International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 15; Issue: 5; May 2025
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Early Oral Motor Stimulation for Promoting Oral Feeding in Preterm Infants: A Randomized Controlled Trial

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DOI: https://doi.org/10.52403/ijhsr.20250501

ABSTRACT

Background and Aims: Preterm infants frequently experience delayed oral feeding due to immature coordination of sucking, swallowing, and breathing. Early oral motor stimulation (OMS) has been proposed as a strategy to promote oral feeding by enhancing neuromuscular coordination. This randomized controlled trial aimed to evaluate the effect of OMS on the progression of oral feeding in preterm neonates.
Methods: A hospital-based randomized controlled trial was conducted in the NICU at Rohilkhand Medical College and Hospital, Bareilly, from August 2023 to July 2024. Seventy-four preterm infants (26–34 weeks gestation) were enrolled and randomized into two groups. Group 1 received structured OMS with Kangaroo Mother Care (KMC) and Non-Nutritive Sucking (NNS), while Group 2 received only KMC and NNS. Ethical clearance and written informed consent were obtained. Feeding outcomes, including time to full gavage, spoon, and breastfeeding, were recorded. Statistical analysis included mean, SD, p-values, and 95% confidence intervals.
Results: Group 1 achieved full breastfeeding significantly earlier (15.7 ± 3.21 days) than Group 2 (18.93 ± 4.28 days), $p<0.001$. Sleep duration between feeds was also significantly longer in Group 1 ($p<0.001$). No significant differences were observed in weight gain.
Conclusion: Early oral motor stimulation enhances feeding outcomes and supports its integration into neonatal care.

Keywords: Oral Motor Stimulation; Preterm Infants; Neonatal Feeding; Breastfeeding; Randomized Controlled Trial

INTRODUCTION

Preterm birth, defined as delivery before 37 weeks of gestation, continues to be a major contributor to neonatal morbidity and mortality worldwide. Among the many challenges encountered by preterm infants, the development of effective oral feeding skills is one of the most critical.[1] These infants often lack the neurological maturity and muscular coordination needed for synchronized sucking, swallowing, and breathing. As a result, they frequently require prolonged tube feeding, which may delay discharge, increase healthcare costs, and elevate the risk of complications such as infections and feeding aversion.[2]

Early transition to oral feeding is a key determinant of clinical outcomes and overall neurodevelopment. Conventional feeding approaches often rely on gestational age or weight as indicators of readiness, ignoring individualized neurodevelopmental progress.[3] Recent findings support the role of early oral motor stimulation—structured sensory-motor interventions targeting the oral structures—in promoting neuromuscular coordination required for feeding. Such stimulation may leverage the neuroplasticity of the infant brain to facilitate earlier attainment of oral feeding milestones.[4]

Despite its potential, evidence regarding the efficacy of early oral motor stimulation remains inconclusive due to limited sample sizes and methodological variability in existing studies. There is a need for well-designed research to establish its clinical utility.[5] This randomized controlled trial evaluated the effect of early oral motor stimulation on oral feeding in preterm neonates, aiming to support its inclusion in standard neonatal care.

MATERIAL AND METHODS

This hospital-based randomized controlled trial was conducted in the Department of Pediatrics at Rohilkhand Medical College and Hospital, Bareilly, Uttar Pradesh, over a period of 12 months from August 2023 to July 2024. A total of 74 preterm neonates between 26 to 34 weeks of gestation, who were hemodynamically stable and admitted to the NICU, were enrolled in the study. Written informed consent was obtained from the parents or guardians before inclusion. Neonates with congenital malformations or those who were critically ill were excluded from the study. Eligible participants were randomly assigned to one of two groups in an alternate sequence. Group 1, the intervention group, received Oral Motor Stimulation (OMS) along with Non-Nutritive Sucking (NNS) and Kangaroo Mother Care (KMC). Group 2, the control group, received only NNS and KMC. Mothers in the intervention group were trained by the principal investigator to perform OMS using a structured protocol involving stimulation of the cheeks, lips, gums, inner cheeks, and tongue. The intervention was carried out five times daily before each feed until discharge or until the infant achieved full breastfeeding. Both groups received standard neonatal care including daily KMC for 3-4 hours and NNS before each feed. Feeding assessments were done at enrollment and then every fifth day during the hospital stay. Data collected included demographic details, feeding milestones, and the amount of feed taken. The primary outcome was the time taken to transition from full gavage feeding to full spoon feeding and then to full breastfeeding. The sample size was calculated to be 74 neonates, with 37 in each group.

RESULTS

This randomized controlled trial compare feeding outcomes and developmental parameters between preterm infants who received early oral motor stimulation and those who received standard neonatal care.

Table 1: Comparative Distribution of Gestational Age by LMP, USG, and NBS Between Group 1 and Group 2

Gestational Age (weeks)	Group 1 - LMP (N, %)	Group 2 - LMP (N, %)	Group 1 - USG (N, %)	Group 2 - USG (N, %)	Group 1 - NBS (N, %)	Group 2 - NBS (N, %)
28	16 (66.67%)	8 (33.33%)	13 (61.90%)	8 (38.10%)	15 (65.22%)	8 (34.78%)
29	4 (80.00%)	1 (20.00%)	7 (63.64%)	4 (36.36%)	4 (80.00%)	1 (20.00%)
30	6 (60.00%)	4 (40.00%)	6 (85.71%)	1 (14.29%)	5 (55.56%)	4 (44.44%)
31	3 (42.86%)	4 (57.14%)	2 (33.33%)	4 (66.67%)	4 (80.00%)	1 (20.00%)
32	0 (0.00%)	3 (100.00%)	3 (33.33%)	6 (66.67%)	2 (22.22%)	7 (77.78%)
33	3 (27.27%)	8 (72.73%)	2 (22.22%)	7 (77.78%)	2 (22.22%)	7 (77.78%)
34	5 (35.71%)	9 (64.29%)	0 (0.00%)	5 (100.00%)	4 (44.44%)	5 (55.56%)
35	–	–	4 (66.67%)	2 (33.33%)	1 (20.00%)	4 (80.00%)

(NBS: New Ballard Score)

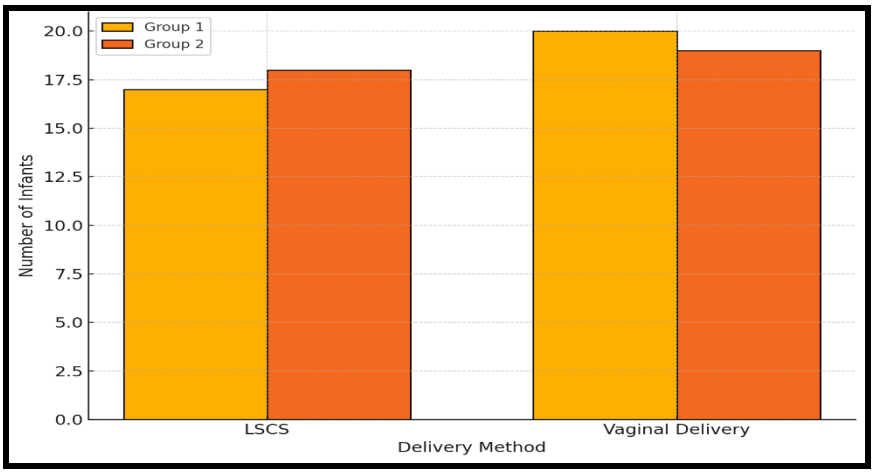

Figure 1: Distribution of delivery methods among two groups of preterm infants' mothers.

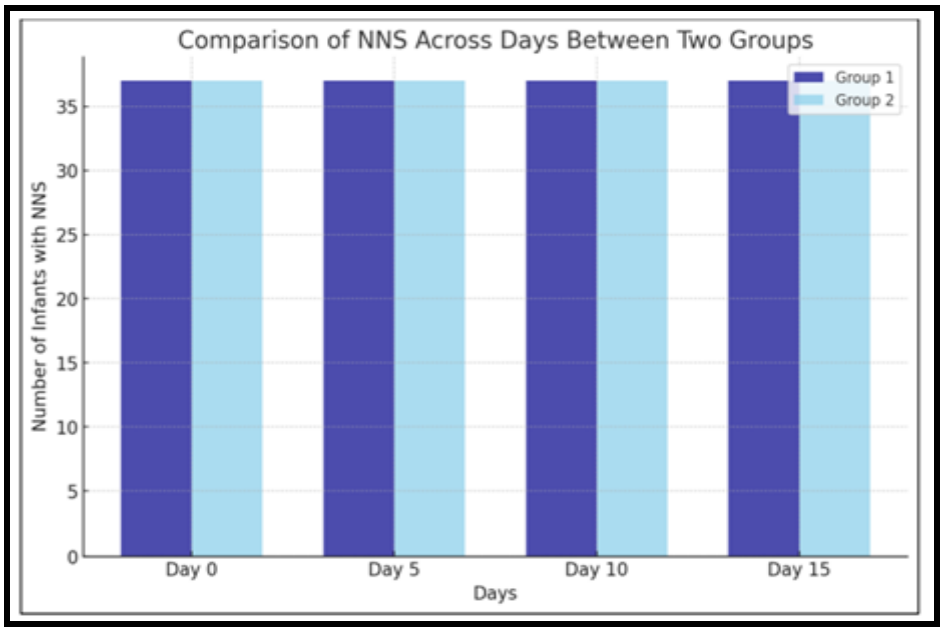

Figure 2: Distribution of non-nutritive sucking (NNS) behaviors among two groups of infants across four time points (Day 0, Day 5, Day 10, and Day 15).

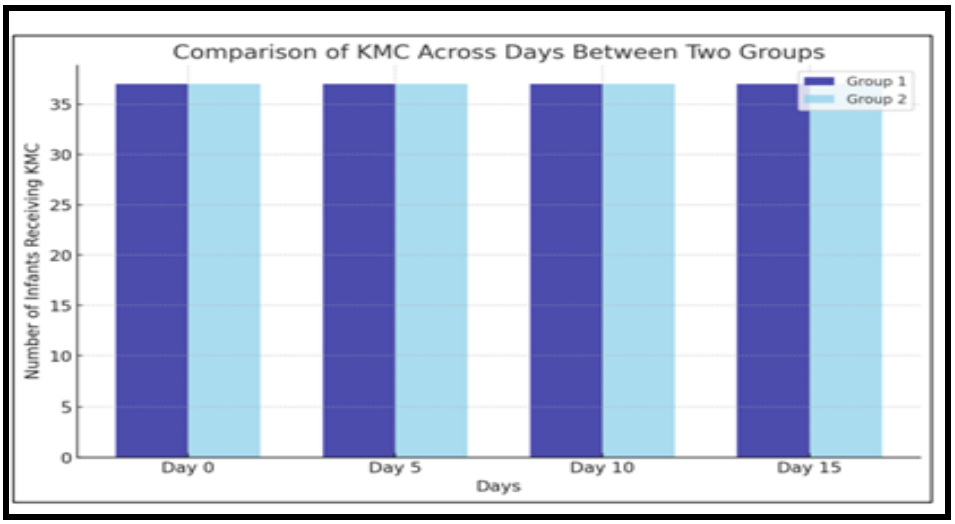

Figure 3: Kangaroo Mother Care (KMC) participation across two groups at four intervals: Day 0, Day 5, Day 10, and Day 15.

Table 2: Comparative Progression of Feeding Methods Between Group 1 and Group 2 (Gavage, Spoon Feed, and Breastfeeding)

Day	Feeding Type	Group 1 (N, %)	Group 2 (N, %)	χ^2, p-value
Day 0	Gavage Feed	Yes: 37 (100.0%)	Yes: 37 (100.0%)	–
	Spoon Feed	No: 37 (100.0%)	No: 37 (100.0%)	–
	Breastfeeding	No: 37 (100.0%)	No: 37 (100.0%)	–
Day 5	Gavage Feed	Yes: 20 (54.05%) No: 17 (45.9%)	Yes: 25 (67.6%) No: 12 (32.4%)	χ^2=1.42, p=0.234
	Spoon Feed	Yes: 10 (27.0%) No: 27 (73.0%)	Yes: 7 (18.9%) No: 30 (81.1%)	χ^2=0.31, p=0.580
	Breastfeeding	Yes: 7 (18.9%) No: 30 (81.1%)	Yes: 5 (13.5%) No: 32 (86.5%)	χ^2=0.09, p=0.752
Day 10	Gavage Feed	Yes: 10 (27.03%) No: 27 (72.9%)	Yes: 15 (40.54%) No: 22 (59.46%)	χ^2=1.51, p=0.219
	Spoon Feed	Yes: 18 (48.6%) No: 19 (51.4%)	Yes: 15 (40.5%) No: 22 (59.5%)	χ^2=0.218, p=0.634
	Breastfeeding	Yes: 9 (24.3%) No: 28 (75.7%)	Yes: 7 (18.9%) No: 30 (81.1%)	χ^2=0.08, p=0.777
Day 15	Gavage Feed	No: 37 (100.0%)	No: 37 (100.0%)	–
	Spoon Feed	Yes: 5 (13.5%) No: 32 (86.5%)	Yes: 9 (24.3%) No: 28 (75.7%)	χ^2=0.79, p=0.373
	Breastfeeding	Yes: 32 (86.5%) No: 5 (13.5%)	Yes: 28 (75.7%) No: 9 (24.3%)	χ^2=0.79, p=0.373

Table 3: Comparison of Amount of Feed between Group 1 & Group 2

			95% Confidence Interval			
Amount of Feed Day	**Group**	**Mean**	**Lower**	**Upper**	**SD**	**P value**
Day 0	Group 1	14.5	13.6	15.5	2.78	0.862
	Group 2	14.6	13.7	15.6	2.83	
Day 5	Group 1	37.7	34.7	40.8	9.16	0.547
	Group 2	36.5	33.7	39.3	8.38	
Day 10	Group 1	64.3	61.5	67.2	8.55	0.820
	Group 2	63.9	61.2	66.6	8.18	
Day 15	Group 1	101.7	98.1	105.3	10.71	0.399
	Group 2	99.5	95.7	103.3	11.47	

Table 4: Comparison of Time to Full Gavage Feed (Days) Between Group 1 and Group 2

Time to Full Gavage Feed (days)	Group 1 (N, %)	Group 2 (N, %)	Total (N, %)	p-value	χ^2
5	20 (54.1%)	11 (29.7%)	31 (41.9%)	0.099	4.62
6	12 (32.4%)	17 (45.9%)	29 (39.2%)		
7	5 (13.5%)	9 (24.3%)	14 (18.9%)		
Total	37 (100.0%)	37 (100.0%)	74 (100.0%)		
Mean ± SD (days)	4.92 ± 0.83	5.95 ± 0.74			

Table 5: Comparison of Feeding Efficiency and Sleep Parameters Between Group 1 and Group 2

Parameter	Group	Mean	95% Confidence Interval	SD	P value
			Lower – Upper		
Sleep Duration Between Feeds (hours)	Group 1	3.31	1.66 – 2.09	0.646	<0.001
	Group 2	2.33	2.19 – 2.47	0.412	
Total Volume Spoon Feed (ml)	Group 1	39.6	36.7 – 42.4	8.6	0.313
	Group 2	37.6	34.9 – 40.4	8.34	
Time to Full Breastfeed (days)	Group 1	15.7	14.63 – 16.78	3.21	<0.001
	Group 2	18.93	17.51 – 20.36	4.28	
Time to Complete Each Breast Feed (min)	Group 1	10.32	9.47 – 11.18	2.58	<0.001
	Group 2	15.35	14.52 – 16.18	2.48	

DISCUSSION

We evaluated the effectiveness of early oral motor stimulation in improving oral feeding outcomes in preterm infants. The gestational age distribution was comparable between the groups when assessed by LMP (p=0.076) and NBS (p=0.065), while ultrasound-based gestational age showed a significant difference (p=0.028), with Group 1 having more infants at earlier gestations. These distributions are consistent with studies by Otto [6] (2017), Atay [7] (2023), and Liu [8] (2011), though our study included a broader gestational range (28–35 weeks).

Delivery methods were nearly equally distributed (p=0.816), contrasting with higher caesarean rates seen in Otto [6] (2017) and Atay [7] (2023), but aligning with Bandyopadhyay [9] (2023). Resuscitation needs (12.16% overall) and respiratory distress rates were higher in Group 2, but differences were not statistically significant (p=0.286), in agreement with Arora [10] (2018) and Bandyopadhyay [9] (2023).

Non-nutritive sucking (NNS) and Kangaroo Mother Care (KMC) were uniformly applied in both groups, ensuring consistency of care. While our study didn't quantify NNS progression, Atay [7] (2023) and Li [11] (2024) reported improved sucking efficiency with interventions. Similarly, consistent KMC across groups aligns with its benefits described in Pereira [12] (2020).

Gavage feeding progressed faster in Group 1, with a shorter mean duration (4.92 vs. 5.95 days), though not statistically significant (p=0.099), echoing trends in Liu [8] (2011) and Rocha [13] (2007). Spoon feeding uptake showed no significant intergroup difference (p>0.05), though Group 1 showed slightly earlier initiation, consistent with Lyu [14] (2014) and Fucile [15] (2010).

Breastfeeding initiation and progression were similar between groups, but Group 1 reached full breastfeeding significantly earlier (15.7 vs. 18.93 days, p<0.001) and completed each session faster (10.32 vs. 15.35 minutes, p<0.001), highlighting the effectiveness of oral stimulation. These outcomes align with findings from Lyu [14] (2014), Zhang [16] (2014), and Nassar [17] (2021).

Feed volumes steadily increased in both groups without significant difference (p>0.05), though Group 1 consistently had slightly higher intake. Urine output and weight gain were also comparable, aligning with findings from Bandyopadhyay [9] (2023) and Liu [8] (2011), indicating minimal impact of stimulation on these parameters.

Finally, Group 1 had significantly longer sleep durations between feeds (3.31 vs. 2.33 hours, p<0.001), suggesting better feeding efficiency and rest. While Lemons [18] (2001) noted feeding influences on sleep, our study provides novel data on how oral stimulation may promote improved rest patterns in preterms.

Strengths of the Study

This study used a randomized controlled design, ensured uniform care protocols like KMC and NNS across groups, and included a wide gestational age range. Objective feeding measures and consistent follow-up enhanced the reliability and applicability of the findings.

Limitations of the Study

The sample size was relatively small, limiting statistical power for some outcomes. Long-term neurodevelopmental follow-up was not included. Feeding efficiency was assessed only during hospitalization, and subjective maternal factors influencing breastfeeding were not evaluated.

CONCLUSION

Early oral motor stimulation improved breastfeeding efficiency and reduced time to full feeding in preterm infants. Though not all results were statistically significant, the intervention showed clinical benefits and supports its integration into neonatal care for faster feeding progression.

Declaration by Authors
Ethical Approval: Approved.
Consent: Written consent secured.
Acknowledgement: None
Source of Funding: None
Conflict of Interest: None.

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How to cite this article: Pallavi Chauhan, Kalpana, Preeti Lata Rai. Early oral motor stimulation for promoting oral feeding in preterm infants: a randomized controlled trial. *Int J Health Sci Res.* 2025; 15(5):1-6. DOI: *https://doi.org/10.52403/ijhsr.20250501*

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