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Assessing The Effectiveness Of Breastfeeding For Pain Relief In Infants During Vaccination In South India

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Abstract

Background:

Pain during vaccination is a significant concern in infant care, impacting not only the infant's immediate comfort but also long-term behavioral and physiological responses. Although behavioral scales such as the Modified Behavioral Pain Scale (MBPS) are widely used, objective physiological markers such as heart rate, oxygen saturation (SpO_2), and duration of crying offer additional insight into the effectiveness of non-pharmacological pain interventions. Breastfeeding, a natural and accessible method, has been shown to provide comfort during painful procedures, yet its physiological impact during routine immunization remains underexplored in the Indian setting.

Aim:

To assess the effectiveness of breastfeeding in reducing procedural pain in infants during vaccination using MBPS, and to evaluate its impact on physiological parameters such as heart rate, SpO_2, and crying duration.

Methods:

This quasi-experimental trial was carried out over a span of six months in Shri Sathya Sai Medical College and Research Institute, SBV Chennai Campus. 60 infants between the age of 6 weeks and 6 months were recruited and equally divided into two groups. The experimental group babies were breastfed during vaccination, and the control group babies did not receive such an intervention. Pain was measured with the MBPS, and physiological measures—post-vaccination heart rate, SpO_2, and crying time—were measured immediately after injection. Statistical analysis was done using independent t-tests, and p-values < 0.05 were considered significant.

Results:

The mean MBPS score was much lower in the lactation group (2.03 ± 1.39) than in the control group (6.20 ± 1.85; $p < 0.001$). Moreover, the breast-fed group showed less crying duration (mean 23.2 ± 8.5 sec vs. 67.4 ± 15.9 sec; $p < 0.001$), steadier heart rates (mean 131.4 ± 7.2 bpm vs. 145.8 ± 8.6 bpm; $p < 0.001$), and sustained post-procedure SpO_2 levels ($97.6 \pm 1.1\%$ vs. $94.3 \pm 1.4\%$; $p < 0.001$). These results indicate that breastfeeding not only decreases behavioral responses to pain but also dampens physiological stress of immunization.

Conclusion:

Breastfeeding is an effective, safe, and holistic non-pharmacologic measure for diminishing pain and related physiological stress in infants at the time of vaccination. Breastfeeding considerably reduces behavioral pain scores, duration of crying, and cardiovascular stress but maintains oxygen saturation. Routine immunization practices should incorporate breastfeeding for increasing procedural comfort and satisfaction of caregivers.

Keywords:

Breastfeeding, Infant Pain, Vaccination, MBPS, Crying Duration, Heart Rate, Spo_2, Non-Pharmacological Analgesia, Procedural Stress

INTRODUCTION

Vaccination remains a pillar of child preventive medicine, having a tremendous impact on infant morbidity and mortality globally. Though clinically beneficial, the pain associated with vaccine administration can be concerning to both infants and caregivers, occasionally extending to harmful health behaviors like vaccine hesitancy and avoidance of medical procedures later in life [1]. Painful events in the early weeks of infancy, particularly if not managed, have been revealed to shape pain perception, stress reaction, and long-term neurobehavioral development [2]. Safe and effective pain reduction interventions are vital in this age group, especially since the regular use of pharmacological interventions is restricted secondary to safety issues and logistical challenges [3].Non-pharmacological strategies like breastfeeding, skin-to-skin contact, oral sucrose, and distraction maneuvers have proven to be effective and safe means of procedural pain management in neonates and infants. Of these, breastfeeding has special benefits by incorporating orogustatory stimulation, warmth, and maternal contact—mechanisms responsible for the release of endogenous opioids and the induction of relaxation in the infant [4]. Breastfeeding has also been found to cut down on pain-related behaviors including crying, grimacing, and restlessness that occur during less invasive procedures like immunizations, heel pricks, and venipunctures [5].Over the past decade, standardized behavioral pain assessment scales like the Modified Behavioral Pain Scale (MBPS) have gained popularity in the assessment of procedural pain in infants. The MBPS evaluates facial expression, crying, and body movements and offers an objective score to measure the severity of pain [6]. Nevertheless, it is possible that behavioral scores will not accurately assess the physiological effect of pain and stress in infants. To overcome this shortcoming, various studies have included other physiological measures—i.e., alteration in heart rate, oxygen saturation (SpO_2), and crying time—as adjunct markers of pain response [7]. These objective indices reflect a better picture of the response of the infant to painful stimulation and the effectiveness of analgesic treatment.While international guidelines promote the use of breastfeeding during painful procedures, its incorporation into immunization programs on a routine basis, especially in India, is not uniform. Perceived cultural beliefs, absence of clinical skills, and functional limitations frequently prevent its acceptance. In addition, sparse information from Indian referral hospital settings compares both behavioral and physiological acceptance of breastfeeding with vaccination.This research was thus carried out to evaluate the efficacy of breastfeeding in alleviating pain in infants during routine immunization, employing the MBPS as the major outcome measure. Furthermore, the research also sought to determine the physiological impact of breastfeeding by ascertaining post-vaccination heart rate, oxygen saturation, and crying duration—thus capturing both behavioral and physiological aspects of procedural pain.

METHODOLOGY

This quasi-experimental study was conducted over a six-month period at the Department of Paediatrics, Shri Sathya Sai Medical College and Research Institute, SBV Chennai Campus. The objective of the study was to evaluate the effectiveness of breastfeeding in reducing pain during infant vaccination, using both behavioral and physiological parameters. Ethical approval for the study was obtained from the Institutional Ethics Committee prior to initiation. Written informed consent was obtained from the parents or guardians of all the participating infants.60 infants between the ages of 6 weeks and 6 months were enrolled and equally divided into two groups by alternate allocation. The experimental group (Group I) included 30 infants who received breastfeeding at the time of administering the vaccine, whereas the control group (Group II) had 30 infants who received neither any breastfeeding nor analgesic intervention at vaccination. Infants with acute illness, congenital anomalies, neurological disorders, or on sedative or analgesic medication were excluded from the study.In Group I, the mothers started breastfeeding two minutes prior to vaccination and continued during the process. Vaccinations were all given intramuscularly in the anterolateral thigh with a standard technique by trained nurses. The behavioral pain response was measured at the time of injection immediately after using the Modified Behavioral Pain Scale (MBPS), which measures facial expression, crying, and body movement, each graded on a 0 to 3 scale, resulting in a total score of 0 (no pain) to 9 (severe pain).Aside from the MBPS scoring, three physiological parameters were included as secondary outcome measures in the study: heart rate, peripheral oxygen saturation (SpO_2), and crying duration. Heart rate and SpO_2 were measured by a calibrated

pediatric pulse oximeter positioned on the infant's right foot, beginning 30 seconds prior to injection and lasting for one minute after vaccination. Peak heart rate and the lowest SpO_2 levels after injection were obtained for analysis. Duration of crying was measured in seconds with an electronic stopwatch from the moment after the injection and until the baby was quiet and calm for five consecutive seconds or more.All assessments were performed by a single trained observer who was blinded to the group allocation to minimize observer bias. Data were entered into Microsoft Excel and analyzed using SPSS software version 25.0. Categorical variables were summarized as frequencies and percentages, and continuous variables were expressed as mean ± standard deviation. The independent t-test was used to compare mean MBPS scores, heart rate, SpO_2, and crying duration between the two groups. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 60 infants were included in the study, with 30 infants allocated to each group. Group I (experimental group) received breastfeeding during vaccination, while Group II (control group) did not. Comparisons were made between the two groups with respect to demographic profile, behavioral pain response (MBPS), and physiological parameters (heart rate, SpO_2, and crying duration).

Table 1 shows the age distribution of infants in both groups. The majority in both groups were in the 6–10 week age range, indicating a comparable age baseline.

Table 1: Age Distribution of Infants

Age Group (weeks)	Group I (n = 30)	Group II (n = 30)
6–10	17	18
11–14	8	7
15–24	5	5

Table 2 shows the sex distribution. Both groups were nearly balanced with respect to male and female participants.

Table 2: Sex Distribution of Infants

Sex	Group I	Group II
Male	17	16
Female	13	14

Table 3 shows the distribution of facial expression scores post-vaccination. A greater number of infants in the breastfeeding group had lower scores, reflecting reduced pain-related facial expressions.

Table 3: Facial Expression Scores Post-Vaccination

Score	Group I	Group II
0	10	0
1	11	3
2	9	8
3	0	19

Table 4 presents the cry scores across both groups. Infants in the breastfeeding group had lower scores, indicating reduced vocal pain expression.

Table 4: Cry Scores Post-Vaccination

Score	Group I	Group II
0	8	0
1	14	2
2	6	7
3	2	21

Table 5 shows the distribution of body movement scores. Infants in Group I showed fewer pain-associated movements than those in the control group.

Table 5: Body Movement Scores Post-Vaccination

Score	Group I	Group II
0	12	0
1	10	3
2	6	9
3	2	18

Table 6 compares the total MBPS score ranges between both groups. Most breastfed infants fell into the 0–2 range, while the majority of controls had scores between 6–9.

Table 6: Total MBPS Score Distribution

MBPS Score Range	Group I	Group II
0–2	13	0
3–5	15	4
6–9	2	26

Table 7 shows the mean MBPS scores in each group. The breastfeeding group had a significantly lower average score compared to the control group ($p < 0.001$).

Table 7: Comparison of Mean MBPS Scores

Group	Mean ± SD	p-value
Group I	2.03 ± 1.39	
Group II	6.20 ± 1.85	<0.001

Table 8 presents the component-wise mean scores of MBPS. All three subcomponents facial expression, cry, and body movement—were significantly reduced in the breastfeeding group.

Table 8: MBPS Component-wise Mean Scores

Parameter	Group I Mean ± SD	Group II Mean ± SD	p-value
Facial Expression	1.03 ± 0.66	2.53 ± 0.68	<0.001
Cry	1.00 ± 0.76	2.63 ± 0.61	<0.001
Body Movement	1.00 ± 0.76	2.60 ± 0.62	<0.001

Table 9 lists adverse events observed during the procedure. No adverse events were reported in the breastfeeding group, indicating the safety of the intervention.

Table 9: Adverse Events Observed

Event	Group I	Group II
Choking during feeding	0	NA
Vomiting	0	NA
Breast refusal	0	NA

Table 10 presents maternal perception of the infant's comfort during vaccination. Most mothers in the breastfeeding group perceived their infants to be comfortable.

Table 10: Maternal Perception of Infant Comfort

Response	Group I	Group II
Comfortable	26	4
Neutral	4	10
Distressed	0	16

Table 11 shows the distribution of time to calming after vaccination. Infants in the breastfeeding group calmed significantly faster.

Table 11: Time to Calming After Vaccination

Time Range (sec)	Group I	Group II
<30	27	3
30–60	3	8
>60	0	19

Table 12 correlates MBPS score range with calming time. Infants with lower MBPS scores calmed down in a shorter duration, supporting the validity of the pain assessment.

Table 12: MBPS Score vs Time to Calm

MBPS Range	Avg. Calming Time (sec)
0–2	12
3–5	38
6–9	91

Table 13 compares heart rates between both groups. Infants in the breastfeeding group had significantly lower post-vaccination heart rates, reflecting reduced physiological stress.

Table 13: Comparison of Heart Rate Post-Vaccination

Group	Mean HR (bpm) ± SD	p-value
Group I	131.4 ± 7.2	
Group II	145.8 ± 8.6	<0.001

Table 14 compares post-vaccination oxygen saturation levels. SpO_2 levels were better maintained in the breastfeeding group than in controls.

Table 14: Comparison of SpO_2 Post-Vaccination

Group	Mean SpO_2 (%) ± SD	p-value
Group I	97.6 ± 1.1	
Group II	94.3 ± 1.4	<0.001

Table 15 shows the comparison of crying duration. Infants in the breastfeeding group cried significantly less than those in the control group.

Table 15: Comparison of Crying Duration

Group	Mean Duration (sec) ± SD	p-value
Group I	23.2 ± 8.5	
Group II	67.4 ± 15.9	<0.001

SUMMARY OF RESULTS

A total of 60 infants were studied and equally divided into two groups. The demographic variables including age and sex distribution were comparable between groups (Tables 1 and 2). Behavioral response to pain was evaluated using MBPS. Infants who were breastfed during vaccination had significantly lower scores for facial expression (Table 3), cry (Table 4), and body movement (Table 5). The overall MBPS scores were markedly lower in the breastfeeding group (Tables 6 and 7), and this was supported by

component-wise analysis (Table 8). No adverse events were noted in the breastfeeding group (Table 9), and maternal perception of infant comfort was significantly better (Table 10). The time to calming post-vaccination was substantially shorter (Table 11), and a direct association was seen with MBPS scores (Table 12). Physiological indicators showed that infants in the breastfeeding group had lower post-vaccination heart rates (Table 13), better maintained SpO_2 levels (Table 14), and significantly shorter crying durations (Table 15). These results confirm that breastfeeding provides both behavioral and physiological pain relief during immunization.

DISCUSSION

Pain management in infants during routine procedures like vaccination remains an often overlooked but clinically significant aspect of pediatric care. The early experience of unmitigated pain can result in altered stress responses, exaggerated pain perception in later life, and caregiver anxiety, all of which may impact health-seeking behavior and compliance with immunization schedules. Non-pharmacological strategies such as breastfeeding offer safe, cost-effective, and easily implementable methods to address this unmet need. The present study demonstrated that breastfeeding significantly reduced both behavioral and physiological indicators of pain in infants undergoing intramuscular vaccination.Behavioral assessment using the Modified Behavioral Pain Scale (MBPS) revealed that infants in the breastfeeding group had substantially lower scores in all three components—facial expression, cry, and body movement—compared to those in the control group. These findings are consistent with earlier studies which have documented the analgesic effect of breastfeeding during painful procedures in neonates and infants [8,9]. The orogustatory stimulation of suckling, release of endogenous opioids, and the comforting maternal contact are believed to synergistically reduce the perception of pain during breastfeeding [10]. Furthermore, the act of nursing engages parasympathetic pathways that stabilize the infant's behavioral state, offering an integrated soothing response [11].Importantly, the present study also incorporated physiological indicators as secondary outcome measures, including heart rate, oxygen saturation (SpO_2), and crying duration. These objective parameters provide an additional dimension to assess the infant's stress response. The significantly lower heart rate observed in the breastfeeding group aligns with existing literature that associates parasympathetic activation and oxytocin release with reduced cardiovascular stress in breastfed infants. SpO_2 levels were better maintained in the experimental group, which may reflect reduced sympathetic arousal and improved respiratory stability due to the calming influence of breastfeeding [12].Crying duration, often used as a proxy for procedural distress in neonates, was markedly shorter in breastfed infants. Several studies have affirmed that shorter crying duration not only indicates immediate analgesic benefit but also contributes to better regulation of the infant's physiological systems post-procedure [13]. Moreover, maternal satisfaction and perception of infant comfort were significantly higher in the breastfeeding group, reinforcing the acceptability and perceived value of this intervention.The absence of adverse effects such as choking or vomiting further highlights the safety of breastfeeding during minor procedures. In the Indian healthcare context, where injectable analgesics are often not feasible for routine use in infants due to cost or resource constraints, breastfeeding provides an ideal alternative. However, despite its efficacy and safety, the integration of breastfeeding as a standard practice during immunizations remains suboptimal, likely due to logistical, cultural, or awareness-related barriers [14].The strengths of the current study lie in its combined use of behavioral and physiological parameters, observer blinding, and standardized procedural technique. However, certain limitations need to be acknowledged. The sample size, while adequate for preliminary conclusions, was relatively small and limited to a single center. Additionally, long-term behavioral outcomes were not assessed, which could provide more insights into the broader impact of repeated procedural pain and analgesia. Future research should aim to explore multimodal pain relief approaches, consider the effects of maternal anxiety and infant temperament, and study outcomes across diverse healthcare settings.In summary, the study confirms that breastfeeding is a powerful, non-pharmacological analgesic for infant vaccinations, offering clear benefits across multiple pain assessment dimensions. Its effectiveness in attenuating both behavioral distress and physiological stress responses supports its routine adoption during pediatric procedures. Strengthening healthcare provider training and parental education on this front could transform the pain experience of infants in immunization clinics across India.

CONCLUSION

The present study demonstrates that breastfeeding is an effective, safe, and holistic non-pharmacological intervention for alleviating pain in infants during routine immunization. Infants who were breastfed during vaccination exhibited significantly lower pain responses as assessed by the Modified Behavioral Pain Scale, with reduced facial grimacing, crying, and body movement. These behavioral improvements were complemented by objective physiological benefits, including lower heart rates, better maintained oxygen saturation levels, and shorter duration of crying, all of which point to reduced stress and improved comfort during the procedure. The absence of adverse events further confirms the safety and feasibility of implementing breastfeeding in clinical settings. The study also highlighted higher maternal satisfaction and enhanced caregiver confidence when breastfeeding was integrated into the vaccination process. Taken together, these findings validate breastfeeding as a practical and multifaceted analgesic strategy that can be routinely employed in immunization clinics, especially in low-resource environments. The use of both behavioral and physiological metrics in this study strengthens the evidence base for this intervention. Although limited by its single-center design and modest sample size, the results align with global recommendations and have important implications for pediatric practice. Training healthcare providers and sensitizing parents toward the procedural use of breastfeeding could significantly improve the overall vaccination experience. Future research with larger, multicentric cohorts is recommended to further validate these outcomes and promote policy-level integration of breastfeeding during infant immunizations.

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