Original Article

Cesarean Delivery and Early Breastfeeding Outcomes: A Cross-Sectional Study of EIBF and Early Postpartum Difficulties

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ABSTRACT

Background: Cesarean section (CS) rates continue to increase globally, particularly in low- and middle-income countries (LMICs) such as Indonesia. While CS is often medically indicated, it may interfere with early initiation of breastfeeding (EIBF) and early postpartum lactation. However, evidence examining both EIBF and early breastfeeding difficulties within Indonesian LMIC settings remains limited.

Methods: This cross-sectional study followed STROBE guidelines and was conducted among 150 postpartum mothers within the first 10 days after delivery. Participants were recruited using consecutive sampling. Eligibility criteria included mothers aged ≥18 years, live singleton birth, and clinical stability. Data were collected using a structured Breastfeeding Initiation and Early Lactation Difficulty Questionnaire adapted from validated instruments (Cronbach's α = 0.82). Chi-square tests were used to assess associations, with assumptions verified (expected cell count ≥5). Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate effect size.

Results: CS was significantly associated with failure to perform EIBF (OR = 214.79; 95% CI: 27.90–1653.65; $p < 0.001$). Mothers undergoing CS were also more likely to experience breastfeeding difficulties during the first 10 days postpartum (OR = 17.26; 95% CI: 6.24–47.74; $p < 0.001$).

Conclusion: CS delivery is strongly associated with delayed EIBF and increased early breastfeeding difficulties. Structured post-cesarean lactation support integrated into surgical recovery protocols is recommended, particularly in LMIC settings.

Keywords: Cesarean Section; Early Initiation of Breastfeeding; Postpartum Period; Lactation Disorders; Maternal Health.

Implications for Practice:

- Hospitals in LMIC settings should integrate structured lactation support into post-cesarean recovery pathways, including early skin-to-skin facilitation and individualized pain management.
- Nurses and midwives should receive standardized training in positioning techniques and early lactation counseling for post-cesarean mothers.
- Low-resource health facilities should implement early postpartum follow-up within 10 days to identify and manage breastfeeding difficulties promptly.

Introduction

Childbirth occurs primarily through vaginal delivery or cesarean section (CS). Globally, CS rates have increased substantially over the past two decades, exceeding 21% of all births and projected to

approach 30% by 2030 (World Health Organization [WHO], 2023). Although CS is a life-saving intervention when medically indicated, unnecessary or non-medically indicated procedures raise concerns regarding maternal and neonatal outcomes, including early breastfeeding practices (Betrán et al., 2021). Evidence suggests that rising CS rates may influence immediate postpartum physiology and maternal–infant interaction, thereby affecting breastfeeding initiation and continuation (Ahmad et al., 2021; Barliyani et al., 2024).

Early initiation of breastfeeding (EIBF), defined as initiating breastfeeding within the first hour after birth, is a cornerstone of neonatal survival and maternal health. EIBF promotes thermoregulation, immune protection through colostrum transfer, and oxytocin-mediated uterine contraction, while strengthening maternal–infant bonding (Nasrullah, 2021; Ulfaa et al., 2023). Despite its well-documented benefits, global EIBF coverage remains suboptimal, particularly in low- and middle-income countries (LMICs), where institutional and procedural barriers may hinder immediate breastfeeding (Anita et al., 2022; Annisa, 2023).

From a physiological perspective, CS may disrupt the maternal recovery–lactation pathway. Vaginal birth stimulates endogenous oxytocin and prolactin release through neurohormonal reflexes activated by labor and early skin-to-skin contact. In contrast, CS—especially when performed before labor onset—may delay lactogenesis II, impair oxytocin pulsatility, and reduce early mother–infant contact due to surgical recovery protocols (Gedefaw et al., 2020). This disruption can lead to delayed EIBF and increased early breastfeeding difficulties, including poor latch, delayed milk production, and reduced feeding frequency. (Hobbs et al., 2016; Maviso et al., 2024).

Several systematic reviews and multicountry analyses consistently demonstrate that CS is associated with delayed breastfeeding initiation and lower exclusive breastfeeding rates (Ibrahim et al., 2023; Oyedele, 2023) Large-scale data from 73 LMICs indicate that higher CS rates are inversely associated with EIBF implementation, particularly in institutional settings with routine postoperative separation of mother and infant (Vaz et al., 2022). Similarly, hospital-based studies report that post-cesarean mothers are significantly more likely to delay breastfeeding beyond the first hour compared to mothers with vaginal births.

Beyond delayed initiation, CS has been linked to early postpartum breastfeeding difficulties. Postoperative pain, limited mobility, anesthesia effects, and emotional stress may interfere with positioning, milk let-down reflex, and maternal confidence (Gedefaw et al., 2020; Mary et al., 2022), Studies across Asia and Sub-Saharan Africa report that mothers undergoing CS experience higher odds of early breastfeeding problems within the first postpartum week (Cirpanli et al., 2022; Ibrahim et al., 2023). These findings support the conceptual sequence: surgical delivery impaired physiological adaptation → delayed EIBF increased early breastfeeding challenges.

Indonesia, classified as an LMIC, has experienced increasing CS rates alongside persistent gaps in optimal breastfeeding practices (WHO, 2023). While national surveys describe EIBF prevalence, limited empirical studies simultaneously examine CS, EIBF, and early breastfeeding difficulties within localized Indonesian healthcare settings. Moreover, few studies integrate physiological and institutional explanations within a unified analytical framework. Understanding this relationship is particularly relevant in LMIC contexts where resource constraints, limited

lactation counseling, and postoperative care practices may exacerbate breastfeeding barriers (Ahmad et al., 2021).

Methods

Study Design

This study employed an analytical cross-sectional design conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. A cross-sectional approach was selected to examine the association between mode of delivery and early breastfeeding outcomes within a defined postpartum window (≤10 days), allowing simultaneous assessment of exposure (Cesarean section [CS]) and outcomes (Early Initiation of Breastfeeding [EIBF] and early breastfeeding difficulties).

Participants

The study was conducted between October and December 2024 in four maternity facilities in Muara Enim, Indonesia: Dr. H.M. Rabain Regional General Hospital, PMB Een Setiawati, Mitra Sehat Clinic Kedung Waringin, and Sugih Waras Public Health Center. The source population consisted of postpartum mothers within the first 10 days after delivery. Inclusion criteria were age ≥18 years, live singleton birth, postpartum period ≤10 days, clinically stable mother and neonate, and willingness to provide written informed consent. Exclusion criteria included severe maternal complications requiring intensive care, neonatal admission to the NICU preventing breastfeeding, and cognitive impairment limiting questionnaire participation. Participants were recruited using consecutive sampling, whereby all eligible mothers presenting during the study period were approached until the target sample size was achieved. A formal a priori power calculation was not performed; however, the total sample of 150 participants met the minimum requirement for chi-square analysis with adequate expected cell counts (≥5 per cell) for categorical comparisons, and this limitation is acknowledged in the discussion. During the study period, 162 postpartum mothers were screened for eligibility, of whom 12 were excluded (7 did not meet inclusion criteria and 5 declined participation). A total of 150 participants were enrolled, no participants withdrew after consent, and complete outcome data were obtained for all respondents.

Instruments

Data were collected using the Breastfeeding Initiation and Early Lactation Difficulty Questionnaire (BIELDQ), adapted from validated breastfeeding assessment instruments used in international postpartum studies. The questionnaire consisted of four sections: sociodemographic characteristics; mode of delivery (CS or vaginal delivery); Early Initiation of Breastfeeding (EIBF) (binary: initiated within 1 hour = yes/no); and early breastfeeding difficulties (binary outcome based on reported difficulties during the first 10 days). Additional breastfeeding indicators included frequency of breastfeeding per 24 hours (<8 vs ≥8 times) and duration per session (<10 vs ≥10 minutes). Content validity was evaluated by three maternal health experts (two obstetricians and one senior midwife). A pilot study was conducted among 20 postpartum mothers outside the study sites. Internal consistency reliability showed acceptable performance (Cronbach's α = 0.82), and minor wording adjustments were made following pilot testing to improve clarity.

Data Collection

Data collection was conducted between October and December 2024 across four maternity facilities in Muara Enim, Indonesia. Eligible postpartum mothers within ≤10 days after delivery were

approached during their visit or postpartum care period. After screening for inclusion and exclusion criteria, participants who met the eligibility requirements were provided with an explanation of the study objectives and procedures, and written informed consent was obtained prior to participation. Data were collected using a structured Breastfeeding Initiation and Early Lactation Difficulty Questionnaire (BIELDQ), administered through direct interview to ensure completeness and minimize missing data. The questionnaire captured sociodemographic characteristics, mode of delivery, early initiation of breastfeeding (EIBF), early breastfeeding difficulties, and additional breastfeeding indicators including frequency and duration of breastfeeding sessions. All data were recorded at a single time point, and no follow-up measurements were conducted.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to summarize participant characteristics and breastfeeding outcomes, presented as frequencies and percentages. Bivariate analysis was performed using the chi-square test to assess the association between mode of delivery (cesarean section vs vaginal delivery) and breastfeeding outcomes, including EIBF and early breastfeeding difficulties. Statistical assumptions for the chi-square test were verified, particularly ensuring that expected cell counts were ≥5. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated to estimate the strength of associations. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

This study was conducted in accordance with ethical principles for human subject research. Ethical approval was obtained from an appropriate institutional review board prior to data collection. All participants provided written informed consent after receiving a clear explanation of the study purpose, procedures, risks, and benefits. Participation was voluntary, and respondents were informed of their right to withdraw at any time without any consequences to their care. Confidentiality and anonymity were strictly maintained by not recording personal identifiers and by securely storing all collected data for research purposes only.

Results

A total of 150 postpartum mothers were included in the analysis. No missing outcome data were recorded. Sociodemographic and clinical characteristics are presented in **Table 1.**

Table 1. Sociodemographic and Clinical Characteristics of Respondents (N = 150)

Variable	Category	n (%)
Age (years)	<25	42 (28.0)
	25–34	78 (52.0)
	≥35	30 (20.0)
Parity	Primiparous	64 (42.7)
	Multiparous	86 (57.3)
Education	Primary–Secondary	91 (60.7)
	Higher Education	59 (39.3)
Mode of Delivery	Cesarean section (CS)	78 (52.0)
	Vaginal delivery	72 (48.0)
Birth Weight (grams)	2500–3500	78 (52.0)
	>3500	72 (48.0)

Distribution of Breastfeeding Outcomes

The overall distribution of breastfeeding practices and early difficulties is presented in **Table 2.**

Table 2. Distribution of Early Breastfeeding Outcomes (N = 150)

Outcome	Category	n (%)
Early Initiation of Breastfeeding (EIBF)	Performed	44 (29.3)
	Not performed	106 (70.7)
Breastfeeding difficulties (≤10 days)	Experienced	96 (64.0)
	Not experienced	54 (36.0)
Breastfeeding frequency (per 24h)	<8 times	117 (78.0)
	≥8 times	33 (22.0)
Duration per session	<10 minutes	121 (80.7)
	≥10 minutes	29 (19.3)

Association Between Cesarean Section and Breastfeeding Outcomes

Chi-square assumptions were met (expected cell counts ≥5). Cesarean section was significantly associated with failure to perform EIBF and with early breastfeeding difficulties (**Table 3**).

Table 3. Association Between Cesarean Section and Breastfeeding Outcomes (N = 150)

Outcome	Cesarean Section (CS) n (%)	Vaginal Delivery n (%)	OR (95% CI)	p-value
EIBF not performed	77 (98.7)	19 (26.4)	214.79 (27.90–1653.65)	<0.001
Breastfeeding difficulties	73 (93.6)	33 (45.8)	17.26 (6.24–47.74)	<0.001

Discussion

This study identified two principal findings. First, cesarean section (CS) was strongly associated with failure to perform Early Initiation of Breastfeeding (EIBF). Second, CS significantly increased the likelihood of experiencing breastfeeding difficulties during the first 10 postpartum days. These findings reinforce the hypothesis that surgical delivery disrupts early maternal–infant adaptation and lactation processes. (Barliyani et al., 2024).

From a physiological perspective, vaginal delivery stimulates endogenous oxytocin and prolactin release through neuroendocrine responses triggered by labor and immediate skin-to-skin contact (Annisa, 2023).. These hormonal mechanisms facilitate early milk ejection and bonding. In contrast, CS—particularly when performed before the onset of labor—may attenuate oxytocin pulsatility and delay lactogenesis II. Postoperative pain, anesthesia exposure, and restricted mobility further limit early skin-to-skin contact, which is a key stimulus for successful EIBF. This maternal recovery–lactation pathway provides a conceptual explanation for the markedly lower likelihood of EIBF among mothers undergoing CS (Anita et al., 2022; Hobbs et al., 2016).

The association between CS and early breastfeeding difficulties observed in this study is also consistent with the physiological and behavioral cascade that follows delayed initiation (Gedefaw et al., 2020). When EIBF does not occur, infants may experience delayed latch establishment, while mothers may perceive insufficient milk supply due to delayed lactogenesis (Cirpanli et al., 2022; Maviso et al., 2024). Surgical discomfort around the abdominal incision often limits optimal positioning, contributing to ineffective attachment and reduced feeding frequency. These early disruptions can compound during the first 10 days postpartum, increasing maternal stress and reducing confidence in breastfeeding capability.

International literature supports these findings. Multicountry analyses across

LMICs demonstrate an inverse association between CS rates and EIBF coverage (Show et al., 2024). Systematic reviews report that mothers who deliver via CS are significantly less likely to initiate breastfeeding within the first hour and more likely to discontinue exclusive breastfeeding earlier than mothers with vaginal delivery (Perrella et al., 2024). Hospital-based studies in Southeast Asia and Sub-Saharan Africa similarly highlight postoperative pain, delayed mother–infant contact, and institutional recovery protocols as key contributors to breastfeeding delay. The consistency between the present findings and international evidence strengthens the plausibility of the observed associations (Ahmad et al., 2021).

However, the magnitude of association observed in this study may reflect contextual realities specific to LMIC healthcare systems (Ginting et al., 2019). In many Indonesian facilities, structured post-cesarean lactation support is not systematically integrated into surgical recovery pathways (Nurbaiti, 2020). Limited availability of lactation consultants, staffing constraints, and routine postoperative separation practices may amplify the physiological challenges inherent to CS (Sukarti et al., 2020). Unlike high-resource settings where recovery rooms often support immediate skin-to-skin contact, resource limitations in LMIC contexts may delay breastfeeding support beyond the critical first hour. These structural factors likely interact with biological mechanisms, intensifying early breastfeeding barriers (Sumaryanti et al., 2022).

The findings should be interpreted with caution (Annisa, 2023). The cross-sectional design limits causal inference, as temporal sequencing between recovery barriers and breastfeeding outcomes cannot be definitively established. Additionally, although strong associations were identified, residual confounding factors such as maternal intention to breastfeed, prior breastfeeding experience, and institutional protocols were not fully controlled. Therefore, while the maternal recovery–lactation pathway offers a plausible explanatory framework, longitudinal research is required to clarify mediating mechanisms (Yanti et al., 2021).

Implications and limitations

This study provides a conceptual and scientific contribution by reinforcing the maternal recovery–lactation pathway framework, in which cesarean section (CS) is understood to disrupt early neurohormonal processes (e.g., oxytocin release and lactogenesis), delay early initiation of breastfeeding (EIBF), and subsequently increase the risk of early breastfeeding difficulties. By simultaneously examining mode of delivery, EIBF, and early lactation challenges within a single analytical model in an Indonesian low- and middle-income country (LMIC) context, this study extends existing theoretical perspectives that often assess these components separately, thereby offering a more integrated explanation of early postpartum breastfeeding outcomes. The findings also contribute to the growing body of global evidence highlighting how physiological mechanisms and health system contexts interact to shape breastfeeding practices in resource-limited settings. However, several limitations should be acknowledged. The cross-sectional design precludes causal inference and limits the ability to establish temporal relationships between exposure and outcomes. The study was conducted in a limited number of facilities within one district, which may reduce generalizability to other settings with different clinical practices. Data were based on self-reported measures collected within the first 10 postpartum days, which may introduce

recall and reporting bias. Additionally, potential confounding variables—such as maternal intention to breastfeed, prior breastfeeding experience, timing of skin-to-skin contact, and facility-specific postoperative protocols—were not fully controlled, which may influence the observed associations.

Relevance to Practice

Nurses and midwives should initiate breastfeeding support immediately in the post-cesarean recovery area by facilitating skin-to-skin contact when clinically feasible, assisting incision-safe positioning (e.g., side-lying or football hold), and providing hands-on latch guidance during the first feeding attempt. Hospitals should embed EIBF as a standard item in post-cesarean care pathways, including coordinated pain management that supports maternal mobility and responsiveness, routine breastfeeding assessment before discharge, and clear referral to lactation support when problems are identified. In low-resource settings, facilities can implement pragmatic follow-up within the first 10 days postpartum (phone call, home visit, or scheduled clinic check) to screen for common breastfeeding difficulties and provide targeted counseling, while engaging family members to assist with positioning, infant handling, and emotional support during early recovery.

Conclusion

Cesarean section (CS) was strongly associated with poorer early breastfeeding outcomes in this Indonesian LMIC setting, as mothers who delivered by CS were substantially more likely to not perform early initiation of breastfeeding (EIBF) within the first hour and to experience breastfeeding difficulties during the first 10 postpartum days; the key take-home message is that CS delivery should automatically trigger structured lactation support starting in the recovery phase—prioritizing early skin-to-skin contact when clinically feasible, incision-adapted positioning assistance, and individualized pain management with breastfeeding counseling—while future longitudinal, multicenter studies are needed to clarify causal pathways (e.g., postoperative pain, delayed lactogenesis, mother–infant separation, and facility protocols) and to evaluate scalable post-cesarean interventions suitable for low-resource settings.

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CrediT Authorship Contributions Statement

Ita Herawati: Conceptualization, Methodology, Supervision, Writing Original Draft, Validation

Budi Ermanto : Methodology, Formal Analysis, Supervision, Writing, Review & Editing

Agnes Andika : Investigation, Data Curation, Resources, Project Administration

Jumsinah: Investigation, Data Curation, Resources

Lia Widiyanti : Software, Data Curation, Visualization

Ocha Gries Tika: Investigation, Validation, Writing – Review & Editing

Yanti Marlita: Project Administration, Resources, Visualization, Writing, Review & Editing

Conflicts of Interest

There is no conflict of interest.

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