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Maternal and Perinatal Factors Influencing Exclusive Breastfeeding and Colostrum Feeding in Rural Indonesia

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KEYWORDS

Exclusive breastfeeding, colostrum feeding, maternal education, parity, environmental sanitation, rural indonesia.

ABSTRACT

The objective of this study was to determine the maternal and perinatal determinants of exclusive breastfeeding and colostrum feeding among mothers with children under five years of age in rural Indonesia. A cross-sectional study was conducted in the community among 210 purposively selected mothers. Data processing: Data were collected through structured interviews and analyzed using bivariate and multivariate logistic regression. The independent variables were maternal age, maternal education, maternal occupation, parity, infant and birth-related factors, paternal factors, socio-economic factors, household smoking exposure, and environmental sanitation. Approval was sought and obtained from the STIKes Panca Bhakti Ethics Committee (No. 018/UE.STIKes/IV/2024). Multiparity (AOR = 2.27; 95% CI 1.18–4.36) was positively associated with exclusive breastfeeding (EBF), whereas environmental sanitation was marginally significantly related (AOR = 3.62; 95% CI 0.99–13.15; p = 0.051). For colostrum feeding, maternal age 25–35 years (AOR = 2.14; 95% CI 1.11–4.12) and high education (AOR = 2.02; 95% CI 0.99–4.14) were significant factors. Maternal experience, education, and household environment have had a significant impact on breastfeeding patterns. Maternal education and household sanitation interventions via a combined community package may potentially promote better early feeding practices in rural communities.

INTRODUCTION

Breastfeeding is a fundamental pillar for ensuring infant health, growth, and survival. It provides optimal nutrition, strengthens the immune system, and supports cognitive and physical development during the early months of life (Knight et al., 2017). The World Health Organization (WHO) and UNICEF recommend that breastfeeding begin within the first hour after birth, continue exclusively for the first six months, and then be sustained alongside complementary feeding up to two years or longer (WHO, 2023). Despite these targets, many low- and middle-income countries (LMICs) still record suboptimal rates of exclusive breastfeeding (Pérez-Escamilla et al., 2023), largely due to the complex interplay of maternal, perinatal, familial, and environmental determinants.

In Indonesia, despite progressive national efforts, EBF coverage remains suboptimal. According to the 2024 WHO/UNICEF joint report, the national EBF rate rose from 52% in 2017 to approximately 66.4% in 2024 (WHO, 2025). At the provincial level, Lampung recorded an EBF rate of 76.2% among infants aged 0–5 months, indicating encouraging progress yet highlighting inter-provincial disparities and sustainability challenges (BPS-Statistics Indonesia, 2024). Meanwhile, only 27% of newborns in Indonesia received breast milk within the first hour after birth, underscoring missed opportunities for optimal early feeding practices (WHO, 2024). Colostrum feeding and early initiation of breastfeeding (EIBF) have been identified as key practices that establish the foundation for successful exclusive breastfeeding (Bhandari et al., 2019; Syahri et al., 2024).

Exclusive breastfeeding (EBF) and colostrum feeding are also widely recognized as critical early-life determinants of child growth and immunity (Kamal et al., 2024; WHO, 2023). Suboptimal

breastfeeding contributes to repeated infections and inadequate nutrient intake—pathways strongly linked to growth faltering and early childhood stunting (Vaivada et al., 2020; Yuke Widyantari et al., 2025). In a context where stunting remains a persistent public health concern in Indonesia, understanding maternal and perinatal factors that shape early feeding behaviors is essential. Strengthening breastfeeding practices represents one of the earliest and most modifiable strategies in stunting prevention within the first years of life.

Several studies in Indonesia and other countries have investigated EBF or EIBF/colostrum separately (Gayatri & Dasvarma, 2020), not taking into account both outcomes simultaneously concerning maternal and perinatal factors especially in rural areas (Nurokhmah et al., 2022). Consistently, data from novel meta-analyses show that good quality antenatal and postnatal services where mothers receive specific information and support are strong predictors of EBF (Agusningtyas et al., 2023). To date, few studies have simultaneously investigated the effect of particular maternal (mother's age at delivery, parity, education) and perinatal (birth weight, age of the infant) factors on early colostrum feeding and EBF among mothers from rural Indonesia. Further, although prior work by the author has concentrated on stunting and its socio-family-environmental correlates, much less consideration has been given to those more upstream feeding behaviors that may at the end of the day underlie the nutritional status of children.

In contrast to the aforesaid studies which used to examine either colostrum feeding or exclusive breastfeeding, the present study is distinct on an entirely different aspect as it attempts to study variables associated with both outcomes together so as to gain a more comprehensive picture on the influences on infant-feeding practices in rural Indonesia.

We hypothesized that high parity, maternal education, and better sanitation would be associated with an increased likelihood of EBF and colostrum feeding.

Therefore, this study is intended to study the *maternal* and *perinatal* factors of exclusive breastfeeding and colostrum feeding among mothers in the rural area of Indonesia. By determining these factors, the study aims to contribute to the development of evidence-based interventions/policies to promote breastfeeding in low-resource and rural settings. The results are anticipated to inform community-oriented breastfeeding promotion strategies, with focus on maternal education, perinatal care, and family support.

METHOD

This study employed an analytical cross-sectional design using retrospective maternal recall. The research was conducted in rural communities of Kedondong Sub-district, Lampung Province, Indonesia, between May and August 2024. Lampung was selected as a representative rural area with variable breastfeeding coverage and maternal health disparities

The study population comprised mothers who had biological children aged 6–59 months and resided permanently in the selected rural communities of Kedondong Sub-district, Lampung Province, Indonesia. The inclusion criteria were: (1) mothers who had given birth within the past five years, (2) willingness to participate and provide informed consent, and (3) availability of basic infant health information either through the Maternal and Child Health (KIA) book or maternal recall. Mothers whose children had congenital anomalies or serious illnesses were excluded.

A total of 210 mothers participated in this study, selected using a purposive sampling technique based on the inclusion criteria and accessibility through Posyandu and Puskesmas registers. This non-probability approach was deemed suitable for capturing mothers with diverse breastfeeding experiences representative of rural household contexts. While purposive sampling may limit external

validity and generalizability, it enabled in-depth exploration of the maternal and perinatal factors influencing early feeding practices in the study area.

Variables and Operational Definitions

This study examined two main outcome variables: exclusive breastfeeding (EBF) and colostrum feeding. Exclusive breastfeeding was defined as whether the child was exclusively breastfed for the first six months of life, based on maternal recall and, where possible, verified using information recorded in the Maternal and Child Health (KIA) book. Colostrum feeding was defined as the mother's practice of providing colostrum immediately after delivery.

The independent variables were grouped into three domains: maternal, perinatal, and household-environmental characteristics.

- Maternal factors included maternal age at childbirth, educational attainment, employment status, and parity.
- Perinatal factors consisted of the infant's current age, birth weight, and early initiation of breastfeeding (IMD).
- Household and environmental factors encompassed the number of family members, socio-economic status, paternal age and education, exposure to cigarette smoke within the household, and environmental sanitation.

Environmental sanitation was assessed based on three indicators—access to clean water, availability of a private latrine, and proper waste management (solid and liquid waste). Each component was scored as "adequate" (1) or "inadequate" (0), and total scores ≥2 were classified as adequate sanitation, while scores <2 indicated inadequate sanitation.

Although the study primarily focused on maternal and perinatal determinants, selected household and environmental variables were included to control for potential confounding effects and to provide a more comprehensive understanding of the contextual influences on early breastfeeding practices.

All data were collected through structured face-to-face interviews using a pre-tested questionnaire. Whenever possible, details related to the infant's birth, IMD status, and birth weight were verified through the mother's KIA records to enhance data accuracy. The questionnaire achieved acceptable internal consistency (Cronbach's $\alpha = 0.82$) in pilot testing among 20 non-study respondents.

Data collection was carried out through face-to-face interviews conducted by trained enumerators under close supervision. The interviews were guided by a structured and pre-tested questionnaire designed to capture information on maternal, perinatal, and household characteristics, as well as breastfeeding practices. Each completed questionnaire was reviewed daily by the field supervisor to ensure accuracy, completeness, and consistency of responses.

To reduce potential recall bias, mothers were encouraged to refer to their Maternal and Child Health (KIA) books or vaccination cards during the interviews when recalling early feeding practices, such as colostrum feeding and exclusive breastfeeding during the first six months of the child's life.

Following data collection, all statistical analyses were performed using IBM SPSS Statistics version 26. The analysis proceeded in several stages. First, univariate analysis was conducted to summarize the frequency distribution and percentage of all study variables. Next, bivariate analysis using the Chi-square test was employed to examine associations between each independent variable and the two outcome variables—exclusive breastfeeding and colostrum feeding.

Variables showing a p-value of less than 0.25 in the bivariate analysis were subsequently included in the multivariate analysis. All variables with a p-value <0.25 in the bivariate analysis were

entered into the multivariate logistic regression model using the enter method to control for potential confounders. Separate binary logistic regression models were developed for each outcome: Model 1 for exclusive breastfeeding and Model 2 for colostrum feeding. Adjusted Odds Ratios (AOR) with 95% Confidence Intervals (CI) were calculated to estimate the strength and direction of associations. The goodness-of-fit for each model was evaluated using the Hosmer–Lemeshow test, with $p > 0.05$ considered indicative of an acceptable fit.

Infant age was included as a covariate in both models to control for the possible effects of recall bias. All statistical tests were two-tailed, and a p-value of less than 0.05 was considered statistically significant.

Ethical approval for this study was obtained from the Ethics Committee of STIKes Panca Bhakti, Lampung, Indonesia (Approval No. 018/UE.STIKes/IV/2024), granted on April 22, 2024. The study adhered to ethical standards for human subjects research and followed the principles of the Declaration of Helsinki.

Written informed consent was obtained from all participants or their legal guardians before data collection. Participation in the study was entirely voluntary, and respondents were informed of their right to withdraw from the study at any time without any negative consequences. To ensure privacy and confidentiality, each participant was assigned a unique identification code, and all data were securely stored and used solely for research purposes.

RESULT AND DISCUSSION

Table 1. Characteristics of Mothers and Children in Rural Indonesia

Characteristics	Frequency (n)	Percentage (%)
Exclusive breastfeeding (EBF)		
Non-exclusive (No)	83	39.5
Exclusive breastfeeding (Yes)	127	60.5
Colostrum Feeding		
No colostrum feeding	50	23.8
Colostrum feeding practiced	160	76.2
Maternal age at childbirth		
<20 or >35 years	75	35.7
20–35 years	135	64.3
Maternal education		
Low (None or less than high school)	130	61.9
High (High school or above)	80	38.1
Maternal occupation		
Employed	17	8.1
Not employed	193	91.9
Parity		
Primiparity	53	25.2
Multiparity	157	74.8
Infant age		
<12 months	25	11.9
≥12 months	185	88.1
Birth weight		
<2500 g	15	7.1

Characteristics	Frequency (n)	Percentage (%)
≥2500 g	195	92.9
Child's Gender		
Male	110	52.4
Female	100	47.6
Early initiation of breastfeeding (IMD)		
Not Practiced	71	33.8
Practiced	139	66.2
Paternal age		
<20 and >35 years	111	52.9
20-35 years	99	47.1
Paternal education		
Low (None or less than high school)	137	65.2
High (High school or above)	73	34.8
Socio-economic status		
< IDR 2.633.284 (low-income)	198	94.3
>=IDR 2.633.284 (above standards income)	12	5.7
Family size		
>4 members	105	50.0
≤4 members	105	50.0
Household smoking exposure		
Yes	187	89
No	23	11
Environmental sanitation		
Inadequate	192	91.4
Adequate	18	8.6

A total of 210 mothers of under-five children participated in this study. Among them, 60.5% practiced exclusive breastfeeding (EBF), while 76.2% reported providing colostrum after delivery. Most mothers (64.3%) were aged 20–35 years and 61.9% had low educational attainment. Only 8.1% were employed, and 74.8% were multiparous. The majority of infants (92.9%) were born with normal birth weight (≥2500 g). Approximately two-thirds (66.2%) of mothers practiced early initiation of breastfeeding (IMD). Most households (94.3%) were below the provincial minimum wage, 89% reported smoking exposure, and 91.4% had inadequate sanitation conditions, reflecting rural health disparities.

Table 2. Bivariate Analysis of Factors Associated with Exclusive Breastfeeding among Mothers in Rural Indonesia

Variable	Non-exclusive (No) *n* (%)	Exclusive breastfeeding (Yes) *n* (%)	OR (95% CI)	p-value
Maternal Age at Delivery				
20–35 years	34 (41%)	41 (32.3%)	1.455(0.820–2.585)	0.199
<20 or >35 years	49 (59%)	86 (67.7%)		
Maternal Education				
Low (None or less than high school)	57 (68.7%)	73 (57.5%)	1.622 (0.906–2.903)	0.102

Variable	Non-exclusive (No) *n* (%)	Exclusive breastfeeding (Yes) *n* (%)	OR (95% CI)	p-value
High (High school or above)	26 (31.3%)	54 (57.5%)		
Maternal Occupation				
Employed	4 (4.8%)	13 (10.2%)	2.252 (0.708–7.161)	0.159
Not employed	79 (95.2%)	114 (89.8%)		
Parity				
Primiparity	28 (33.7%)	25 (19.7%)	2.077 (1.105–3.904)	0.022
Multiparity	55 (66,3%)	102 (80.3%)		
Birth Weight				
<2500 g	7 (8.4%)	8 (6.3%)	1.370 (0.477–3.932)	0.557
≥2500 g	76 (91.6%)	119 (93.7%)		
Early Initiation of Breastfeeding (IMD)				
Not Practiced	30 (36.1%)	41 (32.3%)	1.187 (0.663–2.125)	0.563
Practiced	53 (65.9%)	86 (67.7%)		
Paternal Education				
Low (None or less than high school)	55 (66.3%)	82 (64.6%)	1.078 (0.602–1.932)	0.801
High (High school or above)	28 (33.7%)	45 (35.4%)		
Household Income				
< IDR 2.633.284 (low-income)	80 (96.4%)	118 (92.9%)	2.034 (0.534–7.745)	0.289
>=IDR 2.633.284 (above standards income)	3 (3.6%)	9 (7.1%)		
Household Size				
>4	43 (51.8%)	62 (48.8%)	0.887 (0.510–1.543)	0.672
≤4	40 (48.2%)	65 (51.2%)		
Household Smoking Exposure				
Yes	76 (91.6%)	111 (87.4%)	1.565 (0.614–3.985)	0.345
No	7 (8.4%)	16 (12.6%)		
Environmental Sanitation				
Inadequate	80 (96.4%)	112 (88.2%)	3.571 (1.001–12.747)	0.038
Adequate	3 (3.6%)	15 (11.8%)		

Table 2 presents the bivariate associations between maternal, perinatal, and household factors and exclusive breastfeeding (EBF) among under-five children. The analysis revealed significant relationships between parity and environmental sanitation with EBF status ($p<0.05$). Mothers with multiparity had a higher proportion of exclusive breastfeeding compared to primiparous mothers ($p=0.022$), indicating that prior maternal experience enhances confidence and familiarity with breastfeeding practices. This finding suggests that mothers who have breastfed previous children may possess stronger self-efficacy and established routines supporting successful EBF. Additionally, adequate environmental sanitation was significantly associated with higher rates of EBF ($p=0.038$). Mothers living in households with improved sanitation facilities may experience fewer infant illnesses and lower stress levels, facilitating exclusive breastfeeding continuity. Although not statistically significant, higher maternal education and optimal reproductive age (25–35 years) showed positive trends toward EBF adherence. Employment, income, and household size did not exhibit meaningful relationships, likely due to the socioeconomic homogeneity of rural participants.

Table 3. Multivariate Logistic Regression of Factors Associated with Exclusive Breastfeeding

Variable	AOR (95% CI)	p-value
Maternal Occupation	2.200 (0.654–7.403)	0.203
Maternal Age at Delivery	1.519 (0.833–2.767)	0.061
Maternal Education	1.803 (0.985–3.302)	0.056
Environmental Sanitation	3.617 (0.995–13.148)	0.051
Parity	2.266 (1.179–4.356)	0.014

Hosmer–Lemeshow p=0.231 indicates good model fit
Classification accuracy: 63.3%

Note: AOR = Adjusted Odds Ratio; CI = Confidence Interval; model controlled for infant age and relevant confounders

Table 3 shows the result of multivariate logistic regression in which number of independent predictors associated with EBFCH were identified among children under five years. However, after controlling for other potential confounders, maternal parity continued to be a statistically significant determinant of EBF, whereas environmental sanitation was marginally significant. Multiparity was significantly associated with increased likelihood of exclusive breastfeeding 2.27 times compared to mothers giving birth for the first time (AOR = 2.27; 95% CI 1.18–4.36; $p < 0.05$). This indicates that repeating maternal experience and established patterns of breastfeeding boost one's faith and perseverance to maintain EBF. A further explanation could be that multiparous mothers have more robust social network and have previously received lactation consultation, which may help them in continuing to follow the recommendation in breastfeeding. Although good environmental sanitation was not statistically significant in the usual 5% level (AOR = 3.62; 95% CI 0.99–13.15; $p = 0.051$), the positive trend of the association suggests a possibility that clean environment in the home could have a positive impact on the breastfeeding outcome. Cleaner environments could limit risk of infection and maternal stress, thus indirectly promote sustainable EBF, hence further studies are warranted. Maternal age (AOR = 1.52; $p = 0.061$) and education of mother (AOR = 1.80; $p = 0.056$) were approaching significance, which may indicate that their influence is via maternal experience and environment or both. The logistic regression model showed good goodness-of-fit (Hosmer–Lemeshow $p = 0.231$) and 63.3% of its classification accuracy, indicating that the model was reliable.

Table 4. Bivariate Analysis of Factors Associated with Colostrum Feeding among Mothers in Rural Indonesia

Variable	No colostrum feeding (n %)	Colostrum feeding practiced (n %)	OR (95% CI)	p-value
Maternal Age at Delivery				
20–35 years	25 (50.0%)	50 (31.2%)	1.46 (0.82–2.58)	0.199
<25 or >35 years	25 (50.0%)	110 (68.8%)		
Maternal Education				
High (≥Senior High School)	37 (74.0%)	93 (58.1%)	1.62 (0.91–2.90)	0.102
Low (<Senior High School)	13 (25.0%)	67 (41.9%)		
Maternal Occupation				
Employed	4 (8.0%)	13 (8.1%)	2.25 (0.71–7.16)	0.159
Not employed	46 (92.0%)	147 (91.9%)		

Variable	No colostrum feeding (n %)	Colostrum feeding practiced (n %)	OR (95% CI)	p-value
Parity				
Primiparity	14 (28.0%)	39 (24.4%)	2.08 (1.11–3.90)	0.022
Multiparity	36 (72.0%)	121 (75.6%)		
Birth Weight				
<2500 g	8 (16.0%)	7 (4.4%)	1.37 (0.48–3.93)	0.557
≥2500 g	42 (84.0%)	153 (95.6%)		
Early Initiation of Breastfeeding (IMD)				
Not Practiced	27 (54.0%)	44 (27.5%)	1.19 (0.66–2.12)	0.563
Practiced	23 (46.0%)	116 (72.5%)		
Paternal Education				
Low (None or less than high school)	35 (70.0%)	102 (63.8%)	1.08 (0.60–1.93)	0.801
High (High school or above)	15 (30.0%)	58 (36.2%)		
Household Income				
< IDR 2.633.284 (low-income)	47 (94.0%)	151 (94.4%)	2.03 (0.53–7.75)	0.289
>=IDR 2.633.284 (above standards income)	3 (6.0%)	9 (5.6%)		
Household Size				
>4	29 (58.0%)	76 (47.5%)	0.89 (0.51–1.54)	0.672
≤4	21 (42.0%)	84 (52.5%)		
Household Smoking Exposure				
Yes	45 (90.0%)	142 (88.8%)	1.56 (0.61–3.99)	0.345
No	5 (10.0%)	18 (11.2%)		
Environmental Sanitation				
Inadequate	48 (96.0%)	144 (90.0%)	3.57 (1.00–12.75)	0.038
Adequate	2 (4.0%)	16 (10.0%)		

Maternal and environmental factors known to be associated with colostrum feeding among mothers of under-five children are shown in Table 4. Two factors were significantly different ($p < 0.05$): maternal parity and environmental sanitation. Multiparous mothers reported a significantly higher rate of colostrum feeding than primiparous mothers ($p=0.022$), indicating that previous experience of breastfeeding could facilitate confidence in the early infant-feeding methods. Multiparous women might have acquired a better knowledge of the advantages of giving colostrum and been more at ease with the idea of breastfeeding soon after delivery. Furthermore, good environmental sanitation was a positive predictor of colostrum feeding ($p = 0.038$). M others living in relatively cleaner household environment were at greater odds of initiating early breastfeeding, and the profuse explanations could be due to presence of more or less better hygiene and sanitation practice, less exposure to postpartum infections and more hands of health services. Trends towards increasing maternal education and place of delivery at health facility were also positive for colostrum feeding although not statistically significant, this could indicate the possibility that interaction with skilled providers and receipt of health information may further support optimal feeding practices.

Table 5. Multivariate Logistic Regression of Factors Associated with Colostrum

Variable	AOR (95% CI)	p-value
Maternal Occupation	0.984 (0.288–3.358)	0.979
Maternal Age at Delivery	2.136 (1.107–4.120)	0.019
Maternal Education	2.024 (0.989–4.141)	0.047
Environmental Sanitation	2.484 (0.542–11.370)	0.241
Parity	1.396 (0.662–2.948)	0.381

Model Fit: Hosmer–Lemeshow test, p = 0.624
Classification accuracy: 74.3%
Note: AOR = Adjusted Odds Ratio; CI = Confidence Interval; model controlled for infant age and relevant confounders

Table 5 presents the findings of the multivariate logistic regression on the determinants of colostrum feeding. After controlling for the confounders, both maternal age at child birth and maternal education were still significant predictors ($p < 0.05$). Women between the ages of 20–35 were more than twice as likely to feed colostrum as younger (< 20 years) or older (> 35 years) women (AOR = 2.14; 95% CI 1.11–4.12). This implies that when reproductive age is right, higher knowledge, confidence, and physical pool are led to breast feeding initiation. Similarly, the odds of feeding colostrum was twice higher among mothers who had high education (AOR = 2.02; 95% CI 0.99–4.14; $p < 0.05$) indicating the power of maternal literacy and contact with health services. Mothers who are educated tend to be more attentive to antenatal counseling and know the importance of the immunological and nutritional values of colostrums, which may result more compliance towards early-feeding advices. Though environmental sanitation was not statistically significant anymore after adjusting for other variables (AOR = 2.48; 95% CI 0.53–11.63; $p = 0.241$), the relationship was still positive, which suggested that better home cleanliness still promotes good breastfeeding practices. The model showed good calibration (Hosmer–Lemeshow $p = 0.624$) and a reasonable overall classification accuracy (74.3%), which could be interpreted as the predictive ability being relatively high.

Discussion

From a behavioral perspective, these findings are not unexpected. Maternal perceptions and behaviors related to breastfeeding are often shaped by their surrounding environmental context. Within this framework, the Health Belief Model (HBM) offers a useful lens to understand how maternal perceptions of benefits, barriers, and susceptibility influence breastfeeding decisions. Applying this model helps explain how environmental and personal factors jointly affect maternal feeding behaviors.

This study examined maternal and perinatal factors associated with exclusive breastfeeding (EBF) and colostrum feeding among mothers of under-five children in rural Indonesia. The results revealed that parity and environmental sanitation were significantly associated with EBF, while maternal age and education were important determinants of colostrum feeding. When interpreted alongside previous research on maternal feeding practices, these findings highlight the multifactorial nature of both environmental and experiential influences that shape breastfeeding behaviors in resource-limited settings.

Exclusive Breastfeeding

Multiparous mothers were more likely to practice exclusive breastfeeding than primiparous mothers, consistent with studies from Ethiopia and Japan (Tsega et al., 2025; Kitano et al., 2015). This may reflect stronger breastfeeding self-efficacy and greater experience in managing common lactation challenges such as nipple pain, improper latching, and perceived milk insufficiency (Mohamed et al., 2018; Brani et al., 2024; Huang et al., 2019; Feenstra et al., 2018; Pérez-Escamilla et al., 2023). In contrast, first-time mothers often face uncertainty and limited practical skills, which increase the likelihood of early cessation. These results underscore the importance of providing targeted antenatal and postnatal counseling for primiparous mothers to strengthen confidence, problem-solving ability, and family support for successful exclusive breastfeeding.

These findings align with the Health Belief Model (HBM), where maternal perceptions of susceptibility to infant illness and perceived benefits of breastfeeding influence adherence to exclusive breastfeeding. Multiparous mothers may perceive lower barriers and higher self-efficacy, which strengthen sustained EBF practice.

Interestingly, environmental sanitation showed a marginal association with exclusive breastfeeding ($p = 0.051$). Although not statistically significant, the positive direction suggests that mothers living in cleaner household environments may have better health status and fewer childcare disruptions, enabling sustained breastfeeding. A similar relationship was reported in a multi-country analysis by Kim et al. (2019), which indicated that improved WASH (Water, Sanitation, and Hygiene) conditions reduce infection-related morbidity and indirectly promote breastfeeding continuity. These findings highlight the potential synergy between WASH improvements and maternal–child nutrition interventions.

Although maternal age and education were not statistically significant in this study, both trended toward positive associations with EBF. Educated and mature mothers are generally more aware of breastfeeding benefits and more likely to engage with health workers, as observed in Indonesia and Malaysia (Fatmawati et al., 2023; Jalil et al., 2024). The absence of significance may reflect the relatively homogeneous socioeconomic background of participants. Similarly, variables such as maternal occupation, socioeconomic status, and infant age showed no significant relationship with EBF—consistent with findings from other rural settings in Indonesia and Vietnam (My et al., 2022; Nisa et al., 2021). When socioeconomic variation is limited, psychosocial factors such as self-efficacy, cultural norms, and family support may play stronger roles in shaping breastfeeding practices.

Colostrum feeding

Colostrum feeding showed significant associations with maternal age and education. Mothers aged 20–35 years were more likely to provide colostrum compared with younger or older women, consistent with findings from Niger and Indonesia (Gayatri & Dasvarma, 2020; Hamidou et al., 2024). Women within this age range often exhibit optimal reproductive readiness and have greater access to maternal–child health information, facilitating healthier early-feeding practices (Clément & Tereno, 2023). In contrast, adolescent mothers may have limited breastfeeding knowledge and confidence, whereas older mothers may face health or delivery-related challenges that delay early initiation of breastfeeding.

Maternal education also emerged as an important determinant. Mothers with higher levels of education tend to possess better understanding of neonatal immunity and the protective benefits of colostrum—such as antibodies, immunoglobulins, and bioactive compounds that support gut maturation and reduce infection risk (Arslan et al., 2021). This finding aligns with the meta-analysis

by Amallia et al. (2023), which reported that maternal education positively predicts both early initiation of breastfeeding and colostrum-feeding practices.

These findings align with the Health Belief Model (HBM), in which maternal education and optimal reproductive age enhance *perceived benefits* and provide *cues to action* that encourage timely colostrum feeding. Mothers who recognize the protective value of colostrum and their infant's susceptibility to illness are more likely to engage in early breastfeeding initiation, reinforcing positive health beliefs and proactive maternal behaviors.

Although environmental sanitation did not reach statistical significance in the colostrum model, the direction of association suggests possible indirect effects. Poor sanitation increases maternal workload and household infection burden, which may contribute to delayed breastfeeding initiation. UNICEF and WHO (2023) similarly highlight that environmental conditions, maternal responsibilities, and cultural norms interact to shape infant-feeding practices in rural settings.

Maternal occupation and socioeconomic status also did not show significant associations with colostrum feeding, likely due to the relative social homogeneity of the study population, where most mothers were not formally employed and shared similar economic backgrounds. Such uniformity may reduce variability, masking potential associations that are more apparent in urban or socioeconomically diverse communities.

Overall, these findings emphasize that maternal age and education are key determinants of colostrum feeding in rural, resource-constrained settings. Strengthening health education, reinforcing maternal awareness, and improving WASH-supportive environments are essential strategies to promote timely colostrum feeding and optimal early newborn nutrition.

Policy and Practice Implications

From a community standpoint, the findings emphasize the need for integrated, community-based breastfeeding interventions that address both behavioral and environmental determinants. Tailored antenatal counseling for primiparous and less-educated mothers, maternal education programs through Posyandu networks, and intersectoral collaboration to enhance rural sanitation could collectively strengthen early feeding practices. By promoting maternal knowledge, confidence, and supportive environments, public health programs can improve exclusive breastfeeding and colostrum feeding rates—laying a strong foundation for child growth and stunting prevention in rural Indonesia.

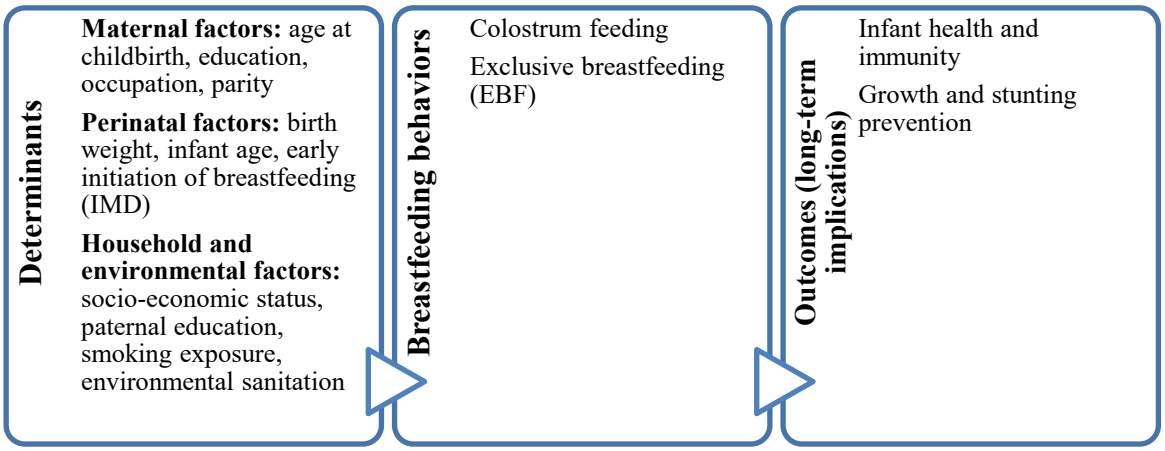

Figure 1. Conceptual framework illustrating how maternal, perinatal, and environmental determinants influence breastfeeding behaviors and subsequent child health outcomes.

This framework illustrates the hypothesized relationships among maternal, perinatal, and environmental determinants influencing early breastfeeding behaviors—specifically colostrum feeding and exclusive breastfeeding. Guided by the Health Belief Model (HBM) and ecological perspective, maternal characteristics (e.g., age, education, parity) shape knowledge, perceived benefits, and self-efficacy related to breastfeeding. Meanwhile, contextual factors such as sanitation, household income, and smoking exposure influence maternal capacity and environmental support for sustained breastfeeding. Together, these determinants affect feeding behaviors that directly contribute to infant health, immunity, and long-term growth outcomes.

Strengths and Limitations

This study's strength lies in its combined analysis of EBF and colostrum feeding within a rural population, offering a comprehensive view of early feeding trajectories. However, several limitations should be acknowledged. The cross-sectional design precludes causal inference, and reliance on maternal recall introduces potential memory bias despite verification using KIA records. The sample size was modest and selected purposively, limiting external validity to other populations. Future longitudinal and mixed-methods studies are recommended to explore behavioral mechanisms and cultural factors influencing breastfeeding sustainability.

Policy and Practice Implications

Tailored antenatal and postnatal counseling—especially for primiparous and less-educated mothers—should emphasize the benefits of early and exclusive breastfeeding within the first 1000 days. Peer-support programs led by experienced mothers and the integration of WASH improvement initiatives into maternal–child health services may further enhance adherence. By reinforcing both behavioral and environmental determinants, community health programs can build a more resilient ecosystem for optimal infant feeding and growth.

CONCLUSION

This study is the first to investigate determinants of exclusive breastfeeding (EBF) and colostrum feeding in rural Indonesia by integrating maternal and newborn health services. It found that maternal age, education, parity, and early initiation of breastfeeding (EIBF) were positively linked to optimal feeding practices, while environmental sanitation showed a nearly significant influence. These findings highlight the importance of improving maternal health literacy, strengthening antenatal and postnatal support, and promoting early breastfeeding to shape infant feeding behaviors. Although stunting was not directly measured, the results are relevant to stunting prevention efforts, as EBF and colostrum feeding are crucial for infant immunity and growth and help reduce infection-related growth faltering. Community-based interventions targeting maternal education, breastfeeding support—especially for first-time mothers—and environmental sanitation could enhance early-life nutrition and support national stunting reduction initiatives. Future research should evaluate the direct impact of these factors and interventions on stunting outcomes and explore scalable models for integrating breastfeeding promotion within rural health systems.

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