

## Neonatal Analgesia: The Effect of Mother's Milk Odour on the Perception of Procedural Pain in Preterm Neonates

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### Abstract

**Background and Aims:** Neonatal pain in preterm neonates can adversely affect their development in multiple domains, such as nociceptive changes, altered brain development, stress system and functional abilities. We plan to research whether the odour of mother's milk is effective in reducing the pain of preterm neonates who unable to access their own mother's milk for any reason.

**Material and Method:** A prospective randomized control trial was done at postnatal ward of Civil Hospital, Ahmedabad, with 100 vaginally delivered preterm neonates (34-36 weeks) without any antenatal, intra-natal or postnatal complications. They were divided into two groups. Group A (EBM group) was given odour of own mother's milk and while Group B (sterile water group) was given odour of sterile water as an analgesic agent.

**Results:** There was a significant decrease in PIPP score in Group A (EBM group) ( $8.72 \pm 1.21$ ) compared to Group B (sterile water group) ( $14.12 \pm 0.86$ ) with a p-value of  $< 0.0365$ . A significant decrease in maximum heart rate was observed in Group A (EBM group) ( $132.22 \pm 13.28$ ) compared to Group B (sterile water group) ( $136.54 \pm 25.12$ ) during the 30 seconds from removal of needle (p-value 0.0448). Additionally there was a significant decrease in the fall in oxygen saturation in Group A (EBM group) ( $96.74 \pm 4.72$ ) compared to Group B (sterile water group) ( $94.48 \pm 7.44$ ) with a p-value of 0.00457.

**Conclusion:** Inhalation of own mother's milk for is effective analgesic for mild to moderate pain in preterm neonates. Inhalation of own mother milk before procedure or during procedure can be used as a non-pharmacological intervention to reduce pain in preterm neonates for whom breastfeeding is contraindicated for any reason.

**Key Words:** Neonatal Pain, Neonatal Analgesia, Preterm, PIPP score.

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## 1- INTRODUCTION

Neonatal pain in preterm neonates can adversely affect their development in multiple domains. Persistent pain can lead to short-term consequences like tachycardia, hypoxemia, increase oxygen requirement, disturbed sleep as well as long-term consequences like neurodevelopmental disturbance, psychosocial and cognitive disturbances. Many innovative method to use non pharmacology interventions like breast feeding, sucrose solution, kangaroo mother care, family centered care, mother's touch, oil massage, supportive nursing care, minimal handling, starting of minimal enteral feeds are considered for reducing mild to moderate neonatal pain in preterm neonates (1,2). We have plan research to determine whether odour of own mother milk is effective to reduce the pain of preterm neonates who are not able to access their own mother's milk for any reason (3,4).

## 2- METHODS

A prospective randomized controlled trial was conducted at the postnatal ward of, Civil Hospital in Ahmedabad from March 1, 2022, to April 31, 2022, after obtaining permission from the institutional ethical committee. The main objective of my study is to determine the analgesic effect of the odour of own mother's milk on mild to moderate procedural pain in preterm neonates. Preterm neonates whose gestational age is between 34-36 weeks who do not have any antenatal, intra-natal and postnatal complications were included in the study after written informed consent. Preterm neonates whose gestational age is <34 weeks or >36 weeks, who were with comorbidities, who were shifted to postnatal ward from neonatal intensive care unit, who were having minor/major congenital malformation or whose parents had not given consent to enroll in the study were excluded from the study. Enrolled

neonates were divided into two groups; via simple randomization, Group A (EBM group) and Group B (Sterile water group). In Group A odour of mother's milk given was used as analgesic agent while in Group B odour of sterile water was used as an analgesic agent during the procedure. In Group A, 2ml mother's milk-soaked sterile gauge piece was kept 2cm away from the nostrils for 2 minutes before the procedure. In Group B, a 2ml sterile water-soaked sterile gauge piece was kept 2cm away from the nostrils for 2 minutes before the procedure. Basic demographic features like mother and father name, significant antenatal, intra-natal, postnatal history, risk factor, mode of delivery, birth weight, gestational age, hours of life at the time of the procedure, breast feeding, other significant history will be recorded in a pre-designed pre-structured proforma. Procedure used for assessing analgesic property of odour of mother's milk on procedural pain was intramuscular injection of hepatitis B vaccine which was given routinely to all preterm neonates in postnatal ward.

The PIPP score was used for assessing pain in these preterm neonates. This score includes gestational age, facial expression, heart rate, oxygen saturation and behavioral status before procedure (5). Based on maximum heart rate above basal heart rate, fluctuation in oxygen saturation during the procedure and facial expression during procedure based on the PIPP score will be calculated during the study.

Before procedure all enrolled neonate were kept in comfortable environment in a quite isolated room in mother's lap. Base line parameters of PIPP score like behavioral state for 15 sec, heart rate and oxygen saturation for 30 sec were observed by two blinded observer and these were recorded in predesigned proforma.

All enrolled neonates of the both groups had received intramuscular injection of hepatitis B vaccine by trained and

qualified staff nurse using 23-gauge needle on anterolateral aspect of thigh after cleaning skin with spirit in morning during 10 am to 12 pm. The injection was given after calling loud "in" when needle was inserted and "out" when needle was removed. Once needle of hepatitis B vaccine injection was removed then all enrolled neonates were observed for their facial expression by one blinded observer and maximum heart rate, minimum oxygen saturation by second blinded observer from removal of needle till 30 seconds.

These parameters were recorded in the proforma, and the PIPP scores for both groups were calculated. Data analysis was performed by comparing the two groups using an unpaired Student's t-test, with a P-value of this <0.05 considered statistically significant.

### 3- RESULTS

A Total of 100 preterm neonates with a gestational age of 34-36 weeks were enrolled in the study and divided into 2 groups, each group consisting of 50 preterm neonates. Group A had a male to female ratio of 1.7:1 with a mean birth weight of  $1.98 \pm 0.61$  kg and group B had male to female ratio of 1.08:1 with a mean birth weight of  $2.01 \pm 0.84$  kg (p-value 0.23), making the baseline characteristics of both groups comparable. Basal heart rate before procedure in group A (EBM group) was  $121.21 \pm 3.24$  per min and in group B (Sterile water group) was  $122.24 \pm 4.32$  per min which was comparable (p-value 0.1). The maximum heart rate observed during 30 seconds of needle removal was significantly lower in

group A ( $132.22 \pm 10.18$  per minute) as compared to group B ( $136.70 \pm 12.21$  per minute) with p-value of 0.0448.

The basal oxygen saturation before the procedure in group A was  $95.55 \pm 2.33\%$  and in group B was  $95.62 \pm 2.14\%$  which was comparable (p-value 0.8) in both groups. The minimum saturation observed during 30 seconds of needle removal was significantly higher in group A ( $95.84 \pm 1.72$ ) compared to group B ( $94.62 \pm 2.44$ ) with a p-value of 0.00457. In group A, 29 neonates had a PIPP score between 4-8, 20 neonates had a PIPP score of 9-12 and only 1 neonate had a PIPP score 13-16. While in group B, 33 neonates had a PIPP score of 13-16, 13 neonates had a PIPP score of 9-12 and only 1 had a PIPP score of 4-8. The mean PIPP score in group A was  $10.72 \pm 1.21$  which was significantly lower than group B which have a mean PIPP score of  $11.17 \pm 0.86$  (p-value 0.0365).

### 4- DISCUSSION

Neonatal pain is a potent and noxious stimulus, which can alone affect in different domains of development of neonates during early days of brain development (6). Neonate experiences pain and stress during different interventions and handling during their Neonatal Intensive Care Unit (NICU) stay and routine care like change in dipper, insertion of nasogastric tube, intravenous catheter, intramuscular injections, applying sticking-plast, use of nasal prongs, intubation and many more noxious stimuli during NICU stay.

**Table-1:** Base line characteristics of study neonates.

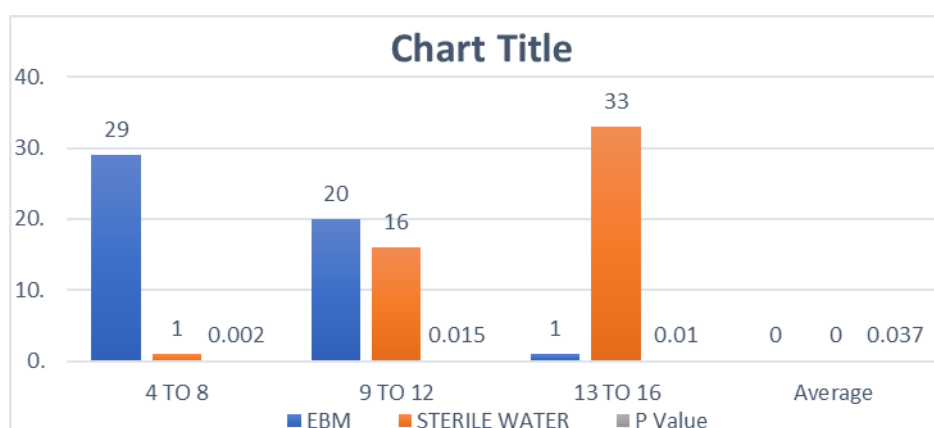
	EBM group(n=50)	NON-EBM group(n=50)	P-value
Male	48	52	0.0001
Average Birth Weight	$1.98 \pm 0.61$	$2.01 \pm 0.84$	0.83
Mean Hours of Life at the time of intervention	$36.2 \pm 0.76$	$36.5 \pm 0.66$	0.036

**Table-2:** Effect of the odour of breast milk on heart rate during procedural pain in preterm neonates.

Parameter	EBM group	NON-EBM group	P-value
Basal Heart Rate	121.21±3.24	122.24±4.32	0.1
Maximum heart rate recorded during procedure	132.22±10.18	136.54±12.21	0.0448

**Table-3:** Effect of the odour of breast milk on oxygen saturation during procedural pain in preterm neonate.

Parameter	EBM group	NON-EBM group	P-value
Basal oxygen saturation	95.55±2.33	95.62±2.14	0.8
Minimal oxygen saturation recorded during procedure	95.84±1.72	94.62±2.44	0.00457



**Figure-1:** Effect of odour of breast milk on PIPP score during procedural pain in preterm neonates.

These noxious neonatal stimuli not only lead to short-term complications but are also associated with long-term complications in growing neonates (7). Short term complications are tachycardia, hypoxemia, increase oxygen requirement, disturbed sleep, feeding intolerance, excessive crying, hypoglycemia and behavioral changes.

Long-term complications associated with neonatal pain are neurodevelopmental disturbance, psychosocial and cognitive dysfunction, hypo-thalamo-pituitary-

adrenal axis disturbance, decrease in perception of pain threshold, neuronal development and arborization (8,9). Most of the procedure and treatment associated with neonatal pain either are preventable or reducible to great extent. Whenever neonatal pain associated with treatment and procedure are inevitable than we usually use pharmacological and/or non-pharmacological measures to reduce experienced procedural pain in neonate by great extent (10).

Various non-pharmacological measures like sensory stimulation (positioning, swaddling, non-nutritional sucking, music), nutritional (oral sweet solution like sucrose (11), maternal interventions like kangaroo-mother-care (12), breast feeding, expressed breast milk had already proven the efficacy via different interventional studies out of which the breast feeding or expressed breast milk is one of the important and major analgesic agent which is commonly used before the procedure in stable preterm and term neonates just before the procedure (13,14). But in critically ill neonates like - the neonates who were having feeding intolerance, necrotizing enterocolitis, neonates with surgical problems and or neonates who are on invasive mode of ventilation; in which the breast feeding, kangaroo mother care and other non-pharmacological interventions cannot be used as analgesic agent for mild to moderate pain hence there is always need of non-pharmacological/pharmacological agent who is easily available, safe and easy to administered to reduce mild to moderate procedural pain in such neonates (15,16).

The present study shows the odour of mother's milk just before the procedure like intramuscular injection of hepatitis B vaccine is a potent and effective analgesic agent for reduction of procedural pain in preterm neonates. Observed Mean PIPP score in group A (EBM group were the odour of 2ml of EBM was used) was  $10.72 \pm 1.21$  which was significantly lower than group B (Sterile water group were odour of 2ml sterile water was used) who has observed Mean PIPP score of  $11.17 \pm 0.86$ . The observed maximum heart rate in group A was significantly lowered than the group B when mother's milk odour used before the procedure. The observed minimum oxygen saturation in group A was significantly higher than group B when odour of mother's milk used. These signifies the efficacy of

analgesic property of mother's milk odour in reducing neonatal pain in preterm neonates in present study.

Study done by Zahra Akbari an et al in which they have assessed the effect of inhaling mother's milk odour on the behavioral response to pain caused by hepatitis B vaccine in preterm infants with gestational age between 32-34 weeks (17). In Zahra Akbari an et al, Mean PIPP score was recorded by investigator in three different groups, group A (own mother's milk odour), group B (other mother's milk odour), group C (distilled water) were  $6.6 \pm 1.3$ ,  $10 \pm 2$  and  $11.4 \pm 1.9$  respectively with p value of 0.012. Another study done Badiie et al. in which they have assessed the calming effect of maternal milk odour in preterm neonates 32-34 weeks using the PIPP score and heel stick as the pain stimulus.18 PIPP score in group A (odour of own mother's milk) was 5.4 and in Group B (odour of formula milk) was 9.0 with p value  $< 0.001$ .

Observe mean PIPP Score in EBM group was significantly lower in EBM Group as compare to formula Milk Group.

Odour or smell of mother's milk releases high level of tryptophan, which increases endogenous opioids and beta endorphins which having natural analgesic effect (16). Breastmilk also releases serotonin which also reduces the pain signaling via gait control theory. This property of breastmilk makes them effective analgesic reliving in mild to moderate pain in neonates.

## 5- CONCLUSION

Inhalation of odour of own mother's milk for is effective analgesic for mild to moderate pain in preterm neonates. Inhalation of own mother milk before procedure or during procedure can be use as non-pharmacology intervention to reduce pain in preterm neonates in whom breastfeeding is contraindicated due to any reason.

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