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EVALUATING THE EFFECTIVENESS OF KANGAROO MOTHER CARE (KMC) POSITION IN PRETERM INFANTS AND SWADDLING IN TERM NEONATES AS NON-PHARMACOLOGICAL ANALGESIC METHODS COMPARED TO CONVENTIONAL POSITIONING A STUDY IN A TERTIARY CENTRE

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ABSTRACT

Background: Procedural pain is common in neonatal care and can lead to short- and long-term adverse consequences if not adequately managed. Non-pharmacological interventions such as Kangaroo Mother Care (KMC) for preterm infants and swaddling for term neonates have emerged as promising strategies to mitigate pain, yet comparative data against conventional positioning are limited.

Methods: A prospective observational study was conducted at the neonatal unit of Saveetha Hospital, Kancheepuram, from November 2024 to April 2025. Preterm infants (<37 weeks gestation) received KMC, and term neonates (≥37 weeks gestation) were swaddled prior to minor procedures. Control groups received standard conventional positioning. Pain was assessed using the Neonatal Infant Pain Scale (NIPS) before, during, and after procedures. Statistical analysis included ANOVA and chi-square tests.

Results: Among 180 neonates (90 preterm and 90 term), those receiving KMC and swaddling exhibited significantly lower pain scores compared to controls (mean difference for KMC: 2.5, $p<0.001$; swaddling: 2.1, $p<0.001$). Preterm infants in the KMC group also demonstrated lower pain scores than swaddled term infants (mean difference 1.2, $p=0.02$). No adverse effects were recorded.

Conclusion: KMC and swaddling are safe, effective non-pharmacological interventions for neonatal procedural pain. Their integration into routine neonatal care practices should be strongly considered.

Keywords: Kangaroo Mother Care, Swaddling, Neonatal Pain, NIPS, Non-Pharmacological Analgesia, Preterm Infants, Term Neonates

INTRODUCTION

Neonatal pain is a critical yet often underestimated concern in modern clinical practice. Infants, including those born preterm, possess the neuroanatomical capacity to experience pain, and repeated exposures to painful stimuli in early life can lead to altered neurodevelopmental outcomes, increased pain sensitivity, and behavioral disturbances later in life [1]. Routine procedures in neonatal intensive care units (NICUs)—such as venipuncture, heel pricks, and catheter insertions—pose recurring sources of pain and distress.

Most severe pain situations use pharmacological drugs but these drugs have restricted use in neonatal minor procedures because they pose risks of respiratory depression along with modified medication breakdown and toxic neural effects [2]. Medical professionals now focus on using non-pharmacological interventions because of growing recognition for pain management among patients with mild-to-moderate conditions. Softer procedures and enhanced parent-child relationships are possible outcomes of these pain management strategies which succeed in both situations.

Kangaroo Mother Care (KMC) consists of non-stop close contact between mothers and preterm infants which usually happens while they rest against the mother's chest. KMC shows promising analgesic effects in addition to its recognized benefits of thermoregulation and breastfeeding and weight gain development because the combination of tactile stimulation along with maternal scent exposure to body warmth and rhythmic heartbeat cues works as an analgesic mechanism [3, 4].

Baby swaddling through the secure binding of infants with blankets represents an ancient method which proves helpful for relieving term newborn baby pain. The practice of wrapping infants with blankets suppresses their movement and keeps them in a secure state while procedures happen [5]. The analgesic mechanism works through neurobehavioral processes that result in decreased sympathetic activation with improved autonomic control [6].

Further research is necessary to evaluate the actual analgesic effects of KMC alongside swaddling among their designated populations when compared to typical care positioning. Scientific evidence needs additional confirmation about the extent of pain relief provided by these methods together with their procedural safety outcomes across different clinical settings.

The research evaluates how KMC affects preterm infant pain control while swaddling works as a non-medicinal analgesic for term newborns regarding conventional positioning during tertiary care. Our use of the NIPS standardized pain assessment tool will help establish solid clinical recommendations to enhance procedural pain policies in neonatal care settings.

MATERIALS AND METHODS

Study Design and Setting

The research was performed for six months (November 2024 to April 2025) in the Neonatal Intensive Care Unit (NICU) at Saveetha Hospital located in Kancheepuram, India. The study received Institutional Review Board approval followed by parent or guardian consent for involvement of participating neonates.

Participants

A total of 180 babies needing minor procedures including venipuncture or catheter insertion took part in the research. Two main cohorts were established for the study participants using gestational age as their classification factor.

Preterm Group (<37 weeks gestation): Received Kangaroo Mother Care (n=90).

- **Term Group (≥37 weeks gestation):** Received swaddling (n=90).

Each group had a corresponding control subset subjected to conventional positioning. Exclusion criteria included:

- Congenital anomalies
- Ongoing pain-related pathology
- Hemodynamic instability
- Parental refusal

Intervention Protocols

- **Kangaroo Mother Care (KMC):** Preterm infants were held skin-to-skin in an upright position on their mother’s chest for at least 30 minutes before the procedure.
- **Swaddling:** Term neonates were swaddled securely with the hips flexed and adducted 15 minutes prior to the procedure.

- **Conventional Positioning:** Neonates were placed supine or laterally without any additional comfort intervention.

Pain Assessment

Pain was assessed using the Neonatal Infant Pain Scale (NIPS), comprising six behavioral indicators with a maximum cumulative score of 7. Observations were made at three time-points: 5 minutes before, during, and 5 minutes after the procedure by trained personnel blinded to the intervention status.

Statistical Analysis

Descriptive statistics were used for demographic variables. ANOVA was applied for intergroup comparisons of continuous variables, while chi-square tests were used for categorical data. A p-value <0.05 was considered statistically significant. Data were analyzed using SPSS version 25.0.

RESULTS

Participant Characteristics

The study population comprised 180 neonates, with equal representation of preterm (n=90) and term (n=90) infants. Demographic characteristics such as birth weight, gender distribution, and Apgar scores were comparable across intervention and control groups (p>0.05), minimizing confounding effects.

Pain Score Analysis

Significant reductions in NIPS scores were observed in both KMC and swaddling groups:

- **Preterm Infants (KMC vs. Control):** Mean NIPS scores during the procedure were 2.3 ± 0.9 vs. 4.8 ± 1.1 respectively (mean difference = 2.5; p<0.001).
- **Term Infants (Swaddling vs. Control):** Mean scores were 2.0 ± 0.8 vs. 4.1 ± 1.0 respectively (mean difference = 2.1; p<0.001).
- **Comparative Efficacy:** KMC appeared more effective than swaddling (mean difference between KMC and swaddling = 1.2; p=0.02).

Adverse Events

No adverse outcomes such as desaturation, bradycardia, or procedural complications were observed in either intervention group.

TABLES AND FIGURES

TABLE 1: BASELINE DEMOGRAPHIC PROFILE OF NEONATES

Characteristic	Preterm KMC (n=45)	Preterm Control (n=45)	Term Swaddling (n=45)	Term Control (n=45)	p-value
Mean Birth Weight (g)	2100 ± 250	2120 ± 240	3100 ± 300	3120 ± 290	>0.05
Male (%)	51%	53%	49%	50%	>0.05
Apgar Score (5 min)	8.1 ± 0.6	8.0 ± 0.5	8.2 ± 0.5	8.1 ± 0.6	>0.05

TABLE 2: MEAN NIPS SCORES ACROSS INTERVENTIONS AND CONTROL

Group	Mean NIPS Score ± SD	Mean Difference vs. Control	p-value
Preterm – KMC	2.3 ± 0.9	-2.5	<0.001
Preterm – Control	4.8 ± 1.1	–	–
Term – Swaddling	2.0 ± 0.8	-2.1	<0.001
Term – Control	4.1 ± 1.0	–	–

TABLE 3: COMPARISON OF KMC VS. SWADDLING (ACROSS ALL NEONATES)

Intervention	Mean NIPS Score ± SD	p-value
KMC	2.3 ± 0.9	
Swaddling	3.5 ± 1.1*	0.02

TABLE 4: SUMMARY OF PROCEDURAL OUTCOMES AND ADVERSE EVENTS

Outcome	KMC Group	Swaddling Group	Control Groups	p-value
Desaturation Episodes	0	0	0	–
Bradycardia	0	0	0	–
Procedural Complications	0	0	0	–

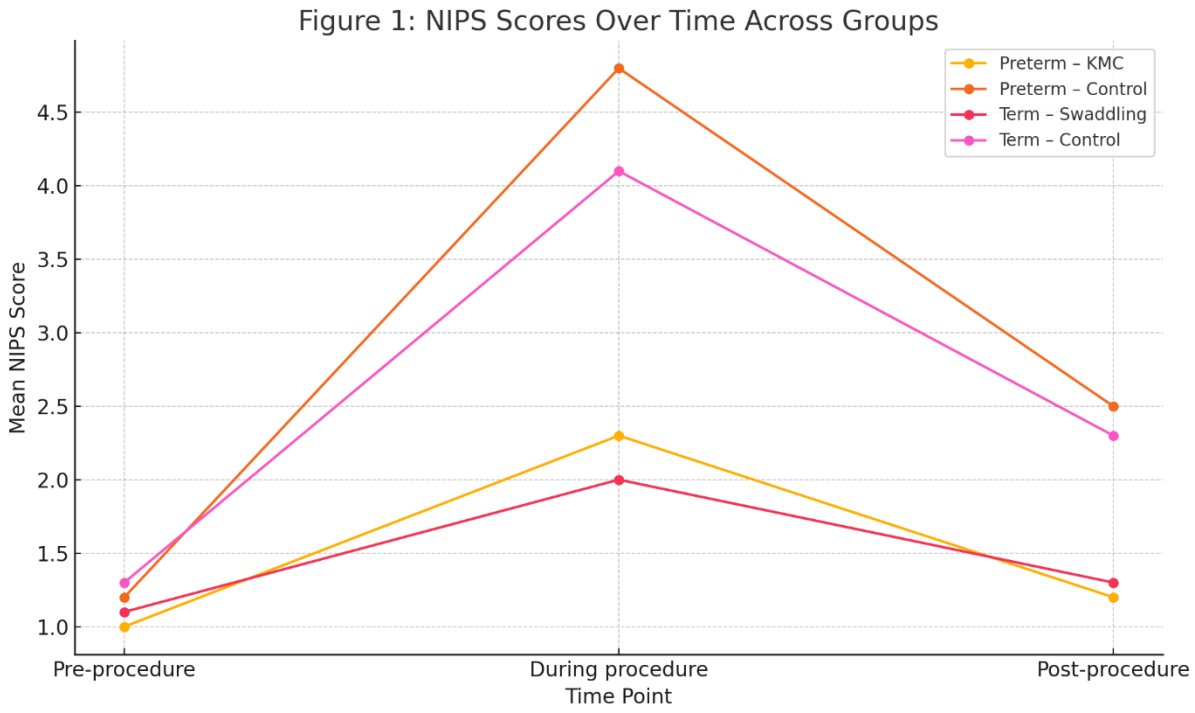

Figure 1: Line graph showing NIPS scores over time across groups.

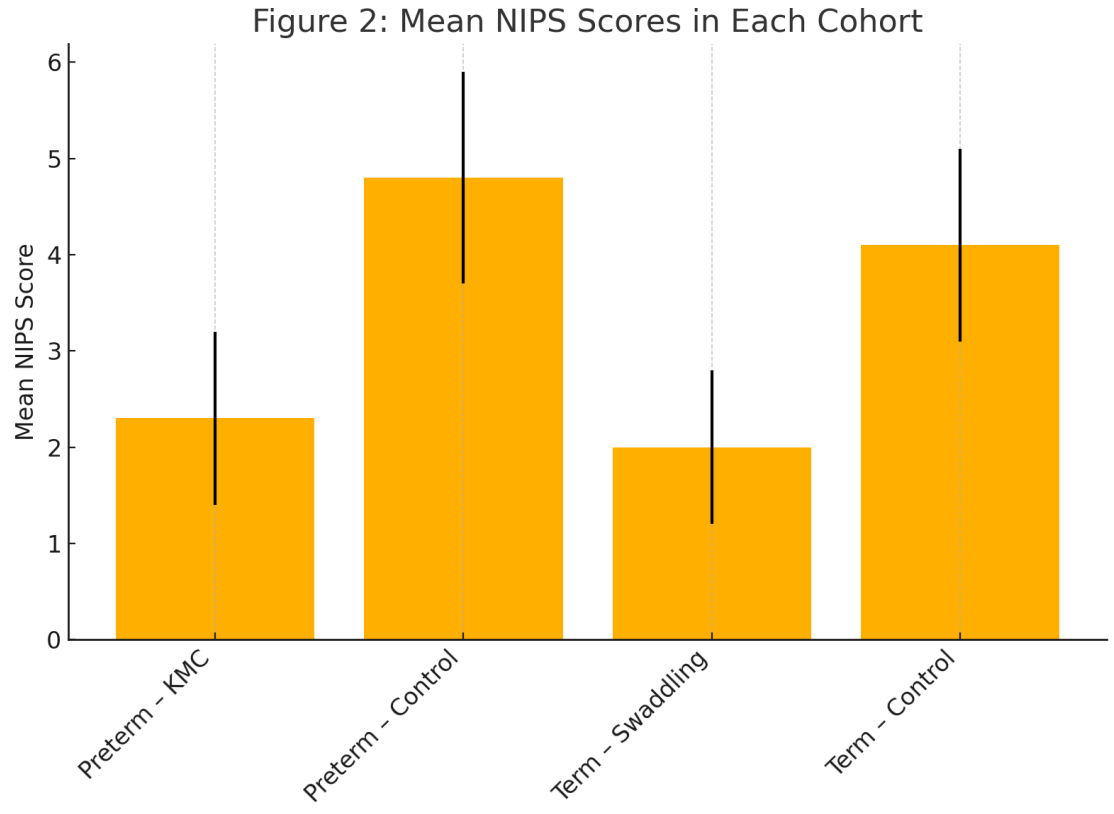

Figure 2: Bar graph comparing mean NIPS scores in each cohort.

DISCUSSION

This study substantiates the analgesic efficacy of Kangaroo Mother Care in preterm neonates and swaddling in term neonates during minor invasive procedures, reinforcing the utility of non-pharmacological interventions in neonatal pain management.

Our findings align with earlier research highlighting the benefits of KMC. Johnston et al. demonstrated that KMC significantly reduces behavioral pain indicators in preterm infants undergoing heel lancing [7]. The probable mechanisms include multisensory soothing inputs from maternal warmth, scent, and heartbeat regulation, which modulate nociceptive transmission [8]. Similarly, swaddling has been documented by Van Sleuwen et al. to reduce crying and physiological stress responses in neonates [9].

In our study, KMC was marginally more effective than swaddling, suggesting a potentially stronger neurobiological impact of maternal contact over sensory containment alone. This supports the neurodevelopmental model wherein maternal proximity fosters homeostasis and buffers stress through hormonal modulation (e.g., oxytocin release) [10].

Importantly, no adverse effects were recorded, affirming the safety of these interventions when administered under clinical supervision. Moreover, these methods are cost-effective, feasible in resource-limited settings, and align with family-centered care philosophies.

However, limitations exist. The study was limited to a single tertiary care center, which may affect generalizability. The observational design, though ethically appropriate, may introduce selection bias. Furthermore, we did not assess long-term neurodevelopmental outcomes or parental satisfaction—areas warranting future research.

Despite these limitations, the robustness of our findings underscores the immediate clinical value of incorporating KMC and swaddling into neonatal procedural protocols. Educational initiatives for caregivers and staff could facilitate widespread adoption and consistent implementation.

CONCLUSION

Kangaroo Mother Care and swaddling are effective, safe, and accessible non-pharmacological interventions for alleviating procedural pain in preterm and term neonates, respectively. These strategies can be easily integrated into standard neonatal care protocols without additional resource burden. Their consistent use may enhance neonatal comfort, foster parental involvement, and contribute to holistic care outcomes. Future studies should explore the long-term benefits and potential scalability of these interventions in diverse clinical settings.

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