

Delayed Lactogenesis and Prelacteal Feeding Among Mothers with Infants Younger Than Four Months in Indonesia: A Cross-Sectional Study

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Abstract

Background: Prelacteal feeding during the early neonatal period may occur when breastfeeding is not established effectively. Delayed lactogenesis may contribute to maternal perception of insufficient breast milk and subsequent introduction of prelacteal feeds; however, evidence regarding of this association in the Indonesian context remains limited.

Aim: This study aimed to examine the association between delayed lactogenesis and prelacteal feeding among mothers with infants younger than four months in Pematangsiantar, North Sumatra, Indonesia.

Method: This cross-sectional study was conducted in July 2024 among mothers with infants younger than four months attending three independent midwifery practices in Pematangsiantar, North Sumatra. Participants had delivered at term, without complications, and had infants with birth weights of 2,000–5,000 g. Data were collected using a structured questionnaire. Associations were examined using bivariate analysis and binary logistic regression. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were estimated using a multivariable model including lactogenesis onset, early initiation of breastfeeding, and infant sex.

Results: Among 62 participants, 16 (25.81%) had delayed lactogenesis and 37 (59.68%) reported prelacteal feeding. Delayed lactogenesis was significantly associated with prelacteal feeding in the bivariate analysis (OR=16.364; 95% CI=1.993–134.336; $p=0.009$). The association remained significant after adjustment for early initiation of breastfeeding and infant sex (aOR=12.702; 95% CI=1.457–110.716; $p=0.021$). Lack of early initiation of breastfeeding was associated with prelacteal feeding in the bivariate analysis (OR=5.520; 95% CI=1.114–27.354; $p=0.036$), but not in multivariable model (aOR=2.519; 95% CI=0.430–14.749; $p=0.306$). Infant sex was not independently associated with prelacteal feeding (aOR=0.463; 95% CI=0.144–1.490; $p=0.197$).

Implications for Practice: These findings support strengthening early breastfeeding counselling and postpartum support, particularly for mothers experiencing or perceiving delayed milk production, while recognizing the need for further prospective evidence.

Keywords: Breastfeeding, Early Initiation of Breastfeeding, Delayed Lactogenesis, Lactogenesis, Prelacteal Feeding

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Introduction

Prelacteal feeding, defined as the provision of foods or liquids other than breast milk during the early neonatal period, remains an important public health concern because it may interfere with optimal breastfeeding practices. Evidence from different settings has identified prelateal feeding as a persistent practice associated with maternal, cultural, socioeconomic, and healthcare-related factors (1–8). Cultural beliefs and family influences may contribute to prelateal feeding, particularly when mothers or family members perceive that newborns require additional fluids or food before breastfeeding is established. Previous studies have also reported associations with parity, maternal education, socioeconomic circumstances, mode of delivery, breastfeeding support, and timing of breastfeeding initiation (1,2,5–8). These findings indicate that prelateal feeding is influenced by multiple and interrelated determinants rather than by a single maternal or infant characteristic.

An important factor that may contribute to prelateal feeding is the timing of lactogenesis. Delayed lactogenesis may increase maternal concern regarding insufficient breast milk, particularly during the early postpartum period when mothers and families expect breastfeeding to become established. Such perceptions may encourage the introduction of formula or other prelateal feeds. However, evidence specifically examining the association between delayed lactogenesis and prelateal feeding remains limited, particularly in Indonesia. Studies conducted in Indonesia have documented substantial variation in prelateal feeding across regions and populations (9–11). Reported prelateal feeds include infant formula, other milk, plain water, sugar water, coffee, rice water, and honey, reflecting differences in local beliefs, practices, and access to health information (9,10). Pematangsiantar provides an important setting in which to examine these practices because it is an urban city in North Sumatra and serves a population with diverse social and cultural backgrounds.

Although previous studies have examined determinants of prelateal feeding, the relationship between delayed lactogenesis and prelateal feeding has not been sufficiently characterized in this local Indonesian setting. Understanding this association may help identify opportunities for early breastfeeding support, particularly among mothers who perceive that their milk production is insufficient. Therefore, this study aimed to examine the association between delayed lactogenesis and prelateal feeding among mothers with infants younger than four months in Pematangsiantar, North Sumatra, Indonesia.

Methods

This cross-sectional study was conducted in July 2024 in Pematangsiantar, North Sumatra, Indonesia. The study population comprised mothers with infants younger than four months who attended three independent midwifery practices. The study sites were selected based on their relatively high number of deliveries in Pematangsiantar. Participants were eligible if they had delivered at term (37–42 weeks), had no reported pregnancy or delivery complications, and had infants with birth weights of 2,000–5,000 g. Both primiparous and multiparous mothers were eligible. The sample size was calculated using the Lemeshow formula for a cross-sectional study with unknown population size (12). The expected prevalence (p) of prelateal feeding was 11.7%, based on a previous study (13). Using the Z value of 1.96, $q=1-p=0.883$, and a margin of error 0.08; the minimum required sample size was 62 participants. Consecutive sampling was used, and eligible participants were recruited until the required sample size was reached.

The researcher collaborated with the participating independent midwifery practices to identify eligible mothers who had given birth within the previous four months. Data were collected during mothers' visits to the midwifery practices and by telephone. A semi-structured questionnaire developed from a review of the relevant literature was used to assess infant-feeding practices. Participants reporting prelateal feeding were asked about the predominant reason for feeding and the type of feed provided. Response options for reasons included frequent infant crying, absence of breast milk, low milk production, and other reasons. Types of prelateal feeding included formula milk, plain water, honey, and other feeds.

Delayed lactogenesis was defined as a reported onset of lactation >72 hours after delivery. Participants with an onset of lactation ≤ 72 hours were classified as having normal lactogenesis. Prelacteal feeding was defined as the provision of any food or liquid other than breast milk to a newborn during the first three days after birth, before breastfeeding was established effectively. Prelacteal feeding status was assessed retrospectively through maternal interview. Categorical

variables were summarized using frequencies and percentages, whereas continuous variables were summarized using means and standard deviations. Bivariate associations between participant characteristics and prelacteal feeding were examined using cross-tabulation and binary logistic regression. Crude odds ratios (ORs) and 95% confidence intervals (CIs) were estimated. A multivariable binary logistic regression model using the Enter method was subsequently performed, including lactogenesis onset, early initiation of breastfeeding, and infant sex. Adjusted odds ratios (aORs) and 95% CIs were reported. Model significance was assessed using the Omnibus Test of Model Coefficients, and goodness of fit was assessed using the Hosmer–Lemeshow test. Nagelkerke R^2 was reported as a measure of model explanatory performance. Statistical significance was defined as $p < 0.05$. All analyses were performed using SPSS version 25.

Ethical Consideration

This cross-sectional study was approved by the Health Research Ethics Committee of the Medan Health Polytechnic, Ministry of Health, Indonesia (No. 01.25815/KEPK/POLTEKKES KEMENKES MEDAN/2024).

Results

A total of 62 participants were included in the analysis. The mean maternal age was 28.35 ± 5.66 years, and 54 participants (87.10%) were aged 20–35 years. The mean parity was 2.19 ± 1.13 , and 19 participants (30.65%) were primiparous. The mean reported onset of lactation was 2.63 ± 1.72 days. Forty-six participants (74.19%) had normal lactogenesis, whereas 16 (25.81%) had delayed lactogenesis. Early initiation of breastfeeding was reported by 48 participants (77.42%), whereas 14 (22.58%) did not report early initiation. High school was the most common educational attainment (69.35%), and 55 participants (88.71%) were housewives. The mean infant birth weight was $3,452.10 \pm 512.05$ g, and 56 infants (90.32%) had birth weights of 2,500–4,000 g. Twelve infants (19.35%) were born by caesarean delivery. The sample comprised 35 male infants (56.45%) and 27 female infants (43.55%). Overall, 37 participants (59.68%) reported prelacteal feeding, and all reported prelacteal feeds were formula milk. Among participants who reported prelacteal feeding, the most frequently reported reason was little breast milk (30/37, 81.08%) (Table 1).

In the bivariate analysis, delayed lactogenesis was significantly associated with prelacteal feeding. Participants with delayed lactogenesis had 16.36 times higher odds of reporting prelacteal feeding than those with normal lactogenesis (OR=16.364; 95% CI=1.993–134.336; $p=0.009$). Lack of early initiation of breastfeeding was also associated with higher odds of prelacteal feeding (OR=5.520; 95% CI=1.114–27.354; $p=0.036$). Infant sex was not significantly associated with prelacteal feeding (OR=0.426; 95% CI=0.151–1.203; $p=0.107$). No statistically significant associations were observed for the other maternal and infant characteristics examined (Table 2).

The multivariable logistic regression model was statistically significant (Omnibus $\chi^2=15.914$, $df=3$, $p=0.001$). Delayed lactogenesis remained significantly associated with prelacteal feeding after simultaneous adjustment for early initiation of breastfeeding and infant sex (aOR=12.702; 95% CI=1.457–110.716; $p=0.021$). Participants with delayed lactogenesis had approximately 12.7 times higher odds of reporting prelacteal feeding than those with normal lactogenesis.

In contrast, lack of early initiation of breastfeeding was not independently associated with prelacteal feeding after adjustment (aOR=2.519; 95% CI=0.430–14.749; $p=0.306$). Infant sex was also not independently associated with the outcome (aOR=0.463; 95% CI=0.144–1.490; $p=0.197$). The Hosmer–Lemeshow test did not indicate evidence of poor model fit ($\chi^2=3.011$, $df=3$, $p=0.390$), and the Nagelkerke R^2 was 0.306 (Table 3).

Table 1. Characteristics of the mothers and infants (N=62)

Characteristics	n (%) / Mean $\pm$ SD
Maternal characteristics	
Maternal age, years	28.35 $\pm$ 5.66
Age groups (years)	
<20 or >35	8 (12.90)
20 – 35	54 (87.10)
Parity	2.19 $\pm$ 1.13
Parity	
Primiparous	19 (30.65)
Multiparous	43 (69.35)
Education	
Elementary school	2 (3.23)
Junior high school	4 (6.45)
High school	43 (69.35)
College/university	13 (20.97)
Education level	
Elementary – junior high school	6 (9.68)
High school – college/university	56 (90.32)
Employed status	
Employed	7 (11.29)
Housewife	55 (88.71)
Lactogenesis onset	2.63 $\pm$ 1.72 days
Lactogenesis onset	
$\leq$ 72 hours	46 (74.19)
$>$ 72 hours	16 (25.81)
Infant characteristics	
Birth weight, gr	3,452.10 $\pm$ 512.05
Birth weight	
2,500–4,000 g	56 (90.32)
< 2,500 or > 4,000 g	6 (9.68)
Mode of delivery	
Vaginal delivery	50 (80.65)
Cesarean delivery	12 (19.35)
Infant sex	
Female	27 (43.55)
Male	35 (56.45)
Early initiation of breastfeeding	
Yes	48 (77.42)
No	14 (22.58)
Prelacteal feeding	
Yes	37 (59.68)
No	25 (40.32)
Type of prelacteal feeding among those reporting prelacteal feeding	
Formula milk	37 (100.00)
Reported reason for prelacteal feeding	
Baby always crying	5 (13.51)
No breast milk	2 (5.41)
Little breast milk	30 (81.08)

Table 2. Bivariate analysis of factors associated with prelacteal feeding

Variable	Prelacteal feeding				OR (95% CI)	p-value
	Yes (%)		No (%)			
Age groups (years)						
< 20 or > 35	6	75.00	2	25.00	2.27 (0.41–12.50)	0.46
20 – 35	31	57.41	23	42.59	Ref.	
Parity						
Primiparous	13	68.42	6	31.58	1.71 (0.54–5.36)	0.51
Multiparous	24	55.81	19	44.19	Ref.	
Education level						
Elementary – junior high school	3	50.00	3	50.00	0.65 (0.12–3.57)	0.68
High school – college	34	60.71	22	39.29	Ref.	
Employed status						
Employed	5	71.43	2	28.57	1.82 (0.32–11.11)	0.69
Housewife	31	57.40	23	42.60	Ref.	
Lactogenesis onset						
> 72 hours	15	93.75	1	6.25	16.36 (1.99–134.34)	0.009*
≤ 72 hours	22	47.83	24	52.17	Ref.	
Birth weight						
<2,500 or >4,000 g	3	50.00	3	50.00	0.65 (0.12–3.57)	0.68
2,500–4,000 g	34	60.71	22	39.29	Ref.	
Mode of delivery						
Cesarean delivery	9	75.00	3	25.00	2.34 (0.57–9.76)	0.33
Vaginal delivery	28	56.00	22	44.00	Ref.	
Infant sex						
Female	14	51.85	13	48.15	0.43 (0.15–1.20)	0.11
Male	24	68.57	11	31.43	Ref.	
Early initiation of breastfeeding						
No	12	85.71	2	14.29	5.52 (1.11–27.35)	0.03*
Yes	25	52.19	23	47.91	Ref.	

*significant at $p < 0.05$; OR = odds ratio; CI = confidence interval; Ref. = reference category.

Table 3. Logistic regression analysis of factors associated with prelacteal feeding

Predictors	B	S.E.	Wald	p-value	aOR	95% CI for aOR	
						Lower	Upper
Delayed lactogenesis vs normal*	2.542	1.105	5.294	0.021	12.702	1.457	110.716
Female vs male infant	-0.770	0.596	1.667	0.197	0.463	0.144	1.490
No early initiation of breastfeeding vs early initiation of breastfeeding	0.924	0.902	1.050	0.306	2.519	0.430	14.749
Constant	0.146	0.427	0.116	0.733	1.157		

*Significant at $p < 0.05$

Reference categories: normal lactogenesis, male infant, and early initiation of breastfeeding.

B = regression coefficient; SE = standard error; aOR = adjusted odds ratio; CI = confidence interval.

Model:

Omnibus $\chi^2 = 15.914$; df = 3; $p = 0.001$; Nagelkerke $R^2 = 0.306$

Hosmer–Lemeshow $\chi^2 = 3.011$, df = 3, $p = 0.390$

Discussion

The principal finding of this study was the strong association between delayed lactogenesis and prelacteal feeding. After adjustment for early initiation of breastfeeding and infant sex, delayed lactogenesis was associated with substantially higher odds of prelacteal feeding (aOR=12.702; 95% CI=1.457-110.716). The wide confidence interval indicates substantial uncertainty regarding the magnitude of the association. This imprecision may reflect the relatively small sample size and the sparse distribution of observations in the delayed-lactogenesis group, in which only one participant did not report prelacteal feeding. Therefore, the finding should be interpreted as evidence of an association rather than as a precise estimate of effect magnitude.

A plausible pathway linking delayed lactogenesis with prelacteal feeding is maternal perception of insufficient breast milk. In this study, little breast milk was the most frequently reported reason for prelacteal feeding, accounting for 81.08% of reported cases. Delayed lactogenesis may increase maternal concern about whether breast milk is sufficient to meet the infant's needs, potentially prompting the introduction of formula feeding. However, because the study did not directly measure maternal perceptions prospectively, this proposed pathway should be considered interpretative rather than causal.

Not all factors initially hypothesized to be associated with prelacteal feeding were statistically associated with the practice in this study. Previous studies have reported associations with parity, educational level, place of birth, maternal employment status, and infant birth weight (10,14). In this study sample, 59.68% of participants reported prelacteal feeding, and all reported prelacteal feeds were formula milk. This proportion appears higher than estimates reported in the 2023 Indonesian Health Survey for Indonesia and North Sumatra (15). It was also higher than the proportion reported in studies from Karanganyar District, Central Java (42.8%) (10) and Sidoarjo and Malang districts, East Java (33.8%) (16). However, these comparisons should be interpreted cautiously because the studies differed in population characteristics, sampling methods, study settings, and definitions of prelacteal feeding. These findings are consistent with a previous study reporting a higher prevalence of prelacteal feeding outside Java than in Java (49.8% vs 39.4% (11).

Several factors may contribute to the higher prevalence of prelacteal feeding outside Java, including sociocultural conditions, educational attainment, socioeconomic status, and access to health services (11). Sociocultural influences may include the role of parents and family members, who may be concerned that infants will become hungry if breast milk is not produced promptly or in sufficient amounts. In some communities, prelacteal feeding has been practiced for generations, and prevailing beliefs and traditions may shape infant-feeding practices (17). Low educational attainment and low socioeconomic status may also limit mothers' access to accurate breastfeeding information (18). Differences in access to health services between Java and other regions of Indonesia may further contribute to the persistence of prelacteal feeding. Geographic barriers and unequal access to health services may limit the dissemination of breastfeeding information to pregnant women and new mothers. The fact that all reported prelacteal feeds were formula milk is noteworthy. This finding may reflect the availability or acceptability of commercial formula in the study setting; however, these factors were not directly assessed and therefore cannot be confirmed from the present data.

Early initiation of breastfeeding was significantly associated with prelacteal feeding in the bivariate analysis but was no longer statistically significant after adjustment. The crude OR decreased from 5.520 to 2.519 after adjustment for lactogenesis onset and infant sex. This attenuation suggests that the crude association was not fully independent of the other variables included in the model. However, because of the cross-sectional design, this change should not be interpreted as evidence of mediation or causality. This finding is consistent with previous studies (2,14,17,19). The timing of breastfeeding initiation may play an important role in determining whether prelacteal feeding is introduced. Initiation of breastfeeding within the first hour after birth has been associated with a lower likelihood of prelacteal feeding (3). Conversely, delayed initiation of breastfeeding, including initiation between one hour and one day after birth, has been associated with higher rates of prelacteal feeding (5,20).

In this study, delayed onset of lactation was associated with prelacteal feeding. A similar association has been reported previously (18). Delayed onset of lactation may cause concern among mothers and family associated with members because they may perceive that the infant is not enough receiving sufficient breast milk. Consequently, mothers and families may introduce prelacteal feeds when breast

milk is perceived to be absent or insufficient, particularly when the infant cries frequently. No statistically significant associations were observed between prelacteal feeding and maternal age, parity, educational level, employment status, infant birth weight, mode of delivery, or infant sex. These findings should be interpreted cautiously because several subgroups were small and the resulting confidence intervals were wide. The absence of statistical significance should therefore not be interpreted as evidence that these factors have no association with prelacteal feeding. In other countries, factors associated with prelacteal feeding are multifaceted and include maternal education, household wealth, cultural beliefs, and delivery practices. Studies have shown that mothers with lower educational attainment, those from poorer households, and those living in low-wealth clusters are more likely to practice prelacteal feeding (1). Cesarean delivery, lack of breastfeeding counseling, and delayed initiation of breastfeeding have also been associated with higher rates of prelacteal feeding (2,5,20). In Ethiopia, maternal education, avoidance of colostrum, and lack of breastfeeding counseling have been associated with prelacteal feeding (21). Overall, these findings suggest that prelacteal feeding is influenced by multiple interrelated individuals, household, cultural, and health-system factors.

This study has several limitations. First, the cross-sectional design limits causal inference and does not establish the temporal relationship between delayed lactogenesis and prelacteal feeding. Second, the study relied on retrospective maternal reports collected up to four months after delivery, which may have introduced recall or reporting bias, particularly regarding the timing of lactogenesis. Third, the sample size was relatively small, and only 16 participants were classified as having delayed lactogenesis; only one participant in this group did not report prelacteal feeding. This sparse distribution may have contributed to the wide confidence interval and limited the precision of the adjusted association. Fourth, the operational definitions of delayed lactogenesis and prelacteal feeding are closely related in timing and concept because both concern breastfeeding and milk availability during the early postpartum period. This conceptual overlap may have contributed to the strength of the observed association. Finally, participants were recruited consecutively from three independent midwifery practices in one city, limiting the generalizability of the findings to other populations and healthcare settings.

This study has several strengths. First, it specifically examined delayed lactogenesis as a potential factor associated with prelacteal feeding, an association that remains relatively underexplored in the Indonesian context. Second, the study used multivariable logistic regression to assess the association after adjustment for early initiation of breastfeeding and infant sex. Third, the observed association was consistent in both bivariate and multivariable analyses, with delayed lactogenesis remaining significantly associated with prelacteal feeding after adjustment. In addition, the study identified little breast milk as the most frequently reported reason for prelacteal feeding, providing relevant context for interpreting the observed association.

Implications for practice

Delayed lactogenesis was significantly associated with higher odds of prelacteal feeding among mothers with infants younger than four months in Pematangsiantar, Indonesia. These findings support strengthening early breastfeeding counselling and postpartum support, particularly for mothers experiencing or perceiving delayed milk production. However, given the cross-sectional design, small sample size, and retrospective assessment, the findings should be interpreted cautiously and confirmed through larger prospective studies.

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Conflicts of interest

The authors declare no conflict of interest.

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Authors' Contributions

I.M: Data acquisition, data analysis and interpretation, and drafting of the manuscript. T.S.W: Study conception and design. L.N: Literature search and critical revision of the manuscript for important intellectual content. All the authors read and approved the final version of the article.

Artificial Intelligence statement

The authors used Chat GPT (GPT-4) and Grammarly in order to improve the readability and language of the manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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