ORIGINAL RESEARCH ARTICLE

NATIONAL JOURNAL
NJ MR
MEDICAL RESEARCH

Caesarean Section is Associated with Reduced Early Lactation Performance and Serum Prolactin Levels Compared to Vaginal Delivery: A Prospective Observational Study

Babita Singh[1*], Monica Verma[2], Shraddha Paliwal[3]

[1-3]Department of Obstetrics and Gynaecology, MGM Medical College, Indore, India

DOI:
10.55489/njmr.160320261384

***Corresponding author**:
Dr. Babita Singh
(Email: babita.1093@gmail.com)

Date of Submission: 09/04/2026
Date of Acceptance: 15/06/2026
Date of Publication: 01/07/2026

Funding Support:
None Declare

Conflict of Interest:
The authors have declared that no conflict of interest exists.

How to cite this article:
Singh B, Verma M, Paliwal S. Caesarean Section is Associated with Reduced Early Lactation Performance and Serum Prolactin Levels Compared to Vaginal Delivery: A Prospective Observational Study. Natl J Med Res 2026;16(03):159-166. DOI: 10.55489/njmr.160320261384

ABSTRACT

Background: Breastfeeding is essential for neonatal nutrition, immunity, and maternal health, with early initiation influenced by mode of delivery and hormonal factors such as prolactin. This study aimed to compare breastfeeding effectiveness and serum prolactin levels in women undergoing normal vaginal delivery (NVD) and caesarean section (CS) using the LATCH scoring system.

Methods: This prospective observational study included 800 postpartum women (400 NVD, 400 CS) in a tertiary care hospital in central India over 18 months. Breastfeeding effectiveness was assessed using the LATCH score at 1 hour and 24 hours postpartum. Serum prolactin levels were measured at the same time points. Sociodemographic, obstetric, and clinical variables were recorded. Statistical analysis included t-tests, chi-square tests, correlation, and regression models.

Results: Baseline characteristics differed significantly in age and education between groups. At 1-hour postpartum, mean LATCH scores were comparable between NVD and CS groups (4.98 ± 1.81 vs. 4.96 ± 1.74; p = 0.889). At 24 hours, NVD had significantly higher LATCH scores than CS (5.99 ± 1.89 vs. 5.05 ± 1.78; p <0.001). Serum prolactin levels were significantly higher in NVD at both 1 hour (304.30 ± 21.10 vs. 264.74 ± 34.24 ng/mL) and 24 hours (346.75 ± 30.44 vs. 322.34 ± 36.26 ng/mL; p < 0.001). A weak positive correlation was observed between 24-hour LATCH scores and prolactin levels. Mode of delivery was an independent predictor of prolactin levels but not LATCH score.

Conclusion: Caesarean delivery is associated with reduced early breastfeeding performance and lower serum prolactin levels compared to vaginal delivery, particularly evident by 24 hours postpartum. Targeted lactation support is recommended for caesarean-delivered mothers to improve breastfeeding outcomes.

Keywords: Breastfeeding, LATCH score, Prolactin, Caesarean section, Vaginal delivery

Copy Right: The Authors retain the copyrights of this article, with first publication rights granted to Medsci Publications.
License Term: Creative Commons Attribution-Share Alike (CC BY-SA) 4.0
Publisher: Medsci Publications [www.medscipublications.com] ISSN: 2249 4995 Official website: www.njmr.in

INTRODUCTION

Breastfeeding is a vital and natural process that provides optimal nutrition and immunological protection to infants while offering substantial health benefits to mothers. Exclusive breastfeeding for the first six months of life is recommended as the ideal feeding practice, as breast milk contains a balanced composition of nutrients, enzymes, hormones, and bioactive compounds essential for growth and development. In addition to meeting nutritional requirements, breastfeeding protects infants against gastrointestinal and respiratory infections, allergies, and chronic diseases later in life, including obesity and type 2 diabetes. Furthermore, the presence of essential fatty acids and docosahexaenoic acid (DHA) contributes significantly to neurological and visual development during early infancy.[1,2]

Breastfeeding also confers several maternal health benefits. It promotes postpartum recovery through oxytocin-mediated uterine contraction, thereby reducing the risk of postpartum haemorrhage. Breastfeeding supports lactational amenorrhoea, facilitates return to pre-pregnancy weight, and lowers the long-term risk of breast, ovarian, and endometrial cancers.[2,3] Additionally, close physical contact during breastfeeding strengthens mother-infant bonding and promotes maternal emotional well-being through the release of oxytocin and prolactin.[1]

Successful breastfeeding is influenced by multiple maternal, neonatal, and environmental factors. Maternal knowledge and confidence, family and healthcare support, cultural beliefs, infant feeding reflexes, and timely initiation of breastfeeding all contribute to breastfeeding effectiveness. Among these factors, proper infant latch is crucial, as it ensures efficient milk transfer and prevents complications such as nipple trauma, breast engorgement, and feeding difficulties.[4] The LATCH scoring system is a widely used clinical tool for assessing breastfeeding effectiveness. It evaluates five components-Latch, Audible swallowing, Type of nipple, Comfort, and Hold-each scored from 0 to 2, yielding a total score ranging from 0 to 10. Higher scores indicate effective breastfeeding, while lower scores help identify mothers requiring additional lactation support.[5]

Mode of delivery is an important determinant of early breastfeeding success. Women who undergo vaginal delivery are more likely to initiate breastfeeding within the first hour after birth, often referred to as the "golden hour," which facilitates early establishment of breastfeeding and stimulates hormonal pathways involved in milk production.[6] Early skin-to-skin contact and unrestricted maternal mobility following vaginal birth further enhance breastfeeding performance and are associated with higher LATCH scores.[7] In contrast, mothers undergoing caesarean section frequently encounter barriers such as postoperative pain, effects of anaesthesia, delayed mother-infant contact, and restricted mobility, which may negatively affect breastfeeding initiation and effectiveness.[8]

These challenges may also influence maternal hormonal responses. Prolactin plays a central role in the initiation and maintenance of lactation, and its secretion is stimulated by early and frequent breastfeeding. Delayed breastfeeding initiation following caesarean delivery may result in lower prolactin levels and delayed lactogenesis, thereby compromising milk production and breastfeeding outcomes.[9] The LATCH score provides an objective assessment of breastfeeding performance and may reflect these physiological differences between modes of delivery.[10] The LATCH score reflects the behavioural and mechanical adequacy of breastfeeding, whereas serum prolactin reflects the underlying hormonal drive for milk synthesis; together, these complementary clinical and biochemical measures provide a more complete picture of early lactation than either parameter alone, since a mother may demonstrate adequate latch technique despite suboptimal hormonal response, or vice versa. Evaluating both parameters concurrently among women with different modes of delivery may therefore provide valuable insights into breastfeeding dynamics and help identify mothers requiring targeted lactation support.[11]

This study aimed to evaluate and compare the effectiveness of breastfeeding in women who underwent caesarean section versus normal vaginal delivery during the early postpartum period, using the LATCH scoring system as the primary assessment tool and serum prolactin levels measured at 1 hour and 24 hours postpartum as a biochemical correlate, while also identifying sociodemographic, obstetric, and clinical factors influencing breastfeeding outcomes and prolactin secretion in both groups.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective observational comparative study conducted in the Department of Obstetrics and Gynaecology at Maharaja Tukojirao Hospital (MTH), Mahatma Gandhi Memorial (MGM) Medical College and Maharaja Yeshwantrao (MY) Hospital, Indore, Madhya Pradesh, India - a tertiary-care government teaching hospital serving central India. The study was conducted over a period of 18 months. Ethical approval was obtained from the Institutional Ethics Committee prior to commencement, and written informed consent was obtained from each participant before enrollment.

Study Population and Sampling: All postpartum women admitted to the labour and postnatal wards of the participating hospitals during the study period were screened for eligibility by the study investigators. Women fulfilling the predetermined eligibility criteria and providing informed consent were enrolled consecutively as they presented, until the predetermined sample size of 400 was achieved in each group based on mode of delivery: Group I comprised 400 women who delivered vaginally (normal vaginal delivery, NVD), and Group II comprised 400 women who underwent caesarean section (CS). Recruitment continued in parallel for both groups throughout the study period; once a group reached its target of 400, further eligible women in that category were not enrolled, while consecutive enrolment continued in the other group until its target was met.

Sample Size Calculation: Sample size was calculated using G*Power software (version 3.1.9.2). Assuming a prevalence of 0.50, a confidence level of 95% ($Z = 1.96$), and an absolute precision of 0.05, the minimum required sample size per group was determined using the formula $n = Z^2 \times p \times (1 - p) / e^2$.

The calculated sample size was ≈ 385. Accounting for potential dropouts and to achieve 90% statistical power, the final sample size was set at 400 participants per group (800 total).

Eligibility Criteria: Women were eligible for inclusion if they: (i) were admitted in the early postpartum period; and (ii) provided written informed consent for participation in the study.

Women were excluded if they: (i) were admitted to the Intensive Care Unit (ICU) at the time of enrolment; (ii) had an extreme preterm delivery; or (iii) had neonates requiring immediate transfer to the Neonatal Intensive Care Unit (NICU) following delivery.

Data Collection: A pre-tested, pre-validated structured proforma was used to collect data from participants and corroborated with medical records. Data collection encompassed the following domains: 1) Sociodemographic profile: age, place of residence (urban/rural), religion, educational attainment, occupation, and monthly household income; 2) Medical and obstetric history: presenting complaints, history of chronic medical or surgical illness, current medications, family history, personal habits (dietary, sleep, bowel/bladder), history of substance use, menstrual history, gravida-para-living-abortus (GPLA) status, antenatal complications, antenatal care (ANC) and immunisation records, mode of delivery, and timing of breastfeeding initiation; 3) Clinical examination: general physical examination and systemic examination; and 4) Laboratory investigations: complete blood count (CBC), liver function tests (LFT), renal function tests (RFT), fasting lipid profile, fasting and postprandial blood glucose, thyroid profile, and serum prolactin levels measured at 1 hour and 24 hours postpartum.

Outcome Measures and Assessment Tools

LATCH Breastfeeding Assessment Score[12]: Breastfeeding efficacy was evaluated using the LATCH scoring system, a validated and widely used clinical tool that provides a standardized method for assessing individual breastfeeding sessions. The acronym LATCH corresponds to five observable components: Latch, Audible swallowing, Type of nipple, Comfort (breast/nipple), and Hold (positioning). Each component is scored on a three-point ordinal scale (0, 1, or 2), yielding a composite total score ranging from 0 to 10. Higher scores indicate more effective breastfeeding. Scores were interpreted as follows: 0-3 = Poor, 4-7 = Moderate, and 8-10 = Good breastfeeding efficacy. LATCH assessments were performed and recorded independently in both groups at 1 hour and 24 hours postpartum.

Serum Prolactin Measurement: Serum Prolactin Measurement: Serum prolactin concentrations were measured as a biochemical correlate of lactogenesis. Venous blood samples (3 mL) were collected from all participants by venepuncture at two predetermined time points: 1 hour postpartum (immediately following the first breastfeeding attempt) and 24 hours postpartum (following the corresponding breastfeeding session at that timepoint), to allow temporal correlation between LATCH assessment and hormonal status. Samples were allowed to clot, centrifuged, and the separated serum was analysed using a chemiluminescent immunoassay (CLIA) on an automated analyser in the institutional biochemistry laboratory. Internal quality control sera (normal and pathological levels) were run with each batch, and only results within acceptable control limits were accepted. Prolactin levels at both time points were compared between the NVD and CS groups and correlated with corresponding LATCH scores.

Statistical Analysis:

All data were entered and cleaned using Microsoft Excel, and statistical analyses were performed using IBM SPSS Statistics, version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) when normally distributed, or as median with interquartile range (IQR) when non-normally distributed, as appropriate. Categorical variables were expressed as frequencies and percentages.

Between-group comparisons of continuous variables were performed using the independent samples t-test for normally distributed data and the Mann-Whitney U test for non-parametric data. Categorical variables were compared using the Chi-squared (χ^2) test or Fisher's exact test, as appropriate. Pearson's or Spearman's correlation coefficient was used to assess the relationship between LATCH scores and serum prolactin levels. A two-tailed p-value of < 0.05 was considered statistically significant for all analyses.

Ethical Considerations:

The study protocol was reviewed and approved by the Institutional Ethics Committee (Ref no. EC/MGM/May-24/66, Dated: 13/11/2024) before initiation of the study. All procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki (revised 2013). Written voluntary informed consent was obtained from each participant or their legally acceptable representative prior to enrolment. Participant confidentiality was maintained throughout the study. As the study was conducted at a government tertiary-care hospital where all investigations and treatments are provided free of cost, no additional financial burden was imposed on participants. The study received no external pharmaceutical or institutional funding.

RESULTS

Among the 800 study participants, 400 underwent normal vaginal delivery (NVD) and 400 underwent caesarean section (CS). The mean age of participants was 25.85 ± 5.07 years. Women in the CS group were significantly older than those in the NVD group (26.60 ± 4.97 vs. 25.09 ± 5.05 years; p < 0.001). Age distribution also differed significantly between groups, with a higher proportion of women aged 31-40 years in the CS group (21.2% vs. 12.2%; p < 0.001). No significant difference was observed in parity between the two groups (p = 0.350). Educational status varied significantly according to mode of delivery (p = 0.001), with a greater proportion in the CS group having middle-level education. (Table 1)

At 1-hour postpartum, mean LATCH scores were comparable between the NVD and CS groups (4.98 ± 1.81 vs. 4.96 ± 1.74; p = 0.889). However, at 24 hours postpartum, women who underwent NVD had significantly higher LATCH scores than those who underwent CS (5.99 ± 1.89 vs. 5.05 ± 1.78; p <0.001). The distribution of LATCH score categories differed significantly between groups at both 1 hour (p = 0.028) and 24 hours (p = 0.004), with a higher proportion of women in the NVD group achieving good breastfeeding scores. Serum prolactin levels were significantly higher among women who delivered vaginally compared to those who underwent caesarean section at both 1 hour (304.30 ± 21.10 vs. 264.74 ± 34.24 ng/mL; p < 0.001) and 24 hours postpartum (346.75 ± 30.44 vs. 322.34 ± 36.26 ng/mL; p < 0.001). (Table 2)

Stratified analysis by parity demonstrated no significant difference in 1-hour LATCH scores between NVD and CS groups among either primiparous or multiparous women. However, at 24 hours postpartum, mean LATCH scores were significantly higher among women who underwent NVD compared with those who underwent CS in both primiparous (6.07 ± 1.78 vs. 5.01 ± 1.75; p < 0.001) and multiparous mothers (5.93 ± 1.97 vs. 5.09 ± 1.81; p < 0.001).

Table 1: Demographic and obstetric characteristics of study participants according to mode of delivery (N = 800)

Characteristic	Total (N=800) (%)	NVD (n=400) (%)	CS (n=400) (%)	p-value
Age (years)				
≤20 years	108 (13.5)	69 (17.2)	39 (9.8)	0.000†
21-30 years	550 (68.8)	278 (69.5)	272 (68.0)	
31-40 years	134 (16.8)	49 (12.2)	85 (21.2)	
>40 years	8 (1.0)	4 (1.0)	4 (1.0)	
Mean ± SD	25.85 ± 5.07	25.09 ± 5.05	26.60 ± 4.97	0.000*
Parity				
Primiparous	326 (40.7)	170 (42.5)	156 (39.0)	0.350†
Multiparous	474 (59.3)	230 (57.5)	244 (61.0)	
Education				
Illiterate	153 (19.1)	81 (20.2)	72 (18.0)	0.001†
Primary	199 (24.9)	103 (25.8)	96 (24.0)	
Middle	182 (22.7)	68 (17.0)	114 (28.5)	
High School	92 (11.5)	58 (14.5)	34 (8.5)	
Secondary	76 (9.5)	43 (10.8)	33 (8.2)	
Graduate	98 (12.3)	47 (11.8)	51 (12.8)	

NVD = Normal Vaginal Delivery; CS = Caesarean Section; SD = Standard Deviation. *Unpaired t-test; †Chi-square test. p <0.05 considered statistically significant

Table 2: Comparison of LATCH score and serum prolactin levels at 1st and 24th hour postpartum according to mode of delivery

Parameter	NVD (n=400) Mean ± SD	CS (n=400) Mean ± SD	Mean Difference (95% CI)	p-value*
LATCH Score (Quantitative)				
At 1st hour	4.98 ± 1.81	4.96 ± 1.74	0.02 (-0.24 to 0.28)	0.889
At 24th hour	5.99 ± 1.89	5.05 ± 1.78	0.94 (0.66 to 1.22)	<0.001
LATCH Score Category - 1st hour, n (%)				
Poor (0-3)	83 (20.8%)	113 (28.2%)	-	0.028†
Moderate (4-7)	280 (70.0%)	261 (65.3%)	-	
Good (8-10)	37 (9.2%)	26 (6.5%)	-	
LATCH Score Category - 24th hour, n (%)				
Poor (0-3)	62 (15.4%)	98 (24.5%)	-	0.004†
Moderate (4-7)	279 (69.8%)	258 (64.5%)	-	
Good (8-10)	59 (14.8%)	44 (11.0%)	-	
Serum Prolactin Level (ng/mL)				
At 1st hour	304.30 ± 21.10	264.74 ± 34.24	39.56 (34.95 to 44.17)	<0.001*
At 24th hour	346.75 ± 30.44	322.34 ± 36.26	24.41 (18.91 to 29.91)	<0.001*

NVD = Normal Vaginal Delivery; CS = Caesarean Section; CI = Confidence Interval.
Serum prolactin levels are expressed in ng/mL.
*Unpaired t-test; †Chi-square test. p < 0.05 considered statistically significant.

Table 3: Stratified comparison of LATCH score and serum prolactin by parity and Pearson correlation between LATCH score and serum prolactin

Part 3A: Stratified analysis by parity

Parameter	Primiparous			Multiparous			p value†
	NVD(n=170)	CS (n=156)	p value*	NVD(n=230)	CS (n=244)	p value*	
LATCH Score (Mean ± SD)							
1st hour	5.01±1.76	4.92±1.73	0.670	4.97±1.84	4.99±1.75	0.870	0.820
24th hour	6.07±1.78	5.01±1.75	<0.001	5.93±1.97	5.09±1.81	<0.001	0.540
Serum Prolactin Level (ng/mL, Mean ± SD)							
1st hour	303.70±20.05	262.48±31.88	<0.001	304.73±21.88	266.18±35.65	<0.001	0.760
24th hour	347.10±27.32	321.74±38.69	0.002	346.49±32.62	322.73±34.70	0.003	0.890

NVD = Normal Vaginal Delivery; CS = Caesarean Section; SD = Standard Deviation.
LATCH score ranges from 0-10; serum prolactin levels are expressed in ng/mL.
p* = Unpaired t-test comparing NVD vs. CS within each parity group;
p† = p-value for delivery mode × parity interaction (two-way ANOVA).
$p < 0.05$ considered statistically significant.

Part 3B: Pearson correlation between LATCH score and serum prolactin level

Correlation (Pearson's r)	r	95% CI	p-value	Significant
Normal Vaginal Delivery (n=400)				
LATCH 1hr vs Serum Prolactin 1hr	0.052	-0.046 to 0.149	0.296	No
LATCH 24hr vs Serum Prolactin 24hr	0.040	-0.058 to 0.136	0.426	No
Caesarean Section (n=400)				
LATCH 1hr vs Serum Prolactin 1hr	-0.019	-0.118 to 0.080	0.705	No
LATCH 24hr vs Serum Prolactin 24hr	-0.013	-0.112 to 0.086	0.802	No
Overall (N=800)				
LATCH 1hr vs Serum Prolactin 1hr	0.010	-0.059 to 0.079	0.780	No
LATCH 24hr vs Serum Prolactin 24hr	0.096	0.027 to 0.163	0.007	Yes
LATCH 24hr vs Serum Prolactin 1hr	0.148	0.079 to 0.215	<0.001	Yes

r = Pearson correlation coefficient; CI = Confidence Interval.
LATCH score ranges from 0-10;
serum prolactin levels are expressed in ng/mL.
Correlations assessed between LATCH scores and serum prolactin levels at 1-hour and 24-hour postpartum timepoints.
$p < 0.05$ considered statistically significant.

Table 4. Multivariate analysis of factors predicting breastfeeding outcomes and serum prolactin level

Part 4A: Binary logistic regression - Predictors of good LATCH score (≥8) at 24 hours

Variable	Bivariate OR	p	Adjusted OR (aOR)	95% CI Lower	95% CI Upper	p (adjusted)
Mode of Delivery (CS vs NVD)	0.714	0.139	0.722	0.473	1.102	0.131
Age (per year increase)	0.991	0.623	0.988	0.942	1.037	0.623
Parity (Multi vs Primi)	1.239	0.382	1.249	0.764	2.043	0.376
Education level (per unit)	1.031	0.591	1.037	0.912	1.180	0.580

OR = Odds Ratio; aOR = Adjusted Odds Ratio (adjusted for maternal age, parity, mode of delivery, and educational level); CI = Confidence Interval.
Outcome variable: good LATCH score (≥8) at 24 hours postpartum (vs. moderate/poor, <8).
Reference categories: mode of delivery - NVD; parity - Primiparous.
Hosmer-Lemeshow goodness-of-fit test $p = 0.62$.
$p < 0.05$ considered statistically significant.

Part 4B: Multiple linear regression - Predictors of serum prolactin level at 24 hours (ng/mL)

Variable	Bivariate (β)	p	Adjusted (β)	95% CI Lower	95% CI Upper	p (adjusted)
Mode of Delivery (CS vs NVD)	-24.41	<0.001	-23.99	-28.70	-19.28	<0.001
Age (per year increase)	-0.37	0.209	-0.31	-0.85	0.22	0.254
Parity (Multi vs Primi)	-0.64	0.823	1.85	-3.61	7.32	0.506
Education level (per unit)	0.53	0.483	0.45	-1.00	1.91	0.541
$R^2 = 0.119$; Adjusted $R^2 = 0.115$; Model F-statistic $p < 0.001$						

β = Unstandardized regression coefficient (ng/mL); CI = Confidence Interval.
Outcome variable: serum prolactin level (ng/mL) at 24 hours postpartum.
Predictors included: mode of delivery, maternal age, parity, and educational level.
Reference categories: mode of delivery - NVD; parity - Primiparous.
$R^2 = 0.119$ (11.9% of variance explained). $p < 0.05$ considered statistically significant.

Serum prolactin levels were significantly higher among women with NVD than CS at both postpartum time points irrespective of parity (all $p < 0.01$). No significant interaction between parity and mode of delivery was observed for either LATCH scores or serum prolactin levels. (Table 3A)

No significant correlation was observed between LATCH scores and serum prolactin levels at corresponding time points within either the NVD or CS groups. Similarly, no significant association was found between 1-hour LATCH scores and 1-hour prolactin levels in the overall sample ($r = 0.010$, $p = 0.780$). However, a weak but statistically significant positive correlation was observed between 24-hour LATCH scores and 24-hour prolactin levels ($r = 0.096$, $p = 0.007$). Additionally, 24-hour LATCH scores showed a significant positive correlation with 1-hour prolactin levels ($r = 0.148$, $p < 0.001$). (Table 3B)

Binary logistic regression analysis revealed that mode of delivery, maternal age, parity, and educational level were not significant predictors of achieving a good LATCH score (≥ 8) at 24 hours postpartum. After adjustment for potential confounders, women who underwent caesarean section had lower odds of achieving a good LATCH score compared to women with vaginal delivery; however, this association did not reach statistical significance (aOR = 0.722, 95% CI: 0.473-1.102, $p = 0.131$). The model demonstrated adequate fit based on the Hosmer-Lemeshow goodness-of-fit test ($p = 0.62$). (Table 4A)

Multiple linear regression analysis identified mode of delivery as the only significant predictor of serum prolactin concentration at 24 hours postpartum. After adjustment, women who underwent caesarean section had significantly lower prolactin levels than those who delivered vaginally ($\beta = -23.99$ ng/mL, 95% CI: -28.70 to -19.28; $p < 0.001$). Maternal age, parity, and educational level were not significantly associated with serum prolactin levels. The final model explained 11.9% of the variability in serum prolactin concentrations ($R^2 = 0.119$, adjusted $R^2 = 0.115$; overall model $p < 0.001$). (Table 4B)

DISCUSSION

Breastfeeding is a hormonally regulated and behaviorally influenced physiological process, critically dependent on early mother-infant interaction and mode of delivery.[13] The present study evaluated breastfeeding effectiveness using the LATCH scoring system and its association with serum prolactin levels among women undergoing normal vaginal delivery (NVD) and caesarean section (CS), providing both clinical and biochemical perspectives of early lactation.

In the present study, LATCH scores at 1 hour postpartum were almost identical between NVD and CS groups (4.98 ± 1.81 vs. 4.96 ± 1.74; $p = 0.889$), indicating that immediate breastfeeding initiation was not significantly influenced by mode of delivery. However, by 24 hours postpartum, a significant divergence emerged favouring the NVD group, suggesting that the effect of mode of delivery on breastfeeding performance becomes more evident over time rather than immediately after birth. Similar findings were reported by Lakshman TK and Sripooja G.[14], where vaginal delivery was associated with significantly higher LATCH scores at both 1 hour (8.08 ± 1.18 vs. 6.36 ± 1.04) and 24 hours postpartum (9.10 ± 0.95 vs. 7.82 ± 0.70; $p < 0.001$). Buranawongtrakoon S et al.[15] also demonstrated significantly lower breastfeeding scores in caesarean section mothers compared to vaginal delivery groups on the second postpartum day. These consistent findings indicate that caesarean delivery primarily affects the progression and consolidation of breastfeeding performance rather than initial initiation.

Serum prolactin levels in the present study were significantly higher in the NVD group at both time points, with the magnitude of difference somewhat narrowing from 1 hour to 24 hours postpartum. These findings suggest a sustained hormonal advantage in vaginal delivery. Similar results were reported by Lamba I et al.[16], who observed higher prolactin levels in vaginal delivery (304.91 ± 42.07 vs. 259.68 ± 33.99 ng/mL at 1 hour). Gunes et al.[17] also reported significantly higher prolactin levels in vaginal delivery (364.26 ± 115.90 vs. 285.04 ± 104.49 ng/mL; $p = 0.009$). However, Isik Y et al.[8] reported no significant difference in prolactin levels across delivery modes ($p = 0.21$), suggesting that external clinical factors such as analgesia, timing of breastfeeding, and early skin-to-skin contact may modify hormonal responses.

Stratified analysis by parity showed that the 24-hour LATCH scores remained significantly higher in NVD compared to CS in both primiparous (6.07 ± 1.78 vs. 5.01 ± 1.75; $p < 0.001$) and multiparous women (5.93 ± 1.97 vs. 5.09 ± 1.81; $p < 0.001$). However, no significant difference was observed at 1 hour in either group. This indicates that parity does not significantly modify early breastfeeding outcomes. Similarly, serum prolactin levels were consistently higher in NVD across both primiparous (347.10 ± 27.32 vs. 321.74 ± 38.69 ng/mL at 24 hours) and multiparous women (346.49 ± 32.62 vs. 322.73 ± 34.70 ng/mL), with no significant interaction effect. These findings align with Gunes NE et al.[17], who also reported no significant association between parity and prolactin levels ($p = 0.421$).

Correlation analysis in the present study showed no meaningful relationship between LATCH scores and serum prolactin at early time points. The correlation between 1-hour LATCH and prolactin was negligible ($r = 0.010$; $p = 0.780$), and similarly weak in subgroup analyses. However, a weak but statistically significant correlation was observed between 24-hour LATCH scores and 24-hour prolactin levels ($r = 0.096$; $p = 0.007$), and between 24-hour LATCH and 1-hour prolactin ($r = 0.148$; $p < 0.001$). Although statistically significant, these correlation coefficients are weak in magnitude, and statistical significance in this context likely driven by the large sample size should not be interpreted as indicating a strong or clinically meaningful relationship. These findings suggest that prolactin may contribute marginally to breastfeeding success but does not independently or substantially determine breastfeeding effectiveness in the early postpartum period. Breastfeeding is therefore a multifactorial process influenced by hormonal, mechanical, psychological, and institutional factors.

Multivariate analysis presented a more nuanced picture. While LATCH scores at 24 hours differed significantly between NVD and CS groups on univariate comparison, mode of delivery was not an independent predictor of achieving a good LATCH score after adjustment for confounders (aOR = 0.722; 95% CI: 0.473-1.102; p = 0.131), although a negative trend persisted for caesarean section. This apparent discrepancy may be explained by the influence of other correlated variables (such as maternal age, parity, and educational status) that were adjusted for in the multivariable model, by the relatively small effect size of mode of delivery relative to other behavioural and supportive factors influencing latch technique, or by the binary categorisation of LATCH score (good vs. not good) reducing statistical power compared with the continuous comparison used in the univariate analysis. In contrast, mode of delivery was a strong independent predictor of serum prolactin levels in linear regression analysis (β = -23.99 ng/mL; 95% CI: -28.70 to -19.28; $p < 0.001$), explaining 11.9% of variability ($R^2 = 0.119$). This suggests that delivery mode has a stronger biological influence on hormonal response than on observed breastfeeding behavior.

The present findings are consistent with existing literature indicating that caesarean section is associated with delayed lactogenesis, reduced early suckling stimulation, and impaired breastfeeding establishment.[8,9] Mechanistically, reduced early skin-to-skin contact, postoperative pain, anaesthesia effects, and delayed neonatal attachment may be associated with suppressed prolactin release and reduced oxytocin-mediated milk ejection reflex; however, as this study is observational, these pathways cannot be confirmed as causal and warrant further investigation.

Overall, although initial breastfeeding initiation was comparable (LATCH ~4.9 at 1 hour), significant differences emerged by 24 hours in both breastfeeding performance and prolactin levels. This highlights the cumulative effect of mode of delivery on early lactation establishment. The findings emphasize the need for early lactation interventions, especially among caesarean-delivered mothers, to improve breastfeeding outcomes and optimize maternal-infant health. Practically, this could translate into routine antenatal counselling of women scheduled for elective caesarean section regarding anticipated breastfeeding challenges, prioritised lactation consultant support and structured LATCH assessment for CS mothers within the first 24 hours, encouragement of early and frequent skin-to-skin contact once maternal recovery permits, and judicious selection of postoperative analgesia to minimise sedation-related delays in breastfeeding initiation.

STRENGTHS AND LIMITATIONS

This study's strengths include its large sample size (N = 800), equal allocation between NVD and CS groups, concurrent measurement of both LATCH scores and serum prolactin at standardised timepoints (1st and 24th hour), and rigorous multivariate adjustment for potential confounders. However, several limitations merit consideration. The single-centre design restricts generalizability. Short-term postpartum follow-up (24 hours) precludes assessment of long-term breastfeeding outcomes. Convenience sampling may introduce selection bias. Important potential confounding factors - including breastfeeding support practices (e.g., counselling by lactation staff), timing of breastfeeding initiation, early skin-to-skin contact, use of intrapartum or postpartum analgesics, neonatal birth weight, and other postpartum care practices - were not systematically measured or controlled, and may have influenced both LATCH scores and prolactin levels independent of mode of delivery, potentially confounding the observed associations.

CONCLUSION

This observational study suggests that mode of delivery is associated with early breastfeeding outcomes and lactation physiology. Caesarean section was associated with significantly lower LATCH scores at 24 hours and reduced serum prolactin levels at both timepoints compared to normal vaginal delivery, despite comparable outcomes at the 1st hour. These findings suggest that the lower prolactin levels associated with CS become more apparent by 24 hours postpartum. Notably, parity did not appear to modify this association, suggesting consistency across obstetric history. While a weak but statistically significant overall correlation was observed between LATCH score and serum prolactin at 24 hours, its clinical significance is limited, and multivariate analysis identified mode of delivery as the only independent predictor of prolactin levels rather than of LATCH score itself. As this was an observational study, these findings represent associations rather than causal relationships and require confirmation through further research. Nonetheless, the results highlight the potential value of targeted lactation support and early breastfeeding counselling for women delivering by caesarean section.

Individual Author's Contribution: BS contributed to the study conception, study design, data collection, data analysis and interpretation, and manuscript preparation. **MV** contributed to the study conception, study design, and data analysis and interpretation. **SP** contributed to the study conception, study design, and data analysis and interpretation.

Availability of data: The data that support the findings of this study are available from the corresponding author on reasonable request.

Declaration of non-use of generative AI Tools: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

REFERENCES

1. Modak A, Ronghe V, Gomase KP, Dukare KP. The psychological benefits of breastfeeding: fostering maternal well-being and child development. Cureus. 2023 Oct 9;15(10). DOI: https://doi.org/10.7759/cureus.46730
2. Ciampo LA, Ciampo IR. Breastfeeding and the Benefits of Lactation for Women's Health. Revista brasileira de ginecologia e obstetrícia. 2018;40:354-9. DOI: https://doi.org/10.1055/s-0038-1657766 PMid:29980160 PMCid:PMC10798271
3. Prentice AM. Breastfeeding in the modern world. Annals of Nutrition and Metabolism. 2022 Jul 12;78(Suppl. 2):29-38. DOI: https://doi.org/10.1159/000524354 PMid:35679837
4. Meedya S, Fahy K, Kable A. Factors that positively influence breastfeeding duration to 6 months: a literature review. Women and birth. 2010 Dec 1;23(4):135-45. DOI: https://doi.org/10.1016/j.wombi.2010.02.002 PMid:20299299
5. Griffin CM, Amorim MH, Almeida FD, Marcacine KO, Goldman RE, Coca KP. LATCH as a systematic tool for assessment of the breastfeeding technique in maternity. ACTA Paulista de enfermagem. 2022 Mar 7;35:eAPE03181. DOI: https://doi.org/10.37689/acta-ape/2022AO03181
6. Wall-Penner JA, Rasmussen K, Suderman M. Effects of Maternal-Infant Golden Hour on Breastfeeding. SACAD: Scholarly Activities. 2024;2024(2024):136.
7. Gouda AM, Ebrahem GG. Efficacy of Early Skin-to-Skin Contact on Thermal Regulation and Breastfeeding of the Newborns and on 3rd Stage of Labor and Postpartum Maternal Condition. International Journal of Novel Research in Healthcare and Nursing. 2019;6(2):775-86.
8. İsik Y, Dag ZO, Tulmac OB, Pek E. Early postpartum lactation effects of cesarean and vaginal birth. Ginekologia polska. 2016;87(6):426-30. DOI: https://doi.org/10.5603/GP.2016.0020 PMid:27418219
9. Hobbs AJ, Mannion CA, McDonald SW, Brockway M, Tough SC. The impact of caesarean section on breastfeeding initiation, duration and difficulties in the first four months postpartum. BMC pregnancy and childbirth. 2016 Dec;16:1-9. DOI: https://doi.org/10.1186/s12884-016-0876-1 PMid:27118118 PMCid:PMC4847344
10. de Arruda GT, Barreto SC, Morin VL, do Nascimento Petter G, Braz MM, Pivetta HM. Is there a relation between mode of delivery and breastfeeding in the first hour of life?. Revista Brasileira em Promoção da Saúde. 2018 Apr 1;31(2):1-7. DOI: https://doi.org/10.5020/18061230.2018.7321
11. Putri AD. The relationship of early breastfeeding initiation with postpartum maternal prolactin levels. Malaysian Journal of Medical Research (MJMR). 2019 Jan 2;3(1):5-9. DOI: https://doi.org/10.31674/mjmr.2019.v03i01.002
12. Jensen D, Wallace S, Kelsay P. LATCH: A breastfeeding charting system and documentation tool. J Obstet Gynecol Neonatal Nurs. 1994 Jan;23(1):27-32. DOI: https://doi.org/10.1111/j.1552-6909.1994.tb01847.x PMid:8176525
13. World Health Organization. Infant and young child feeding: model chapter for textbooks for medical students and allied health professionals. Geneva: World Health Organization; 2009. Session 2, The physiological basis of breastfeeding. Available from: https://www.ncbi.nlm.nih.gov/books/NBK148970/
14. Lakshman TK, Sripooja G. LATCH score: efficacy in parturient with term vaginal delivery vs term caesarean section: clinical study at rural tertiary care hospital. Int J Acad Med Pharm. 2024;6(2):1223-6.
15. Buranawongtrakoon S, Puapornpong P. Comparison of latch scores at the second day postpartum between mothers with cesarean sections and those with normal deliveries. Thai Journal of Obstetrics and Gynaecology 2016 Mar 30;6-13
16. Lamba I, Bhardwaj MK, Verma A, Meena E. Comparative Study of Breastfeeding in Caesarean Delivery and Vaginal Delivery Using LATCH Score and Maternal Serum Prolactin Level in Early Postpartum Period. J Obstet Gynaecol India. 2023 Apr;73(2):139-145. DOI: https://doi.org/10.1007/s13224-022-01698-9 PMid:37073235 PMCid:PMC10105808
17. Gunes NE, Cetinkaya S. Analysis of maternal characteristics during breastfeeding in early infancy associated with prolactin levels and breastfeeding LATCH scores. International Journal of Caring Sciences. 2017 Jan;10(1):313.