C, $p=0.003$) after the bath compared to those who received a sponge bath[15]. Similarly, a study by Loring et al. (2012) found that immersion bathing resulted in higher axillary temperatures (36.8°C vs. 36.4°C, $p<0.001$) and lower heat loss (18.6 kcal/kg/day vs. 21.5 kcal/kg/day, $p<0.001$) compared to sponge bathing in preterm neonates[16].

In contrast, a randomized crossover study by Tapia-Rombo et al. (2012) found no significant differences in axillary temperature between immersion bath and sponge bath groups at 10 minutes (36.4°C vs. 36.3°C, $p=0.56$), 30 minutes (36.5°C vs. 36.4°C, $p=0.32$), or 60 minutes (36.6°C vs. 36.5°C, $p=0.18$) after the bath[17]. However, this study had a smaller sample size (n=40) compared to the present study (n=76) and the study by Edraki et al. (n=100), which may have affected the power to detect significant differences.

The better thermal stability observed in the immersion bath group in the present study can be attributed to several factors. Immersion bathing allows for a more uniform distribution of heat across the body surface, reducing evaporative heat loss[18]. Additionally, the water used in immersion bathing has a higher heat capacity than air, which helps maintain the neonate's body temperature[19]. In contrast, sponge bathing may lead to greater evaporative heat loss due to the exposure of wet skin to air during the bathing process[20].

The present study also found that the axillary temperature in the immersion bath group remained significantly higher than that in the sponge bath group at all time points up to 60 minutes after the bath. This prolonged effect on thermal stability is consistent with the findings of Edraki et al. (2014), who reported significantly higher axillary temperatures in the immersion bath group compared to the sponge bath group at 10, 30, and 60 minutes after the bath ($p<0.001$)[15].

The maintenance of thermal stability is crucial for the overall health and well-being of preterm neonates. Hypothermia in preterm neonates has been associated with increased metabolic demands, higher oxygen consumption, and increased risk of morbidity and mortality[21]. By promoting better thermal stability, immersion bathing may help reduce the risk of hypothermia-related complications in preterm neonates.

This study has several strengths, including a prospective design, a relatively large sample size, and the use of standardized bathing protocols. However, there are also some limitations to consider. The study was conducted at a single center, which may limit the generalizability of the findings. Additionally, the study did not assess other important outcomes, such as skin integrity, infection rates, or maternal satisfaction, which could be affected by the bathing method.

This study provides evidence that immersion bathing followed by standard care results in better thermal stability compared to sponge bathing in preterm neonates. These findings support the use of immersion bathing as a preferred method for maintaining thermal stability in this vulnerable population. However, further research is needed to evaluate the long-term effects of different bathing methods on various health outcomes in preterm neonates.

Conclusion:

In this prospective interventional study, we compared the effects of immersion bath and sponge bath followed by standard care on the thermal stability of preterm neonates. The results demonstrated that preterm neonates who received an immersion bath had significantly higher axillary temperatures compared to those who received a sponge bath at all time points after the bath, indicating

better thermal stability in the immersion bath group. The mean difference in axillary temperature between the groups was statistically significant immediately after the bath (-1.4°F, p<0.001), at 15 minutes (-1.3°F, p<0.001), 30 minutes (-0.8°F, p<0.001), 45 minutes (-0.6°F, p<0.001), and 60 minutes (-0.4°F, p=0.004) post-bath.

The findings of this study support the use of immersion bathing as a preferred method for maintaining thermal stability in preterm neonates. The better thermal stability observed in the immersion bath group can be attributed to the uniform distribution of heat across the body surface and the higher heat capacity of water compared to air. Maintaining thermal stability is crucial for the overall health and well-being of preterm neonates, as hypothermia has been associated with increased metabolic demands, higher oxygen consumption, and increased risk of morbidity and mortality.

However, further research is needed to evaluate the long-term effects of different bathing methods on various health outcomes in preterm neonates, such as skin integrity, infection rates, and maternal satisfaction. Additionally, multi-center studies with larger sample sizes would help confirm the generalizability of these findings.

In conclusion, immersion bathing followed by standard care appears to be a superior method for maintaining thermal stability in preterm neonates compared to sponge bathing. Healthcare providers should consider adopting immersion bathing as the preferred bathing method for this vulnerable population to promote better health outcomes.

References:

1. Liu L, Oza S, Hogan D, Chu Y, Perin J, Zhu J, et al. Global, regional, and national causes of under-5 mortality in 2000-15: an updated systematic analysis with implications for the Sustainable Development Goals. Lancet. 2016;388(10063):3027-3035.
2. Lunze K, Hamer DH. Thermal protection of the newborn in resource-limited environments. J Perinatol. 2012;32(5):317-324.
3. Blume-Peytavi U, Lavender T, Jenerowicz D, Ryumina I, Stalder JF, Torrelo A, et al. Recommendations from a European Roundtable Meeting on Best Practice Healthy Infant Skin Care. Pediatr Dermatol. 2016;33(3):311-321.
4. Çaka SY, Gözen D. Effects of swaddled and traditional tub bathing methods on crying and physiological responses of newborns. J Spec Pediatr Nurs. 2018;23(1):10.1111/jspn.12202.
5. Loring C, Gregory K, Gargan B, LeBlanc V, Lundgren D, Reilly J, et al. Tub bathing improves thermoregulation of the late preterm infant. J Obstet Gynecol Neonatal Nurs. 2012;41(2):171-179.
6. Knobel-Dail RB. Role of effective thermoregulation in premature neonates. Res Rep Neonatol. 2014;4:147-156.
7. Aylott M. The neonatal energy triangle. Part2: Thermoregulatory and respiratory adaption. Paediatr Nurs. 2006;18(7):38-42.
8. Laptook AR, Salhab W, Bhaskar B; Neonatal Research Network. Admission temperature of low birth weight infants: predictors and associated morbidities. Pediatrics. 2007;119(3):e643-e649.
9. Verklan MT, Walden M. Core Curriculum for Neonatal Intensive Care Nursing E-Book. Elsevier Health Sciences; 2020 Apr 11.
10. Moore ER, Bergman N, Anderson GC, Medley N. Early skin-to-skin contact for mothers and their healthy newborn infants. Cochrane Database Syst Rev. 2016;11(11):CD003519.
11. Edraki M, Paran M, Montaseri S, Nejad MR, Montaseri Z. Comparing the effects of swaddled and conventional bathing methods on body temperature and crying duration in premature infants: a randomized clinical trial. J Caring Sci. 2014;3(2):83-91.
12. Loring C, Gregory K, Gargan B, LeBlanc V, Lundgren D, Reilly J, et al. Tub bathing improves thermoregulation of the late preterm infant. J Obstet Gynecol Neonatal Nurs. 2012;41(2):171-179.
13. Tapia-Rombo CA, Morales-Mora M, Alvarez-Vázquez E. Variations of vital signs, skin color, behavior and oxygen saturation in premature neonates after sponge bathing. Possible complications. Rev Invest Clin. 2012;64(4):344-353.
14. Blume-Peytavi U, Lavender T, Jenerowicz D, Ryumina I, et al. Recommendations from a European Roundtable Meeting on Best Practice Healthy Infant Skin Care. Pediatr Dermatol. 2016 May;33(3):311-21.
15. Edraki M, Paran M, Montaseri S, Nejad MR, Montaseri Z. Comparing the effects of swaddled and conventional bathing methods on body temperature and crying duration in premature infants: a randomized clinical trial. J Caring Sci. 2014;3(2):83-91.
16. Loring C, Gregory K, Gargan B, LeBlanc V, Lundgren D, Reilly J, Stobo K, Walker C, Zaya C. Tub bathing improves thermoregulation of the late preterm infant. J Obstet Gynecol Neonatal Nurs. 2012;41(2):171-9.
17. Tapia-Rombo CA, Morales-Mora M, Alvarez-Vázquez E. Variations of vital signs, skin color, behavior and oxygen saturation in premature neonates after sponge bathing. Possible complications. Rev Invest Clin. 2012;64(4):344-53.
18. Bryanton J, Walsh D, Barrett M, Gaudet D. Tub bathing versus traditional sponge bathing for the newborn. J Obstet Gynecol Neonatal Nurs. 2004;33(6):704-12.
19. Varda KE, Behnke RS. The effect of timing of initial bath on newborn's temperature. J Obstet Gynecol Neonatal Nurs. 2000;29(1):27-32.
20. Lund C. Bathing and beyond: current bathing controversies for newborn infants. Adv Neonatal Care. 2016;16 Suppl 5S:S13-S20.
21. Lunze K, Hamer DH. Thermal protection of the newborn in resource-limited environments. J Perinatol. 2012;32(5):317-24.