

Original Research Article

Effectiveness of breastfeeding on pain level during heel prick among neonates: a true experimental study

Vinita Pandey^{1*}, Diksha Bahuguna², Shikha Pal³, Mehvish Khalid⁴, Sonia Sharma²

¹Department of Community Health Nursing, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

²Department of Mental health Nursing, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

³Clinical Instructor, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

⁴Department of OBG, Dev Bhoomi Uttarakhand University, Dehradun, Uttarakhand, India

Received: 29 April 2026

Accepted: 08 June 2026

*Correspondence:

Dr. Vinita Pandey,

E-mail: vinivcon@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Heel prick is the most common painful procedure performed on healthy term neonates. Repeated untreated procedural pain in the neonatal period is associated with long-term adverse neurodevelopmental outcomes and altered pain thresholds. Breastfeeding is a well-established non-pharmacological analgesic, yet remains underutilized in Indian hospital settings. This study aimed to assess the effectiveness of breastfeeding on pain during heel prick among healthy term neonates.

Methods: A true experimental post-test only design was employed. Sixty healthy term neonates (gestational age 37–42 weeks, postnatal age 0–5 days, birth weight ≥ 2500 g) admitted to the postnatal ward of Civil Hospital, Dehradun, India, were randomly allocated to an experimental group (n=30) receiving breastfeeding during heel prick and a control group (n=30) receiving routine care. Pain was assessed using the validated Neonatal Infant Pain Scale (NIPS).

Results: The mean NIPS score was significantly lower in the experimental group (2.03 ± 0.809) compared to the control group (5.80 ± 1.095 ; $t=15.152$, $p<0.001$). In the experimental group, 73.3% of neonates experienced mild-to-no pain and none experienced severe pain, whereas 86.7% of controls experienced severe pain. A statistically significant association was observed between sex and pain level ($\chi^2=6.140$, $p=0.046$).

Conclusions: Breastfeeding is a highly effective, safe and cost-free non-pharmacological analgesic for procedural pain in healthy term neonates. Breastfeeding analgesia should be formally integrated into neonatal pain management protocols in Indian hospitals, with structured nursing training to support implementation.

Keywords: Breastfeeding, Heel prick, Neonatal pain, Neonatal infant pain scale, Non-pharmacological analgesia, Newborn, Procedural pain

INTRODUCTION

Neonates routinely undergo painful procedures during hospital admission, with heel prick blood sampling being the most frequent.

Despite its seemingly minor nature, this procedure causes measurable acute pain, evidenced by increased heart rate, prolonged crying, facial grimacing and decreased oxygen saturation. Contrary to historical misconceptions,

neonates possess well-developed nociceptive pathways and may exhibit heightened pain sensitivity compared to older infants.¹ Repeated untreated procedural pain in the neonatal period is associated with long-term adverse neurodevelopmental outcomes, altered pain thresholds and behavioral changes.²

Non-pharmacological interventions are preferred for minor procedures given their safety profile. Among these, breastfeeding has emerged as particularly effective,

working through a combination of skin-to-skin contact, suckling, the sweetness of breast milk and olfactory-based mother–infant bonding that activates endogenous opioid systems and inhibits nociceptive transmission via gate control theory.^{3,4} Despite an established evidence base, breastfeeding analgesia remains underutilized in Indian neonatal care settings.

The present study was therefore undertaken to rigorously evaluate its effectiveness using a true experimental design, with the objective of determining the effect of breastfeeding on pain level during heel prick among healthy term neonates, as measured by the validated neonatal infant pain scale (NIPS).

METHODS

Study design and setting

This true experimental post-test only study was conducted in the postnatal ward of Civil Hospital, District Dehradun, Uttarakhand, India, in July–August 2021.

The hospital serves as a primary referral facility for the district and provides routine neonatal care including metabolic screening via heel prick blood sampling.

Study population and eligibility criteria

Healthy term neonates of gestational age 37–42 weeks, postnatal age 0–5 days and birth weight ≥ 2500 g undergoing routine heel prick blood sampling were eligible for inclusion.

Critically ill neonates and those whose mothers declined to participate or were unable to breastfeed were excluded. A total of 60 neonates were recruited and randomly allocated by the even-odd method to the experimental group (n=30) or the control group (n=30).

Intervention

In the experimental group, breastfeeding was initiated 1–2 min before the heel prick procedure and continued throughout. The mother held the neonate in a standard breastfeeding position with full skin contact. In the control group, no analgesic intervention was provided and the heel prick was performed according to routine ward practice.

Pain assessment

Pain was assessed immediately during the procedure using the NIPS, a validated seven-item behavioral scale evaluating facial expression, cry, breathing pattern, arm movements, leg movements and state of arousal.

Total scores range from 0 to 7, classified as: mild to no pain (0–2), mild to moderate pain (3–4) and severe pain (>4). The scale demonstrated high reliability ($r=0.86$) and

content validity was confirmed by nine subject-matter experts.

Statistical analysis

Data were analyzed using SPSS version 22.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as frequencies, percentages, means and standard deviations. Homogeneity between groups was assessed using chi-square tests.

An unpaired t-test was used to compare mean NIPS scores between the experimental and control groups. Chi-square analysis was performed to determine the association between socio-demographic variables and pain level. A p value of <0.05 was considered statistically significant.

Ethical considerations

Ethical clearance was obtained from the Institutional Research and Ethics Committee of the affiliated nursing college prior to data collection. Written informed consent was obtained from parents or guardians of all participant neonates. Confidentiality of participant data was maintained throughout the study.

RESULTS

Baseline characteristics

The two groups were homogeneous with respect to neonatal age, sex, mode of delivery and staff qualification (all $p>0.05$), confirming comparability at baseline. The socio-demographic profile of the study participants is presented in Table 1.

Pain level comparison between groups

In the experimental group, 22 (73.3%) neonates experienced mild-to-no pain (NIPS score 0–2) and none experienced severe pain (NIPS >4).

In contrast, 26 (86.7%) control group neonates experienced severe pain and none had mild-to-no pain. The mean NIPS score was significantly lower in the experimental group (2.03 ± 0.809) compared to the control group (5.80 ± 1.095 ; $t=15.152$, $p<0.001$), confirming the analgesic effectiveness of breastfeeding (Table 2).

Association between socio-demographic variables and pain level

Chi-square analysis revealed a significant association between sex and pain level ($\chi^2=6.140$, $df=2$, $p=0.046$). Male neonates exhibited higher rates of severe pain (50.0%) while female neonates had a higher proportion of moderate pain (34.6%). No significant associations were identified for neonatal age, mode of delivery or staff qualification (Table 3).

Table 1: Socio-demographic profile of study participants (n=60).

Variables	Experimental (n=30) N (%)	Control (n=30) N (%)
Age (in days)		
1	12 (40.0)	14 (46.7)
2	11 (36.7)	10 (33.3)
3	5 (16.7)	6 (20.0)
4	2 (6.7)	0 (0.0)
Sex		
Male	17 (56.7)	17 (56.7)
Female	13 (43.3)	13 (43.3)
Mode of delivery		
Vaginal	20 (66.7)	18 (60.0)
Caesarean section	10 (33.3)	12 (40.0)

NS=not significant.

Table 2: Comparison of pain levels and mean NIPS scores between the experimental and control groups (n=60).

Pain levels (NIPS)	Score	N	Experimental n (%)	Control N (%)
Mild to no pain	0–2	22	22 (73.3)	0 (0.0)
Mild to moderate pain	3–4	12	8 (26.7)	4 (13.3)
Severe pain	>4	26	0 (0.0)	26 (86.7)
Mean±SD			2.03±0.809	5.80±1.095

*** p<0.001.

Table 3: Association between pain level and selected socio-demographic variables (n=60).

Variables	Severe pain N (%)	Moderate pain N (%)	Mild/No pain N (%)	χ^2 , df, p value
Sex				
Male (n=34)	17 (50.0)	3 (8.8)	14 (41.2)	$\chi^2=6.140$ df=2, p=0.046*
Female (n=26)	9 (34.6)	9 (34.6)	8 (30.8)	
Age of Neonate (days)	—	—	—	p=0.543 (NS)
Mode of Delivery	—	—	—	p=0.552 (NS)
Staff Qualification	—	—	—	p=0.734 (NS)

*p<0.05, NS=not significant, χ^2 =chi-square, df=degrees of freedom.

DISCUSSION

This study demonstrated a dramatic reduction in procedural pain with breastfeeding during heel prick. The mean NIPS score was 65.0% lower in the breastfed group (2.03±0.809 vs. 5.80±1.095), with none experiencing severe pain compared to 86.7% in controls (p<0.001). These findings are consistent with a robust international evidence base supporting breastfeeding as an effective non-pharmacological analgesic in neonates. Gray et al reported a 91% reduction in crying and an 84% reduction in grimacing in breastfed neonates during heel lance, closely paralleling our finding of zero severe pain in the experimental group.⁵ Carbajal et al demonstrated breastfeeding's superiority over glucose-plus-pacifier (p<0.0001) in a 180-neonate randomized controlled trial.⁶ Simalti and Singh and Behl et al, both confirmed breastfeeding's superior analgesic effect over 25% oral dextrose and non-nutritive sucking in Indian settings, directly supporting the applicability of our findings to the Indian context.^{7,8}

The analgesic mechanism is explained by gate control theory (Melzack and Wall, 1965): multisensory stimuli during breastfeeding warmth, suckling, sweetness of milk, skin contact and olfactory cues activate large-diameter afferent fibers that inhibit ascending nociceptive signals at the spinal dorsal horn.^{4,9} The significant sex-based association warrants further investigation; neurological and behavioral differences in pain expression may underlie the higher rates of severe pain observed in male neonates.

This study has several limitations. The sample size was relatively small (n=60), which may limit the generalizability of findings. The study was conducted in a single center and the post-test only design precludes pre-intervention baseline pain comparisons. Microbiological or hormonal correlates of the analgesic effect were not assessed. Future multicenter randomized controlled trials with larger samples and objective physiological markers of pain response are warranted to consolidate these findings.

CONCLUSION

Breastfeeding is a highly effective, safe, cost-free and easily implementable non-pharmacological analgesic for healthy term neonates undergoing heel prick blood sampling. The results of this true experimental study demonstrate a statistically significant and clinically meaningful reduction in procedural pain, as measured by the NIPS, in breastfed neonates. Breastfeeding analgesia should be formally incorporated into neonatal pain management protocols in Indian hospitals. Nurses should receive structured training in breastfeeding analgesia as an evidence-based independent nursing function.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Hall RW, Anand KJS. Pain management in newborns. Clin Perinatol. 2014;41:895–924.
2. Anand KJS, Carr DB. The neuroanatomy, neurophysiology and neurochemistry of pain, stress and analgesia in newborns and children. Pediatr Clin North Am. 1989;36:795–822.
3. Shah PS, Herbozo C, Aliwalas LL. Breastfeeding or breast milk for procedural pain in neonates. Cochrane Database Syst Rev. 2012;11:4950.
4. Melzack R, Wall PD. Pain mechanisms: a new theory. Science. 1965;150:971–9.
5. Gray L, Miller LW, Philipp BL. Breastfeeding is analgesic in healthy newborns. Pediat. 2002;109:590–3.
6. Carbajal R, Veerapen S, Couderc S. Analgesic effect of breast feeding in term neonates: randomised controlled trial. BMJ. 2003;326:13.
7. Simalti AK, Singh RK. Breast feeding as analgesia in neonates: a randomized controlled trial. Med J Armed Forces India. 2016;72:268–72.
8. Behl A, Singh G, Makkar JK. Comparative study of analgesic effect of breast feeding versus dextrose during heel lance in neonates. Int J Pediatr Nurs. 2017;1:129–35.
9. Uga E, Candriella M, Perino A. Heel lance in newborn during breastfeeding: an evaluation of analgesic effect. Ital J Pediatr. 2008;34:5673.
10. Diler A, Sevil I. Effects of breastfeeding and heel warming on pain levels during heel stick in neonates. Int J Nurs Pract. 2019;25:12706.

Cite this article as: Pandey V, Bahuguna D, Pal S, Khalid M, Sharma S. Effectiveness of breastfeeding on pain level during heel prick among neonates: a true experimental study. Int J Contemp Pediatr 2026;13:1410-3.