Effect Of Preterm Infant Oral Motor Intervention (Piomi) On Feeding Readiness and Feeding Behaviour in Preterm Neonates- A Randomised Control Trial

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ABSTRACT

Objectives: The study aimed to evaluate Preterm Infant Oral Motor Intervention on Feeding Readiness and Feeding Behaviour in Preterm Neonates.

Methodology: 32 children diagnosed with Feeding difficulty, divided into two groups: Group A (n = 16, mean age – 30 ±1.25 weeks) which received Preterm Infant Oral Motor Intervention for thrice/day and Group B (n = 16, mean age – 30 ±1.50) which received Oral Motor Stimulation once/day. Both groups underwent sessions over 10 consecutive days. Preterm oral feeding readiness assessment scale, Preterm Infant Breastfeeding Behavior Scale and Weight was taken before and after the intervention.

Results: Both groups showed statistically significant improvements across all outcome measures (p<0.002). However, Intervention Group i.e Group A demonstrated a slightly greater improvement in Feeding readiness and Behaviour, weight gain and reduced no. of days to transition from gavage to Oral Feeding.

Conclusion: Preterm Infant Oral Motor Intervention and Oral Motor Stimulation both significantly improved feeding readiness, feeding behavior, weight gain, and the transition from gavage to oral feeding in preterm neonates. However, Group A, which received PIOMI, for more no. of times/day, showed greater improvements across all outcome measures. This suggests that increased frequency of specific oral motor intervention for preterm neonates i.e PIOMI may be more effective in enhancing feeding outcomes in preterm infants

Keywords: *Preterm Infant Oral Motor Intervention, Feeding Readiness, Feeding Behavior, Oral Motor Stimulation, Preterm Neonates, Gavage to Oral Feeding, Weight Gain*

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1. INTRODUCTION

World Health Organization has defined Preterm birth as babies born alive before 37 weeks of pregnancy are completed or fewer than 259 days since the first day of the woman's last menstrual period (LMP).[1] The number of preterm births is estimated at 15 million each year.[2] Global estimates show that approximately 10.6% of all live births are preterm and in India approximately 13.61% preterm babies are born out of all live births.[3]

Etiology of preterm birth

The causes of preterm birth are complex and largely unknown, involving maternal, fetal, and environmental factors. Common contributors include antepartum hemorrhage, uterine overdistention, cervical incompetence, hormonal changes, and infections. Prematurity increases the risk of cerebral palsy, sensory deficits, learning disabilities, and respiratory illness, leading to physical, psychological, and economic burdens.[1]

Preterm neonates commonly struggle with oral feeding (bottle feeding with an artificial nipple) because their oral motor skills are underdeveloped and their sucking, swallowing, and respiration are not coordinated.[4] Premature newborns have trouble adjusting to life outside the womb because many organ systems are still developing, including the suction reflex, which is important for preparedness for oral feeding.[2]

Premature neonates struggle with oral feeding due to delayed oral-motor skills and poor suck-swallow-breath coordination, essential for preventing apnea, aspiration, bradycardia, and hypooxygenation. Feeding difficulties also increase energy expenditure, hindering growth. Their eating experiences in the first year differ from full-term babies.[5] Approximately 23% of premature neonates with gestational age ≤30 weeks experience feeding delays until age 2 years .[6] They struggle to eat meals with novel textures, may be sensitive to them, and eventually stop eating them.[5]

Research shows that therapies like non-nutritive sucking (NNS), feeding positions, and oral motor programs improve oral-motor feeding in preterm neonates. Oral stimulation, involving pressure or stroking of mouth structures, aids transition from gavage to full oral feeding, boosts weight gain, and reduces LOS. Studies found pre-meal oral stimulation in preterm neonates (32–36 weeks PMA) and NNS during gavage (26–32 weeks PMA) accelerated feeding transitions. Similar results were reported by Fucile et al. for neonates at 34.5 weeks PMA. Both studies used the 15-minute Beckman Oral Motor Intervention (BOMI).[4]

Various strategies, including Fucile's protocol, multi-sensory intervention, non-nutritive sucking (NNS), and oral assistance, have been explored to support oral feeding in preterm infants. However, many oral stimulation techniques are too time-consuming or unsuitable for younger neonates due to physiological instability and limited oral capacity. While older neonates tolerate longer interventions, NICU advancements necessitate adaptable therapies. To address this, Dr. Brenda Lessen developed Beckman's Oral Motor Intervention (BOMI), or Premature Infant Oral Motor Intervention (PIOMI), which a study found tolerable for neonates born before 30 weeks if administered from 29 weeks onward.[5]

PIOMI is an oral motor program designed to enhance strength and muscle activation through resistance and facilitated movement. Adapted from BOMI, which was originally a 15-minute intervention for term neonates, children, and adults with feeding difficulties, PIOMI was modified for preterm infants who struggle with prolonged procedures due to stress and limited oral capacity. To suit neonates as early as 29 weeks PMA, the original 11 BOMI steps were reduced to 8, and session duration was shortened from 15 to 5 minutes in collaboration with Debra Beckman.[4] The PIOMI is also the only preterm oral motor intervention that has established published intervention fidelity based on a formal training program to ensure it is easily taught and can be consistently and reliably performed.[5]

Current oral feeding assessment scales for preterm neonates focus on bottle feeding, while WHO advocates breastfeeding as the best practice. Determining when to start breastfeeding in preterm infants is challenging due to a lack of standardized methods. To address this, the Preterm Oral Feeding Readiness Assessment Scale (POFRAS) was developed to help healthcare professionals assess breastfeeding readiness in neonatal units.POFRAS consists of 18 items across five categories: corrected gestational age, behavioral organization, oral posture, oral reflexes, and non-nutritive sucking. Each item is scored from 0 to 2, with a total score of 0–36. It has strong interrater (ICC: 0.84) and intrarater (ICC: 0.97) reliability. The scale provides a "pass" or "fail" rating and has shown sensitivity and specificity at a cutoff score of 30 (Fujinaga et al., 2013).The Preterm Infant Breastfeeding Behavior Scale (PIBBS) assesses feeding behavior in NICU infants, enabling parents and healthcare providers to evaluate rooting, areola grab, latching, sucking, burst length, and swallowing. PIBBS helps identify challenges in feeding maturation, sucking duration, and swallowing efficiency.[8,9,10,11]

This study addresses the critical need to improve feeding outcomes in preterm neonates, as approximately 23% of those born at ≤30 weeks gestation experience feeding delays up to two years of age. While the Preterm Infant Oral Motor Intervention (PIOMI) has shown promise in enhancing muscle activation and strength, previous studies have only examined its effects when applied once daily before feeding. There is limited research on the impact of more frequent applications. This study aims to bridge that gap by evaluating the effects of administering PIOMI 15–20 minutes before each feeding. By exploring the benefits of increased application frequency, this research seeks to provide deeper insights into PIOMI's role in enhancing oral motor development and reducing feeding delays. The findings will be instrumental in shaping clinical practices and interventions to improve long-term feeding outcomes in preterm neonates.

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2. MATERIALS & METHODOLOGY

This randomized controlled trial was conducted in the Neonatal Intensive Care Unit at Dr. D. Y. Patil Vidyapeeth and Vatsalaya Mother and Child Care. The study targeted preterm neonates born between 29 to 36 weeks of gestation. A total of 52 neonates were screened, out of 32 meeting the inclusion criteria were selective using simple random sampling.

Eligible neonates were medically stable, on gavage feeding, had Apgar scores of 4–7 at 1 and 5 minutes, and met baseline scores on POFRAS and PIBBS. Exclusion criteria included congenital anomalies, respiratory distress, intraventricular hemorrhage, necrotizing enterocolitis, cranial malformations, chromosomal anomalies, prenatal drug exposure, or those requiring ventilatory support.

Outcome measures included the Preterm Oral Feeding Readiness assessment scale to assess feeding Readiness, Preterm infant Breastfeeding behavior scale for assessing feeding behaviour as primary outcomes measures and weight gain and no. of days to transition from gavage feeding to oral feeding as the secondary outcome measures.

PROCEDURE

After obtaining approval from the institutional ethical committee. Informed consent was obtained from parents or guardians. Pre-assessment of outcome measures was conducted before intervention.

The participants were randomly divided into two groups using simple random sampling: Group A (PIOMI intervention group) and Group B (Control group). Baseline data were collected, and standard protective measures, including scrubs, masks, and hair caps, were followed before entering the NICU. Pre-intervention evaluation included weight measurement using an electronic weighing scale, assessment of feeding readiness using POFRAS, and assessment of feeding behavior using PIBBS.

In Group A, all neonates were routinely monitored for vital signs and SPO2 levels. Physiological and behavioral stress cues, such as apnea, bradycardia, tachycardia, and reduced PO2, were continuously observed during stimulation. The PIOMI protocol was implemented after pediatric approval for gavage feeding. This 5-minute oral-motor intervention was administered by a therapist, targeting facial and oral structures through specific stimulation techniques, including lip rolling, cheek stretching, and tongue, gum, palate, and cheek massage to elicit sucking and non-nutritive sucking (NNS). Before each session, the therapist followed strict hygiene protocols, including handwashing and wearing latex gloves.

In Group B, neonates were also monitored for vital signs and SPO2 levels, with stress cues observed throughout. The control group received Oral Motor Stimulation (OMS) once daily for 10 days. Both groups continued receiving routine physiotherapy and standard nursing care.

Post-intervention evaluation included weight measurement using an electronic scale, reassessment of feeding readiness and behavior using POFRAS and PIBBS, and calculation of the duration required to transition from gavage to oral feeding.

3. RESULTS

 32 Preterm Neonates with Feeding Difficulties participated in this study, The mean age of participants in Group A is 30 weeks with a standard deviation of ±1.25, while Group B has a slightly higher mean age of 30 weeks with a standard deviation of ±1.50. In terms of gender distribution, Group A consists of 7 girls and 9 boys, whereas Group B includes 8 girls and 8 boys.

After checking the normality, within group analysis for POFRAS, PIBBS, Weight gain and Days for transition from Gavage feeding to Oral feeding of Group A and Group B Wilcoxon Signed Rank Test as the data was not normally distributed . The between group Analysis for POFRAS, PIBBS, Weight gain and Days for transition from Gavage feeding to Oral feeding of Group A and Group B was done using Mann Whitney U Test.

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TABLE 1 - COMPARISON OF PRE AND POST POFRAS, PIBBS AND WEIGHT GAIN OF GROUP A AND GROUP B (WITHIN GROUP ANALYSIS)

VARIABLE		PRE (MEAN ± SD)	POST (MEAN ± SD)	T/Z value	P VALUE	EFFECT SIZE
POFRAS	GROUP A	12 ± 3.09	34.4 ± 1.19	Z=4.134	<0.002	1.65
	GROUP B	11.97 ± 1.16	30.21 ± 1.07	Z=4.681	<0.002	1.55
PIBBS	GROUP A	4.2 ± 0.93	15.8 ± 2.96	Z=7.862	<0.002	2.29
	GROUP B	3.5 ± 1.73	13.3 ± 2.59	Z=5.070	<0.002	1.53
WEIGHT GAIN (g)	GROUP A	1508 ± 326	1862.8 ± 296	Z=7.862	<0.002	3.01
	GROUP B	1498.5 ± 273	1654.3 ± 259	Z=5.070	<0.002	2.19

SD- Standard Deviation, POFRAS – Preterm oral Feeding Readiness Assessment Scale, PIBBS – Preterm Infant Breastfeeding Behaviour Scale, T – Student t test, Z – Wilcoxon signed rank test.

Table 2 - COMPARISON OF MEAN DIFFERENCE OF POFRAS, PIBBS AND WEIGHT GAIN BETWEEN GROUP A AND GROUP B (BETWEEN GROUP ANALYSIS)

VARIABLES		MEAN	SD	U Value	P value	EFFECT SIZE
POFRAS	GROUP A	22.6	± 1.26	369	0.876	0.0417
	GROUP B	18.3	±1.35			
PIBBS	GROUP A	11.64	±0.96	265	0.703	0.0972
	GROUP B	10.62	± 0.99			
WEIGHT GAIN (g)	GROUP A	362.3	± 22	1165	0.703	0.0972
	GROUP B	253.5	± 19			

SD- Standard Deviation, POFRAS – Preterm oral Feeding Readiness Assessment Scale, PIBBS – Preterm Infant Breastfeeding Behaviour Scale, U – Mann Whitney U test.

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4. DISCUSSION

The study was conducted as an attempt to find out the effect of Preterm Infant Oral Motor Intervention on Feeding Readiness and Feeding Behaviour in Preterm Neonates . Both the interventions were given according to the protocol explained in procedure. Study also aimed to evaluate whether intervention provided better results in improving Feeding Readiness and Feeding Behaviour in Preterm Neonates when given thrice/day . Both interventions were administered over 10 days, for three times per day with each session lasting 5 minutes, and their impact was assessed through standardized outcome measures.

For the same we conducted study in 2 groups with n = 16 in Group A (PIOMI) and n = 16 Group B (OMS). Both interventions were administered over 10 days, for three times per day with each session lasting 5 minutes, and their impact was assessed through POFRAS for Feeding Readiness, PIBBS for Feeding Behaviour, weight Gain, and Days taken to transition from gavage to oral feeding. The mean age of participants in Group A is 30 weeks with a standard deviation of ±1.25, while Group B has a slightly higher mean age of 30 weeks with a standard deviation of ±1.50. In terms of gender distribution, Group A consists of 7 girls and 9 boys, whereas Group B includes 8 girls and 8 boys. The similarity in mean ages between the two groups suggests that age differences are minimal, reducing the likelihood of age-related biases in the study findings.

Findings from the data analysis and results showed that both Preterm Infant Oral Motor Intervention and Oral Motor Stimulation led to statistically significant improvements in Feeding readiness, feeding behaviour, weight gain and reduction in the number of days for transition from gavage to oral feeding.

Similar to our study, a randomized controlled trial by Pari Singh et.al compared the effects of Premature Infant Oral Motor Intervention (PIOMI) and routine Oromotor stimulation (OMS) on oral feeding readiness in preterm neonates (29 -33 weeks). The PIOMI group showed faster oral feeding readiness (by 2.7 days), earlier transition to full oral feeds (by 2 days), shorter hospital stays (by 8 days), and greater weight gain (4.9 g/kg/day more) compared to OMS. Exclusive breastfeeding rates were also significantly higher at 1 month (24.5%) and 3 months (27%) post-discharge in the PIOMI group. Subgroup analysis favored PIOMI, particularly for neonates >28 weeks gestational age, with improved weight gain and transition times. Odds ratios indicated higher likelihoods of achieving feeding readiness, full oral feeds, and exclusive breastfeeding with PIOMI. In conclusion, PIOMI is a more effective intervention for improving oral feeding outcomes in preterm neonates. Considering the early birth of newborns and the consequent deprivation of spontaneous sucking and swallowing in the uterus, it seems that performing massage can be effective in the neuronal myelination and oral-motor development of these premature infants.[12]

The intervention group took 12 days and the Control group took 14.5 days to transition from gavage feeding to oral feeding , which shows that the intervention group took less days, which is supported by the findings of a randomised controlled trial by Tapas B et. Al which examined whether the Premature Infant Oral Motor Intervention (PIOMI) helps preterm babies transition from tube feeding to spoon feeding more quickly. Thirty-two babies were divided into two groups: one received PIOMI along with routine care, while the other received only routine care. Babies who received PIOMI learned to spoon-feed significantly sooner than those who didn't. However, there was no difference between the groups in hospital stay length, health stability, or infection rates. This suggests that PIOMI is a safe and effective way to help preterm babies start spoon feeding earlier.[13]

The weight increased in both the groups but Intervention group showed slightly more gain in weight than control group. Similar results were found in a study done by Thabet et. al where PIOMI was effective in improving preterm neonates' feeding performance, reducing the duration of hospital stay, and increasing their weight.[14]

As compared to earlier studies the current study focused on giving PIOMI thrice per day before feeds and showed better results in all the outcomes than previous studies. There are several reasons which might have led to the this. Firstly, providing Premature Infant Oral Motor Intervention (PIOMI) three times a day instead of once enhances oral muscle strength and improves coordination of sucking, swallowing, and breathing. More frequent stimulation reinforces neuromuscular development, helping preterm infants transition to independent feeding faster. Secondly, increased exposure to PIOMI enhances sensory-motor learning and feeding endurance while reducing feeding-related stress. Since PIOMI is a gentle and non-invasive intervention, increasing its frequency can maximize benefits without causing harm, potentially leading to shorter hospital stays and better long-term feeding outcomes. Thirdly, more frequent PIOMI sessions can promote better digestion and nutrient absorption by encouraging earlier and more efficient oral feeding, reducing dependence on tube feeding. This may lead to improved weight gain and overall growth in preterm infants. Fourthly, repeated stimulation throughout the day helps maintain consistency in feeding training, reinforcing oral skills and preventing regression. This continuous reinforcement ensures that preterm infants retain and strengthen their feeding abilities, leading to a smoother transition to full oral feeding.

Despite these findings, the study has some limitations. The intervention period was limited to 10 Days; a longer duration might provide more insights into the long-term effects of both interventions. Future research can focus on long term impact of PIOMI on growth and Neurodevelopment and also on the effects of applying PIOMI for more number of days on feeding outcomes.

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5. CONCLUSION

In the present study, both PIOMI and OMS effectively enhanced Feeding Readiness, Feeding Behaviour, weight gain and reduced no. of days for transition from gavage feeding to oral feeding in Preterm Infants . However, Intervention group demonstrated slightly greater improvements, likely due to its structured, specific and adaptive approach. Thus, increased dosage PIOMI can be used as an effective treatment approach to improve the Feeding Readiness, Feeding behaviour, weight gain and to reduce no. of days taken to transition from gavage feeding to oral feeding

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