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Breastfeeding Outcomes and Longitudinal Weight Trajectories Among Mother-Infants Dyads Receiving Community-Based Lactation Support During the First Six Weeks of Life

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ABSTRACT: Early postnatal period is a critical window for establishing effective breastfeeding practices, yet mothers in rural communities' have limited access to continued, skilled lactation support post-delivery. This study aimed to assess maternal breastfeeding knowledge and longitudinal infant weight gain patterns within the first six weeks after birth. Infant weight was recorded at Days 0, 7, 14, 21, 28, 35, and 42. Breastfeeding knowledge was measured pre- and post-support intervention in three areas: infant positioning, latching and effective suckling, and overall breastfeeding knowledge. Changes in infant weight during follow-up were analysed using repeated measures analysis and linear mixed effects modelling with a random intercept specific to the infant to correct for within-infant correlations. Secondary factors of NICU admission and its interaction with time were explored. There was a significant increase in knowledge of appropriate positioning from 12.7% at baseline to 97.3% at Day 42, and in knowledge of latching and sucking from 28.2% to 81.8%. Mean weight from 2877 ± 444 g at Day 0 and subsequently increased to 3863 ± 464 g by Day 42. There was a significant time effect on infant weight ($F = 1770$, $p < 0.001$, partial $\eta^2 = 0.942$) with repeated measures analysis. The linear mixed-effects model yielded a strong longitudinal time effect ($F(6,654) = 1770$, $p < 0.001$), and a high ICC of 0.941 was observed in terms of the clustering of infants in the model. NICU had significantly lower overall weight than the non-NICU infants ($F(1,108) = 5.80$, $p = 0.018$), But rigorous clinical trials that involve non-counselled NICU subsets are required to assess the efficacy of the intervention alone and its post-NICU growth outcomes.

1. INTRODUCTION

Breastfeeding is one of the components of early-life nutrition and prevention of infectious morbidity; however, the optimal breastfeeding practice is not achieved in all cases. In 2023, only about 48% of infants under 6 months of age were exclusively breastfed, and only 46% of newborns started breastfeeding within 1 hour of birth, which represents a continued lack of timely and sustained breastfeeding supports. Breastfeeding offers nutrition and immunity protection in a growth spurting period and suboptimal breastfeeding rates have been linked to significant preventable childhood morbidity and mortality. Recent estimates of global losses show a potential impact of over 820,000 child deaths each year due to the failure to improve breastfeeding practices, highlighting the need for effective protection and support of breastfeeding. Ensuring the establishment of good

breastfeeding is especially influenced by mothers' hands-on abilities early in the postnatal period. Despite advances in maternal and infant health services in India, the recent NHFS-6 data indicate a concerning decline in exclusive breastfeeding. According to NHFS-6 the infants exclusively breastfed for 6 months were reduced from 63.7% in NFHS-5 (2019–21) to 55.8%, showing a 7.9% decrease.

Maintaining breastfeeding post discharge from hospital remains a substantial challenge. Improper maternal and family knowledge of infant positioning, latching and effective suckling can have implications for suboptimal breastfeeding practices & inadequate milk transfer resulting in implications for infant weight gain and breastfeeding related morbidity; hampering effective breastfeeding and can lead to poor consumption of breast-milk and slow weight gain in the early months.. Facility-based counselling tend to be insufficient once the mothers return to their communities where they may be less supported and some get entangled with several myths. Community-based lactation support can reinforce breastfeeding knowledge, address feeding difficulties and facilitate appropriate breastfeeding practices throughout this critical time.

Community breastfeeding support appears feasible in India too, based on evidence. To illustrate, the BEST4Baby programme was designed to be culturally sensitive, with culturally trained peer counsellors making multiple home visits to breastfeeding mothers in rural India and showing positive exclusive breastfeeding results. However, the evidence associating the type of lactation support in the community, shifts in maternal breastfeeding knowledge, and actual infant weight gain documented across the first six weeks in the baby's life is not as robust as it is for other Asian populations, including India's rural communities, and some babies with varying clinical features. Thus, the current study was conducted on pairs of mother and infant who were receiving lactation support in the community, from birth to the first six weeks post-birth.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

We implemented the support system study in villages around Chikkaballapur district, Karnataka, India, a prospective longitudinal study to evaluate maternal breastfeeding knowledge and infant growth. They study followed a structured community-based lactation support programme. The focused on early postnatal period of 42 days. The primary outcome was infant bosy weight measured at defined follow-ups and maternal knowledge assessed before and after exposure to the lactation support programme. In particular, NICU admission was considered a clinical characteristic of the infant and was examined as a secondary factor.

2.2 Study Population and Participant Recruitment

2.2 Study Population and Participant Recruitment

Mother–infant pairs participating in the community-based lactation-support programme were considered for enrolment. Mothers who provides consent and be available for community-based follow-up were required as inclusion criteria. Mothers and infants with significant medical conditions, chronic illnesses, or other conditions necessitating ongoing medical management were excluded from the study, as these factors could independently influence breastfeeding practices, infant feeding, or growth. NICU admission alone was not an exclusion criterion. Infants who required NICU admission but were subsequently available for community follow-up were retained in the study and included in the longitudinal analysis. A total of 150 mother–infant pairs were initially enrolled. During follow-up, 40 pairs were lost, either due to relocation from the study area or discontinuation of follow up. The remaining 110 mother–infant pairs (73.3% of the enrolled cohort) constituted the final analytical sample. The follow-up schedule was conducted from birth to 42 days of age at days 0, 7, 14, 21, 28, 35 and 42.

2.3 Community-Based Lactation Support Programme

The community-based lactation support programme was designed to provide mothers with practical, skills based breastfeeding support during the early post-natal period. The counselling content was structured with reference to Health Spoken Tutorial resources developed through the Spoken Tutorial Project, IIT Bombay. The training resources include dedicated breastfeeding sessions addressing the science of breastfeeding, early breastfeeding practices, breastfeeding positioning, cross-cradle hold, breast handling, latching, breastfeeding counselling points, management of breastfeeding difficulties, and practical demonstrations of positioning and latching.

2.4 Demonstration-Based and Hands-on Lactation Training

Practical breastfeeding skills were demonstrated using infant doll models and breast models to demonstrate appropriate infant handling, breast positioning, and attachment techniques. After the demonstration, mothers were encouraged to practice these techniques under supervision. Counsellors provided individualized guidance and, when necessary, direct assistance to support mothers in achieving correct infant positioning and attachment during breastfeeding. The HST resources specifically provide training on cross-cradle positioning, maternal preparation, infant positioning, breast holding, latching, breastfeeding counselling, and live demonstrations of positioning and latching.

2.5. Breastfeeding Counselling and Maternal Breastfeeding Knowledge Assessment

Mothers were received instructions on proper breast attachment and deep latching techniques. Demonstrations emphasized recognition of appropriate attachment and correction of ineffective attachment. Mothers were guided in recognizing effective suckling and identifying signs suggestive of ineffective breastfeeding. Counselling sessions also reinforced appropriate breastfeeding practices and addressed common difficulties encountered during the early postnatal period.

Maternal breastfeeding knowledge was assessed using the Breastfeeding Assessment Form incorporated into the Health Spoken Tutorial training (HST) resources. The HST curriculum specifically includes a session on the Breastfeeding Assessment Form, as well as components addressing breastfeeding positioning and counselling. Maternal knowledge was assessed at baseline and again following the community-based lactation-support programme.

The assessment focused on three principal domains:

1. Infant positioning
2. Latching and effective sucking
3. Overall breastfeeding knowledge

For the binary knowledge variables used in the present analysis, a score of 1 indicated that the mother demonstrated knowledge of both required components of the assessed concept. A score of 0 was assigned when the mother lacked knowledge of at least one of the required components. The same assessment framework was applied at baseline and follow-up to facilitate comparison of maternal knowledge over time.

2.5 Infant Weight Assessment, Study Variables and Outcome Measures

Infant body weight was the principal anthropometric outcome measure. Weight was recorded on Days 0, 7, 14, 21, 28, 35 and 42. The weighing procedure was standardized across all follow-up assessments as far as practically feasible. Infant weight was recorded in grams (g) and analysed as a continuous outcome in the longitudinal analyses. The primary objective was to characterize the trajectory of absolute infant weight over the first six weeks of life rather than to classify infants according to a single weight threshold.

2.6 Statistical Analysis

Statistical analyses were performed using Jamovi version 2.7, with the relevant statistical modules for repeated-measures and mixed-effects analyses. Continuous variables were summarized using mean, standard deviation, median, minimum and maximum, while categorical variables were summarized using frequencies and percentages. Changes in infant weight across the seven predefined time points were initially evaluated using repeated-measures analysis of variance (RM-ANOVA) by correlating the repeated measurements obtained from the same infant. To account for the correlation arising from repeated measurements within individual infants, a linear mixed-effects model (LMM) was fitted.

3. RESULTS AND DISCUSSION

3.1. **3.1** Participant Characteristics

The study included 110 mother–infant pairs who had infant weight measurements available at all scheduled follow-up assessments from Day 0 through Day 42. Maternal age data were available for 99 participants, with a median age of 26 years (interquartile range: 24–29 years). Maternal age was missing for 11 participants. Infant weight data were available for all 110 infants at each assessment point.

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Table no 1: Attrition data of sample population

Status	n
Initially enrolled	150
Completed follow-up	110
Relocated	10
Discontinued participation	10
Other	5
Lost to follow-up	15

3.2. Longitudinal Infant Weight Trajectory

A total of 110 mother–infant pairs were followed longitudinally from Day 0 to Day 42. The mean infant weight at Day 0 was 2877 ± 444 g. A decline in mean weight was observed during the first week, with the mean weight decreasing to 2700 ± 417 g at Day 7. Thereafter, infant weight increased progressively, reaching 2858 ± 419 g at Day 14, 3065 ± 426 g at Day 21, 3312 ± 442 g at Day 28, 3592 ± 451 g at Day 35, and 3863 ± 464 g at Day 42. Repeated-measures analysis demonstrated a significant change in infant weight across the seven follow-up time points (Greenhouse–Geisser corrected $F = 1770$, $p < 0.001$, partial $\eta^2 = 0.942$). Mauchly's test indicated violation of the assumption of sphericity ($W = 0.00539$, $p < 0.001$); therefore, the Greenhouse–Geisser correction was applied. Bonferroni-adjusted pairwise comparisons showed that mean weight was significantly lower at Day 7 than at Day 0 (mean difference = 177.2 g, $p < 0.001$). The difference between Day 0 and Day 14 was not statistically significant (mean difference = 18.9 g, $p = 1.000$), indicating recovery to approximately baseline weight by Day 14. Subsequently, significant increases in weight were observed between each consecutive follow-up assessment from Day 14 to Day 42 (all $p < 0.001$). Overall, the weight trajectory demonstrated an initial early postnatal decline followed by recovery and sustained weight gain throughout the 42-day follow-up period.

Repeated Measures ANOVA

Within Subjects Effects						
	Sphericity Correction	Sum of Squares	df	Mean Square	F	p
time	Greenhouse-Geisser	1.20e+8	2.04	5.89e+7	1770	<.001
Residual	Greenhouse-Geisser	7.41e+6	222.80	33276		
Note. Type 3 Sums of Squares						

Between Subjects Effects					
	Sum of Squares	df	Mean Square	F	p
Residual	1.39e+8	109	1.27e+6		
Note. Type 3 Sums of Squares					

Assumptions

Tests of Sphericity				
	Mauchly's W	p	Greenhouse-Geisser ε	Huynh-Feldt ε
time	0.00539	<.001	0.341	0.347

3.3. Breast feeding Practices

3.3.1. Mother's overall knowledge

The analysis included 110 mothers assessed at both Day 0 and Day 42. At Day 0, the mean value for the overall breastfeeding-knowledge criterion was 0.00 (SD = 0.00), indicating that none of the mothers met the predefined criterion for overall breastfeeding knowledge at baseline. At Day 42, the mean increased to 0.791 (SD = 0.409), indicating that 79.1% of mothers met the predefined overall breastfeeding-knowledge criterion at the end of follow-up.

Descriptives					
	N	Mean	Median	SD	SE
mother knowledge on breastfeeding at 0 day	110	0.000	0.00	0.000	0.0000
mother knowledge on breastfeeding at 42nd day	110	0.791	1.00	0.409	0.0390

3.3.2. Improvements in latching and Suction

Among the 110 mothers assessed at both time points, the mean score for latching and sucking was increased from 0.282 (SD = 0.452) at Day 0 to 0.818 (SD = 0.387) at Day 42. As the variable was binary, these values correspond to approximately 28.2% of mothers meeting the predefined criterion for appropriate latching and sucking at Day 0, compared with 81.8% at Day 42. Thus, the descriptive findings indicate an increase in the proportion of mothers meeting the latching and sucking criterion during the follow-up period.

3.3.3. Improvement in Baby Positioning

Infant positioning demonstrated a significant improvement between baseline and Day 42. At baseline, 14 of the 110 mother–infant pairs (12.7%) were classified as having the predefined desired positioning. By Day 42, this proportion had increased to 107 of 110 pairs (97.3%) with only three participants (2.7%) remained in the non-desired positioning category. The change in paired proportions was statistically significant according to McNamara's test ($\chi^2 = 93.0$, df = 1, $p < 0.001$), indicating a statistically significant improvement in infant positioning between baseline and Day 42. Overall, the findings demonstrate a substantial increase in the proportion of mother-infant pairs achieving the desired positioning during the follow-up.

Descriptives				
	LACTATION COUNSELLING	position of baby holding	latching and suction	mother knowledge on breastfeeding practice
N	No	52	52	52
	YES	69	69	69
	Yes	97	97	97
Missing	No	1	1	1
	YES	0	0	0
	Yes	0	0	0
Mean	No	0.442	0.346	0.0385
	YES	1.00	0.986	1.00
	Yes	0.979	0.990	0.979
Median	No	0.00	0.00	0.00
	YES	1	1	1

	Yes	1	1	1
Standard deviation	No	0.502	0.480	0.194
	YES	0.00	0.120	0.00
	Yes	0.143	0.102	0.143
Minimum	No	0	0	0
	YES	1	0	1
	Yes	0	0	0
Maximum	No	1	1	1
	YES	1	1	1
	Yes	1	1	1

Frequencies

Frequencies of position of baby holding				
position of baby holding	LACTATION COUNSELLING	Counts	% of Total	Cumulative %
0	No	29	13.3%	13.3%
	YES	0	0.0%	13.3%
	Yes	2	0.9%	14.2%
1	No	23	10.6%	24.8%
	YES	69	31.7%	56.4%
	Yes	95	43.6%	100.0%

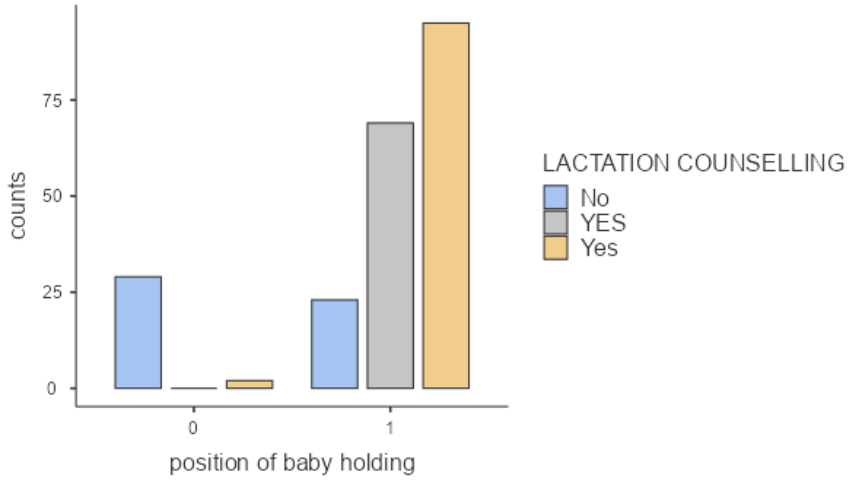
Frequencies of latching and suction				
latching and suction	LACTATION COUNSELLING	Counts	% of Total	Cumulative %
0	No	34	15.6%	15.6%
	YES	1	0.5%	16.1%
	Yes	1	0.5%	16.5%
1	No	18	8.3%	24.8%
	YES	68	31.2%	56.0%
	Yes	96	44.0%	100.0%

Frequencies of mother knowledge on breastfeeding practice				
mother knowledge on breastfeeding practice	LACTATION COUNSELLING	Counts	% of Total	Cumulative %
0	No	50	22.9%	22.9%

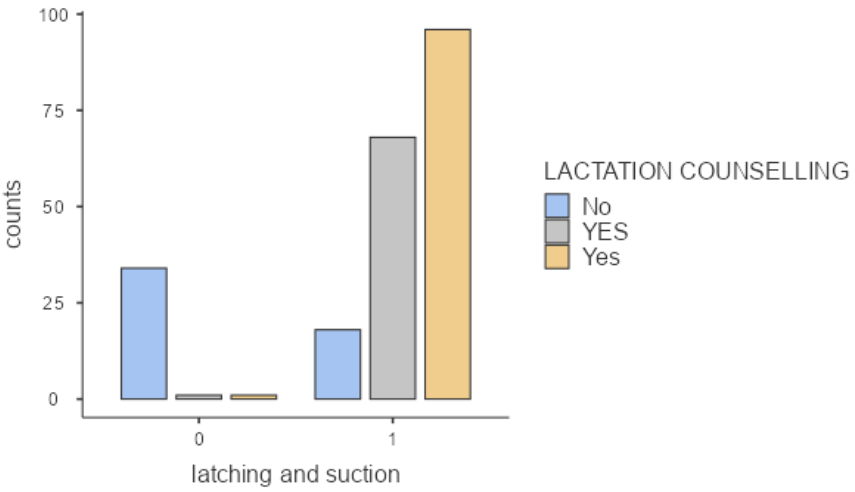
	YES	0	0.0%	22.9%
	Yes	2	0.9%	23.9%
1	No	2	0.9%	24.8%
	YES	69	31.7%	56.4%
	Yes	95	43.6%	100.0%

Plots

position of baby holding

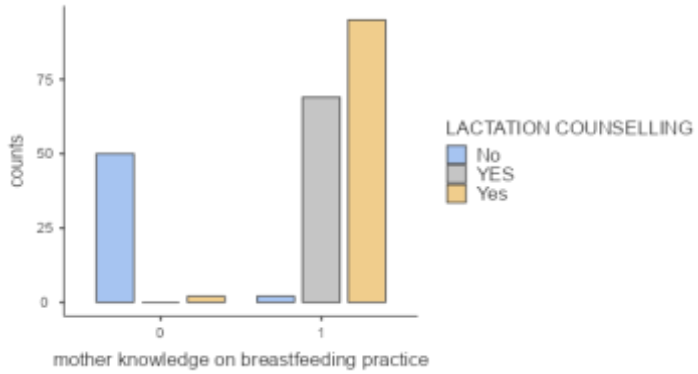


latching and suction



mother knowledge on breastfeeding practice

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3.4. NICU vs non-NICU growth trajectory

A repeated-measures ANOVA was performed to examine changes in infant body weight from Day 0 to Day 42 between NICU-admitted and non-NICU infants. The analysis demonstrated a significant main effect of time, indicating that infant body weight increased over the follow-up period, F (1,107) = 560.676, p < .001, partial η^2 = 0.840. A significant between-subject effect of NICU status was also observed, F (1,107) = 9.770, p = .002, partial η^2 = 0.084, indicating an overall difference in body weight between NICU-admitted and non-NICU infants. However, the Time × NICU status interaction was not statistically significant, F (1,107) = 0.769, p = .382, partial η^2 = 0.007. This indicates that the pattern of weight gain from Day 0 to Day 42 did not differ significantly between the two groups. Thus, although NICU-admitted and non-NICU infants demonstrated a significant increase in body weight, both groups demonstrated a similar pattern of longitudinal weight gain during the follow-up period.

3.5. Infant Weight Gain According to Lactation Counselling

Infant weight gain from Day 0 to Day 42 was compared between infants whose mothers who had received antenatal breastfeeding counselling those whose mothers had not. The mean weight gain was higher among infants whose mothers had received antenatal counselling (1008 ± 230 g) than among those whose mothers had not received counselling (897 ± 251 g), representing a mean difference of 111 g. However, this difference in mean weight was not statistically significant (t (108) = −1.96, p = .053, 95% CI −224 to 1.48 g). The standardized effect size was moderate (Cohen's d = −0.475). Levene's test indicated no significant difference in variance between the two groups (F = 0.107, p = .745). Therefore, the Student's t-test was used to compare mean weight gain between the groups.

Repeated Measures ANOVA

Within Subjects Effects					
	Sum of Squares	df	Mean Square	F	p
time	4.61e+7	1	4.61e+7	2214.739	<.001
time ✻ Child sex	14767	1	14767	0.709	.402
Residual	2.02e+6	97	20815		
Note. Type 3 Sums of Squares					

Between Subjects Effects					
	Sum of Squares	df	Mean Square	F	p
Child sex	1.44e+6	1	1.44e+6	4.15	.044
Residual	3.37e+7	97	347624		
Note. Type 3 Sums of Squares					

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Independent Samples T-Test								
		Statistic	df	p	Mean difference	SE difference		Effect Size
Weight Gain	Student's t	-1.96	108	.053	-111	56.8	Cohen's d	-0.475
Note. H_a $\mu_{No} \neq \mu_{Yes}$								

Infant weight gain and longitudinal weight trajectories were compared between female and male infants. Mean weight gain from Day 0 to Day 42 was 956 ± 195 g among female infants (n = 43) and 991 ± 211 g among male infants (n = 56). The difference in weight gain between the two groups was not statistically significant, t (97) = −0.842, p = .402, with a small effect size (Cohen's d = −0.171). Repeated-measures ANOVA demonstrated a significant main effect of time, F(1,97) = 2214.739, p < .001, confirming a significant increase in infant body weight between Day 0 and Day 42. A significant between-subject effect of infant sex was observed, F(1,97) = 4.15, p = .044, indicating an overall difference in body weight between male and female infants. However, the Time × Child Sex interaction was not statistically significant, F(1,97) = 0.709, p = .402, indicating that the pattern of weight gain over the follow-up period did not differ significantly between male and female infants

3.4 Discussion

The present study tracked the trend of these 110 mother-infant dyads from birth to Day 42 and found a distinct weight change trend throughout the first postnatal months, with significant gains in maternal feeding knowledge of infants and breastfeeding-related behaviours. Initial decrease in weight took place up to 07 days followed by gradual gain from the day 07 to day 42. The birth weight was 2877 g and after 6-weeks of follow-up the final weight was 3863 g, providing a mean gain of around 986 g. The repeated measures analysis also revealed a highly significant change in weight with a large effect size (Greenhouse–Geisser corrected F = 1770, p < .001, partial η^2 = 0.942). The overall pattern of weight loss followed by weight gain is physiologic for the early neonatal weight change, which is characteristic of neonates with a usual weight loss in the first postnatal days followed by a weight gain until the infant reaches birth weight, then a leveling off period of sustained growth. The present trajectory thus offers, therefore, an important longitudinal description in addition to only relying on birth and final follow-up measurements.

Notably of interest in the breast feeding setting is the marked weight gain after the first week. WHO and UNICEF highlight the need for breastfeeding counselling to be a continuum starting from the pregnancy and extending to the postnatal period; counselling to include practical breastfeeding skills, and anticipatory guidance on common breastfeeding challenges (WHO/UNICEF, 2021). Current evidence also shows that intervention to support breastfeeding is correlated with better breastfeeding practices and breastfeeding persistence rather than significant short-term anthropometric outcomes of infants (Patel et al, 2023; Dib et al, 2024). In the present cohort, it is crucial to note that weight gain has been observed to be sustained and that this needs to be interpreted as a positive outcome over a period of time that has occurred alongside the support provided for breastfeeding rather than as evidence that it were counselling alone that was responsible for the observed weight gain. One of the significantly high results that showed in the present study was the increase in maternal knowledge about breastfeeding from Day 0 to Day 42. None of the 110 mothers were able to meet the overall knowledge criterion at baseline, while 79.1% of them would meet the criterion at Day 42. Likewise, for the appropriate latching and sucking rate, the number of children meeting the criterion would increase from around 28.2% at the baseline until 81.8% on Day 42. Appropriate baby positioning had no better effect, improving from 12.7% at initiation to 97.3% at Day 42, and was found to be highly significant (McNemar's test, χ^2 = 93.0, p < .001). The results indicate that the intervention brought better results in closer breastfeeding outcomes to the intervention such as practical breastfeeding skills and maternal understanding, which are immediate outcomes of breastfeeding counseling. This pattern is similar to recent research which proves that learning and information sessions for education and counselling can be used to help increase the knowledge, confidence and self-efficacy regarding breastfeeding and the actual breastfeeding practice. The systematic review revealed that prenatal breastfeeding education programs established with a systematic structure led to increasing the breastfeeding knowledge, attitudes and self-efficacy levels of women (Kehinde et al., 2023). Likewise, a systematic review of 40 randomized controlled trials showed that breastfeeding self-efficacy increased strongly after any breastfeeding education algorithm (Maleki et al., 2021). The changes in knowledge and positioning and latching scores gave behavioural evidence of knowledge gained by mothers during follow-up, although this was not directly measured in this study, given the large gains reported in these scores. The findings also endorse the idea of not teaching

breastfeeding only by transmitting information but by demonstrating, observing and correcting breastfeeding techniques. Those recent clinical guidelines have shed light on positioning, attachment and effective milk transfer as key elements of the breastfeeding support (Pommeret-de Villepin et al., 2022).

The change in positioning noted in the present study is of special interest as positioning and attachment are learned skills that can directly impact the efficacy and comfort of breastfeeding. WHO's integrated infant and young child feeding counselling materials focus on actions rather than on information – counselling and demonstration of breastfeeding skills (WHO andUNICEF,2021). Basically, the evidence from the intervention studies in education implies that it is better to use both information and skills training than to provide information without using skills training. Breastfeeding education programs indicated through a systematic review and meta-analysis of interventions that a combination of lecture and skills-enhancing education resulted in better breastfeeding outcomes and lower breast-feeding related difficulties (2021). The structured counselling technique employed in the current study, with practical demonstrations and reinforcement, might therefore account for the greatest improvement in positioning and latching and mothers' knowledge.

Results also confirm other evidence from LMICs. In their systematic review of breastfeeding support packages in LMICs, Rana et al. (2021) identified that multifaceted breastfeeding interventions may have a positive effect on breastfeeding practices but inconsistent effect size according to intervention component, timing, provider and context. Patel et al. (2023) found that, overall, EE&S interventions have a positive effect on breastfeeding outcomes for initiation and exclusive breastfeeding, but there is significant variation in the impact of the individual interventions. The relevance of these observations to the present communitybased study is that family support, contact with the health services and socio-economic factors and cultural practices as well as maternal knowledge, play a part in the process of breastfeeding. The results of the current study thus corroborates the benefits of structured Counselling integrated within a wider system of community-based maternal and child health services.

The results from the infant growth measurement should also not be used to infer changes in the knowledge or technique of breastfeeding that occurred. Significant difference was not observed between infant weight gain according to antenatal counselling of breastfeeding and infant skill development despite significant increase of maternal knowledge and skills on breastfeeding. The mean antenatal counselling received by infants and their weight gain up to 42 days was 1008 ± 230 g and 897 ± 251 g, respectively, and difference of 111 g (descriptive) was observed between the two groups. However, this difference did not reach conventional statistical significance ($t(108) = -1.96$, $p = .053$; 95% CI −224 to 1.48 g).

The standardized effect size (Cohen's $d = -0.475$) indicated a moderate effect size, meaning that the lack of significance should not be taken as an indicator that the groups are the same. Instead, the present study found there was a tentative difference, which may not be reliable enough in this sample to determine if it is meaningful. This evidence fits very well into the current systematic-review evidence. Dib et al. (2024) reviewed 32 studies that investigated interventions aiming to increase exclusive breastfeeding and results showed there was a significant increase in exclusive breastfeeding rates without any overall significant impact on infant/child growth. An informative difference between the behavioural outcomes and the anthropometric outcomes was demonstrated: an intervention aimed at improving breastfeeding practices can be effective at influencing this behavior without there being a measurable difference in infant weight (anthropometric) over a relatively short time frame. Breastfeeding counselling or education may have a low level of certainty for its effect on infant weight at one and two months as there is significant risk of bias and indirectness (Mohandas et al., 2024). The overall results of the present study, therefore, suggest that the small improvement in weight gain that was seen in the counselling group may be biologically plausible, and such gains point to a difference with caution. This is because there is a difference between antenatal counseling and the structured lactation counseling which was implemented during the study. Antenatal counselling is exposure to breastfeeding related information before birth, and could vary greatly in content, intensity and timing from the structured postnatal counselling that is part of the present programme. There is evidence that antenatal education may support breastfeeding initiation and knowledge, and post-natal interventions following birth may have a greater impact when provided with post-natal education (Kehinde et al., 2023; Oggero et al., 2024). A recently published systematic review identified an association between interventions with a psychological component or extra in-person postpartum intervention and an effect on breastfeeding duration beyond 12 weeks (Oggero et al., 2024). The present finding of a slight but non-statistically-significant difference in weight gain between the antenatal and non-counselled groups should therefore not be interpreted as an indication against the use of structured lactation support postnatally. The present findings also align with the fact that the most measurable advantages of breastfeeding support are likely to be related to prolongation of breastfeeding, and increasing maternal capabilities as opposed to immediate changes in infant

growth. In a systematic review and meta-analysis of lactation consultant interventions (2025), exclusive and any breastfeeding proportions in discontinued mothers were lower; and the duration of any breastfeeding was longer, but there was some uncertainty about effects on infant growth.In a systematic review and metaanalysis of lactation consultant interventions (25) not only were proportions of mothers who ceased breastfeeding exclusive and proportions of mothers who ceased breastfeeding any breastfeeding reduced, but also was the duration of any breastfeeding increased; however there was some uncertainty about effects on infants' growth. Likewise, evidence for wider infant health outcomes was less assessed and varied, and support interventions for breastfeeding led to improvements in breastfeeding outcomes; 90 randomized trials involving nearly 50,000 participants were included in the evidence review, which was recently updated for the US Preventive Services Task Force (US Preventive Services Task Force Evidence Review, 2025). The results of this study are similar to what has been seen in the current study, as the maternal breastfeeding outcomes differed significantly within their exposure groups, but the difference in infant weight gain between these groups did not meaningfully outpace the differences between the groups. One more way in which the NICU analysis helps in understanding infant growth is by analyzing the situation from one separate angle. However, based on the overall interaction between time and infant weight an overall effect of time was found in the present study, which confirmed that infants gained weight from Day 0 to Day 42. Additionally, there was a large group difference between the NICU and non-NICU groups in terms of weight overall. However, the weight change over time, separated by NICU exposure, was not statistically significant ($p = .382$) and there was no statistically significant difference between the weight change over time of infants admitted to the NICU with and without admission to the NICU. NICU-admitted infants therefore had significantly different weight at birth from those who did not require such hospitalization, but showed similar patterns on a longitudinal growth scale on follow-up. Weighing differences between groups are not necessarily differences in the rate or pattern of growth because this distinction is important as it identifies a different clinical population who may be of lower birth weight, have more illness burden or have different feeding problems in the early period and therefore be at risk of different incremental rates of growth from the outset of their time in the NICU. The non-existence of significant interaction is especially important because it implies that the longitudinal community follow up and support with feeding were appropriate in infants with varying early clinical histories. But it is not to be inferred that counselling led infants gained better growth than those who were not counselled. The current study did not have a separate untreated NICU comparison group that was specifically utilised to test the causal effect of the counselling in this NICU subset. Recent findings highlight the need for integrated interventions with trained health care workers, maternal education, and family support in addition to appropriate clinical follow-up for babies with higher clinical vulnerability, to support breastfeeding. Further, evidence for infants with growth faltering is skimpy, and is typically weak or very weak (Mohandas et al., 2023; Mohandas et al., 2024). The present results, then, do offer some descriptive evidence for ongoing weight gain among NICU and non-NICU infants but are hypothesis generating with regard to the impact of counselling. The general results confirm that it is necessary to see the process of breastfeeding support as a process, not just one education event. For antenatal and postnatal periods, WHO and UNICEF recommend to provide counselling, and highlight the need for trained providers, and for repeated contacts and anticipatory guidance (focusing on future pregnancy encounters) (WHO and UNICEF, 2021). Representing further evidence of the timing and intensity of breastfeeding support, recent evidence shows that it plays a role in the effectiveness. Duminovitch et al. (2021) conducted a meta-analysis of lactation consultant interventions in 2021 and included information from a 2025 update. In 2021's expanded analysis, increased effects on breastfeeding continuation were found with earlier postpartum support, and with more intense lactation consultant interventions, in 2025. There may have been opportunities for mother to be reinforced, and provide corrective information and consolidation of skills for mother to work her technique through and through the repeated follow up of the present study until Day 42, which would not necessarily have been provided during a single counselling session. The study is significant for community based maternal and child health programmes, implemented in rural areas. There was a significant improvement in knowledge, positioning and latching abilities, implying that the provision of structured breastfeeding counselling can fill the gap of practices that has been faced by mothers, even if their baseline knowledge is low. As evidenced by various studies, community support and professional breastfeeding support can have a positive effect on breastfeeding practices in LMIC settings (Rana et al., 2021; Patel et al., 2023). The results further reinforces the importance of standardised counselling information and hands on demonstrations and follow up, as opposed to verbal routine advice. The WHO recent competency and skills framework for breastfeeding support providers also include, in addition to the hours of training, the prevention of critical demonstrated competence in knowledge, skills and attitudes (WHO, 2026). There are some areas that need to be addressed. First, the study took place in a community-based setting, so although findings might be applicable to other populations and health-care contexts, it is not certain. Second, the infant weight was collected at all planned checkpoints for 110 infants where there was a

42-day window for assessment of longer duration breastfeeding continuation and growth; however, there are some infants that did not have infant weight measurements conducted at every time point. Third, the comparison based on antenatal counselling was not randomized; hence, residual confounding and possible differences between the group of mothers who received and that who did not receive antenatal counselling cannot be ruled out. Fourth, there were different groups in terms of the groups size in the ANC counselling comparison with 21 mothers in the non-counselled group, and 89 in the group counselled group, thus limiting the statistical power in detecting between group differences. Lastly, improved knowledge and breastfeeding technique could be a consequence of repeated exposure to assessments and follow-up services, as well as to counseling. These factors emphasize the importance of careful application of causal statements.

The use of the same mother-infant pair throughout the entire first postnatal month from birth to Day 42 enabled a detailed analysis of the early postnatal weight trajectory to be made rather than using two measurements only. Allows for simultaneous assessment of infant growth and of breastfeeding outcomes parents. Both the improvements in knowledge, positioning and latching and the growth analysis suggest that the intervention had measurable proximal breastfeeding outcomes, and that the analysis provided valuable information about infant trajectories in a community setting. Findings will also provide evidence from a population in the rural context of India, where context-specific breastfeeding support is important. The findings from the study indicated that structured breastfeeding support resulted in significant increases in breastfeeding knowledge among the mothers, positioning of baby, latching and sucking skills among the infants, and a period of weight loss that lasted until Day 42 among the infants. All infants showed meaningful weight gains over time, but there were differences in the overall weights between infants with and without a NICU admission. Antenatal breastfeeding counselling showed a descriptively higher mean weight gain of infants of 111 g in the primary 42 days of life, but the difference was not significantly different from the conventional level of significance.

4. CONCLUSION

Community-based lactation support services were found to be associated with statistically significant improvements in mothers' breastfeeding knowledge, progression in infant weight recovery and weight gain within the first 6 weeks of life. Importantly, the infants admitted to the NICU who received support also showed that they gained weight over the course of the study, even though their total weight was lower than that of the non-NICU infants. Taken together, these findings suggest that the most immediate and consistent benefits of structured breastfeeding support may be improvements in maternal knowledge and breastfeeding technique, whereas measurable effects on infant weight may require larger samples, longer follow-up and more rigorous control of potential confounding. The results support continued integration of structured, competency-based breastfeeding counselling into community maternal and child health services, with repeated antenatal and postnatal contact and particular attention to mothers and infants requiring additional support.

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AUTHOR CONTRIBUTIONS

Dr Neethu Asokan: Conceptualization, Investigation, Methodology, Data Curation, Formal Analysis, Supervision, Writing—Review & Editing.

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CONFLICT OF INTEREST-The authors declare that there is no conflict of interest.

ETHICS STATEMENT

Ethical approval was not required for this study as it was an ongoing intervention in the hospital an only data was collected.

DATA AVAILABILITY STATEMENT

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

REFERENCES

[1] D'Hollander CJ, McCredie VA, Uleryk EM, Kucab M, Le RM, Hayosh O, et al. Breastfeeding support provided by lactation consultants: a systematic review and meta-analysis. JAMA Pediatr. 2025;179(5):508-520. doi:10.1001/jamapediatrics.2024.6810.

[2] Dib S, Fair FJ, McCann LJ, Nicholls A, Kalea AZ, Soltani H, et al. Effects of exclusive breastfeeding promotion interventions on child outcomes: a systematic review and meta-analysis. Ann Nutr Metab. 2024;80(2):57-73. doi:10.1159/000535564.

[3] Kehinde J, O'Donnell C, Grealish A. The effectiveness of prenatal breastfeeding education on breastfeeding uptake postpartum: a systematic review. Midwifery. 2023;118:103579. doi:10.1016/j.midw.2022.103579.

[4] Maleki A, Faghihzadeh E, Youseflu S. The effect of educational intervention on improvement of breastfeeding self-efficacy: a systematic review and meta-analysis. Obstet Gynecol Int. 2021;2021:5522229. doi:10.1155/2021/5522229.

[5] Mohandas S, et al. Effectiveness of postnatal maternal or caregiver interventions on outcomes among infants under six months with growth faltering: a systematic review. Nutrients. 2024;16(6):837. doi:10.3390/nu16060837.

[6] Mohandas S, Rana R, Sirwani B, Kirubakaran R, Puthussery S. Effectiveness of interventions to manage difficulties with breastfeeding for mothers of infants under six months with growth faltering: a systematic review update. Nutrients. 2023;15(4):988. doi:10.3390/nu15040988.

[7] Muraleedharan Rohini A, Elavally S, Saradakutty G. Effectiveness of breastfeeding education compared to standard hospital information on exclusive breastfeeding among mothers: a systematic review. J Educ Health Promot. 2022;11:125. doi:10.4103/jehp.jehp_708_21.

[8] Oggero MK, Rozmus CL, LoBiondo-Wood G. Effects of prenatal breastfeeding education on breastfeeding duration beyond 12 weeks: a systematic review. Health Educ Behav. 2024;51(5):665-676. doi:10.1177/10901981231220668.

[9] Patel A, et al. Interventions for promoting and optimizing breastfeeding practices: an overview of systematic review. Front Public Health. 2023;11:984876. doi:10.3389/fpubh.2023.984876.

[10] Pommeret-de Villepin B, Barasinski C, Rigourd V. Initiating and supporting breastfeeding: guidelines for interventions during the perinatal period from the French National College of Midwives. J Midwifery Womens Health. 2022;67 Suppl 1:S56-S73. doi:10.1111/jmwh.13420.

[11] Purohit H, Bhatt G, Patel N, Prajapati S, Mehariya V. Effect of antenatal breastfeeding counseling on early initiation and exclusive breastfeeding in India: systematic review and meta-analysis. Breastfeed Med. 2026. doi:10.1177/15568253261473721.

[12] Rana R, McGrath M, Sharma E, Gupta P, Kerac M. Effectiveness of breastfeeding support packages in low- and middle-income countries for infants under six months: a systematic review. Nutrients. 2021;13(2):681. doi:10.3390/nu13020681.

[13] Resvick H, Foster A, Hartman B, DaSilva O, Coughlin K, Madill J. Breastfeeding supports growth in small for gestational age infants: a systematic review and meta-analysis. Acta Paediatr. 2025;114(2):258-271. doi:10.1111/apa.17490.

[14] US Preventive Services Task Force Evidence Review. Interventions to support breastfeeding: updated evidence report and systematic review for the US Preventive Services Task Force. JAMA. 2025.

[15] World Health Organization, United Nations Children's Fund. Implementation guidance on counselling women to improve breastfeeding practices. Geneva: World Health Organization; 2021.

[16] World Health Organization, United Nations Children's Fund. Infant and young child feeding counselling: an integrated course. Trainer's guide. 2nd ed. Geneva: World Health Organization; 2021.

[17] World Health Organization. Ensuring competency for providers of breastfeeding support and care. Geneva: World Health Organization; 2026.