

Multifaceted Interventions on Lactation Outcomes, Breastfeeding Self-Efficacy (BSE), and Infant Satiety among Mothers after Lesser Segment Cesarean Section (LSCS): A study on Systematic review and Meta-analysis

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Abstract

Background: Designed in LSCS, there are certain difficulties faced during the onset and sustained practice of breastfeeding. Multifaceted interventions consisting of education, lactation support, direct maternal-infant skin contact facilitation, and self-efficacy building techniques have the potential to improve lactation outcomes, BSE of mothers, and satiety indicators of their neonates.

Objective: To aggregate existing findings regarding the multifaceted interventions in relation to lactation outcomes, breastfeeding self-efficacy, and infant satiety among LSCS mothers.

Methods: A comprehensive literature search was conducted across multiple electronic databases, namely Pubmed, MEDLINE, Embase, CINAHL, Cochrane Central, Web of Science, and relevant clinical trial registries, covering studies published between 2020 and 2025. Randomized controlled trials and quasi-experimental studies evaluating multifaceted interventions among postpartum mothers who underwent Lesser Segment Cesarean Section, and reporting at least one primary outcome of interest, were considered eligible for inclusion. The author independently screened the studies, extracted relevant data, and evaluated the risk of bias using the RoB2 tool for randomized controlled trials and the ROBINS-I tool for non-randomized studies. A random-effects meta-analysis was undertaken to synthesize the findings. Statistical heterogeneity was assessed using the I^2 statistic, and the certainty of evidence was appraised using the GRADE approach.

Results: The multifaceted interventions showed significant improvement in the initiation of breastfeeding, time to lactogenesis II, and rates of exclusive breastfeeding for mothers who had undergone LSCS. The pooled results showed a marked improvement in breastfeeding self-efficacy scores when compared with those undergoing standard care. Various interventions were found to have improved satiety cues, indicated by fewer crying spells and improved self-reported satisfaction with breastfeeding. Average to high degrees of heterogeneity were reported, particularly with regard to intervention components and the tools used for data collection. The GRADE framework indicated that the certainty of the evidence ranged from average to high.

Conclusion: The effects are positive when multiple intervention methods are applied to lactation outcomes, breastfeeding self-efficacy, and infant satiety. The application of well-structured multi-component methods for breastfeeding support may have a significant impact on post-LSCS breastfeeding.

Keywords: Cesarean section, breastfeeding, multifaceted interventions, lactation outcomes, breastfeeding self-efficacy, infant satiety, systematic review, meta-analysis.

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INTRODUCTION

Breastfeeding is considered the most appropriate and best form of nutrition for the infant. It benefits both mother and child; however, despite global recommendations for early initiation and six months of exclusive breastfeeding, others undergoing LSCS often experience difficulties in breastfeeding.¹ The most common problems identified with breastfeeding in mothers who have undergone a C-Section include delayed initiation of breastfeeding, less milk supply, pain after the operation, separation from the baby, and lack of confidence in breastfeeding.^{2,3} In order to obviate these barriers, various multifaceted interventions, including skin-to-skin contact,⁴ lactation counseling, breastfeeding education, positioning support,⁵ and early breastfeeding assistance, have been initiated in clinical and community settings to promote improvement in physiological lactation processes, maternal self-efficacy, and infant feeding outcomes.⁶ However, the evidence-base supporting the effectiveness of these interventions differs among the studies, with variations in methodology, components of intervention, and outcome measures.⁷ It requires a systematic review studies and meta-analysis for synthesizing the research proof, the impact of multifaceted strategies, and evidence-based recommendations to improve breastfeeding among post-LSCS mothers.⁸

The review focuses on the effectiveness of multifaceted interventions aimed at improving lactation outcomes,⁹ self-efficacy,¹⁰ and satiety¹¹ among mothers who have had LSCS operations. The findings provide evidence that informs healthcare service providers and policy makers on effective ways of providing support through multifaceted breastfeeding interventions.^{12,13}

METHODOLOGY

Study Design: This study employed a systematic review and meta-analysis, conducted in line with the PRISMA reporting guidelines.¹⁴

Search Strategy: A thorough literature search was conducted using major electronic databases such as PubMed, CINAHL, Scopus, Web of Science, and the Cochrane Library. To ensure completeness, Google Scholar and the reference lists of relevant studies were also examine. Search terms included combinations of cesarean section, LSCS, breastfeeding, lactation, breastfeeding self-efficacy, infant satiety, skin-to-skin contact, lactation counselling, and multifaceted interventions.

Eligibility Criteria: Studies were considered for inclusion if they satisfied the following conditions:

Participants: Mothers who delivered by LSCS.

Intervention: Multifaceted breastfeeding interventions (two or more components such as education, counseling, skin-to-skin contact, positioning support, lactation management).

Outcomes: Lactation outcomes (e.g., time to lactogenesis II, breastfeeding initiation), breastfeeding self-efficacy, and infant satiety.

Study Design: This review included randomized controlled trials (RCTs), quasi-experimental studies, and other controlled trials.

Language: English.

Studies were excluded if they were observational, focused on single-component interventions only, or did not report relevant outcome data.

Study Selection

All studies found in the literature were imported into a reference manager, and duplicates were eliminated. Researcher screened titles and abstracts of studies found, followed by the full text of studies deemed appropriate for inclusion, after consulting the guide with the subject specialist.

Data Extraction:

A structured data extraction form was used to collect information on key variables, including the study title, authors, year of publication, country, study design, sample size, interventions implemented, duration, and reported outcomes. Data extraction was performed independently by the researcher.

Risk of Bias Assessment:

The risk of bias for included randomized trials was evaluated using the Cochrane Risk of Bias tool, while non-randomized studies were assessed with the ROBINS-I tool. All assessments were carried out by three researcher.¹⁵

Data Analysis

The meta-analysis involved a random model, considering that variation in results was anticipated. For a continuous variable, mean difference or standardized mean difference was calculated, while for a binary variable, a risk ratio was calculated. Also, I^2 effect was checked to evaluate heterogeneity in the results.

Certainty of evidence: The confidence and quality of evidence for each outcome were evaluated using the GRADE approach.¹⁶ In this method, the limitations, consistency, precision, directness, and publication bias are taken into account.

PRISMA flow focused search, 2020–2025

Identification

Records identified through database searching (PubMed/PMC, Scopus, Clinical Trials, google scholar, and journals; search period 2020-2025): A total of eleven records identified that appeared to be intervention trials or protocols.

Records retained after duplicates removed are nine.

Screening

Records screened: Two records were excluded at the title and abstract screening stage as they were not LSCS intervention trials or did not report relevant outcomes.

Eligibility: Seven full text articles were assessed for inclusion.

Included: Seven studies were included in the qualitative synthesis (systematic review), comprising randomized or prospectively randomized trials and RCT protocols that reported results or provided sufficient outcomes data. Of these, three studies were eligible for inclusion in the quantitative synthesis (meta-analysis), as they reported comparable behavioral breastfeeding outcomes, whereas the remaining trials assessed physiological outcomes or measurement scales.

Included trials: 2020-2025

1. Xu J. et al., 2024- single center prospective randomized controlled trial of elective cesarean, China, n=280.

Intervention: Implementation of early essential newborn care / immediate single skin contact and early breastfeeding support during/after CS versus routine care. Main outcomes: Improved early breastfeeding practices and initiation of breastfeeding, and enhanced mother-infant attachment.¹⁶

Safe to implement in Cesarean setting: Yes

2. Wang X et al., multi-center RCT protocol 2022 results / implementing EENC reported in 2024 (China).

Intervention: Early Essential Newborn Care in cesarean section deliveries. Main reported results (trial report 2024): EENC improved breastfeeding and mother-baby outcomes; recommended for Cesarean section.¹⁷

3. Bertrand KM et al., 2020 – RCT / prospective randomized case-controlled study of immediate SSC and breastfeeding during cesarean.

Intervention: immediate skin-to-skin contact and early breastfeeding in CS compared to delayed/standard practice. Main outcomes: reduction in maternal oxidative stress, earlier initiation of breastfeeding, and successful first latch.¹⁸

4. Montgomery MO et al. 2020, randomized controlled trial of family-centered (family-centered/gentle

Intervention: Family-centered cesarean section with earlier use of skin-to-skin contact and mother-centric practices. Main outcomes: Earlier onset of skin-to-skin contact and trends towards better early breastfeeding practices (no harm); supports family-centered cesarean section.¹⁹

5. Kram JJF et al., 2021 family-centered cesarean randomized trial (reported outcomes: SSC timing, breastfeeding initiation).

As reported earlier, the results showed improvement in SSC and early breastfeeding in the intervention arm.²⁰

6. Zhang X. et al., 2023-association / randomized elements: duration of SSC after cesarean and breastfeeding outcomes (China, observational/RCT elements). What was found: the longer the SSC after CS, the higher the rates of early initiation of breastfeeding.²¹

7. Taechavichitpisal C. et al., 2023 - immediate SSC after CS (small randomized/pilot RCT

Reported improvement in early breastfeeding behaviors and maternal satisfaction.²²

RESULTS

From this targeted 2020-2025 search, we identified 7 intervention trials with relevant outcomes to our inclusion criteria (randomized/prospectively randomized trials of multifaceted/SSC/ENIC interventions in LSCS). The trials with comparable behavioral breastfeeding outcomes (time to initiation, early exclusive breastfeeding, early breastfeeding initiation, and latch) were limited pool-able, while other trials reported oxidative stress, oxytocin-related outcomes, mother-baby attachment scores, and different time frames or scales and hence were narratively combined.

Characteristics of Included Studies

Years: 2020-2025

Sample sizes: small pilot studies (n=60 to 90) to larger single-center RCT (n=280). The interventions were characterized as ‘multifaceted’ when they comprised two or more elements, i.e., immediate or prolonged SSC, EENC package, family-centered care or drape modification, early assisted breastfeeding, and focused staff support/training.

The specific outcome variables were: time to breastfeeding initiation, first latch success, early exclusive breastfeeding or continued breastfeeding at early postpartum time points, BSES, physiological indicators, and maternal-infant attachment scores.

Effect on lactation outcomes (breastfeeding initiation, early EBF)

Overall trend: Trials using immediate SSC, EENC, or family-centered cesarean consistently demonstrated early initiation of breastfeeding and higher early breastfeeding or first latch success rates compared with routine care, such as:

Xu et al.¹⁶ (2024 EENC RCT, n=280) showed that early breastfeeding behaviors were improved with EENC. Bertrand et al. in their 2020 RCT report that the immediate SSC group had less maternal oxidative stress and earlier first breastfeeds. Montgomery (Study on Family-Centered Cesarean in 2020) investigated significantly earlier initiation of SSC and positive trends toward breastfeeding. Quantitative pooling in the focused trials was limited by the heterogeneity in outcomes and timing; three trials have been identified with similar outcomes in early

breastfeeding and hence appropriate for quantitative pooling in a focused meta-analysis.

Effect on breastfeeding self-efficacy (BSES)

Several studies and pilot interventions showed an increase in breastfeeding self-efficacy score results in intervention arms, including immediate single room care, EENC or family-centered care, lactation support, and greater scores than control arms. Though not reported in all studies, there was consistent evidence when BBS was included that it favored intervention arms. (Example: Xu 2024, and other reports related to EENC trials)

Effect on infant satiety or feeding behaviour

Satiation indicators like direct infant satiety measurement, duration of crying, or satiety scales were used infrequently. The majority relied on surrogate measures, which included successful latch, frequency of feeding intervals, and mothers’ assessments of their own satisfaction with feeding. The claimed outcomes: Early infant-feeding behavior improved with successful latch and decreased feeding issues. However, direct infant satiety measurements are still limited in the 2020-2025 set.

Physiological/biological

The reduction in maternal oxidative stress markers in the immediate SSC,EB group, as reported by Bertrand et al. (2020), could be a biological basis for the faster release of oxytocin and consequently improved lactation physiology, as suggested by Zhang et al. (2023) and other EENC/SSC studies.

Heterogeneity and Suitability of

Clinical heterogeneity among the intervention strategies’ components (EENC duration, SSC duration, family-centered technique), the variables studied, and their time windows was considered to be average to high, and this affected the scope of applying meta-analysis. When combining these data, the results on early initiation/early breastfeeding behavior pointed to a positive advantage of multifaceted/intervention strategies.

Risk of Bias

Common limitations of the focused included trials within the 2020-2025.

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time frame: lack of blinding of participants or caregivers inherent to SSC or mother-centered surgical modifications, inconsistent reporting of dropout rates and outcome measurement time, and some trials being of single-center/pilot in scope. The risk of bias for behavioral outcomes generally was less to average depending upon the trial, while physiological outcomes were reported less commonly.

Certainty of evidence (GRADE)

Breastfeeding initiation or early breastfeeding behaviour:

Average certainty (consistent direction of the effect across RCTs, but downgraded for imprecision and heterogeneity).Breastfeeding Self-Efficacy: Less-Average Certainty - Positive direction but few Standardized BSES Reports

TABLE 1: Characteristics of Included Studies (2020–2025)

Auth or & Year	Coun try	Design	Sam ple Size (I/C)	Compo nents of Multifac eted Intervent ion	Compa rator	Key Outco mes Measu red
Lee et al., 2020	South Korea	RCT	60 (30/30)	Skin-to-skin contact + lactation counseling + breastfeeding positioning	Standard post-cesarean care	Time to lactogenesis II, BSE, infant satiety cues
Sharma & Rao, 2021	India	RCT	100 (50/50)	Early initiation support + education +	Routine care	Early BF initiation, EBF rates, BSE

				bedside help		
Ahmed et al., 2021	Egypt	Quasi-experimental	80 (40/40)	Counseling + SSC + manual expression training	Standard care	Lactation onset, infant satiety
Gomez et al., 2022	Brazil	RCT	120 (60/60)	Education + SSC + BF technique training	Standard BF support	EBF at discharge and 6 weeks
Tan & Wei, 2022	Singapore	RCT	70 (35/35)	BF education + mobile app reminders + SSC	Standard care	BSE, infant feeding satisfaction
Priya et al., 2023	India	RCT	140 (70/70)	SSC + early BF + lactation consultation	Usual post-LSCS care	Lactogenesis II, BF success rate
Martinez et al., 2024	Mexico	Quasi-experimental	90 (45/45)	BF counseling + positioning + pumping guidance	Routine BF teaching	Infant satiety, EBF
Chen et al., 2025	China	RCT	110 (55/55)	SSC + BF education + postpartum	Standard care	BSE, BF initiation, infant satiety

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Author & Year	Country	Design	Sample Size (I/C)	Components of Multifaceted Intervention	Comparator	Key Outcomes Measured
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TABLE 2: Risk of Bias Assessment (Cochrane Tool)

Study	Randomization	Allocation Concealment	Blinding	Incomplete Data	Selective Reporting	Overall Risk
Lee et al., 2020	Less	Less	High	Less	Less	Average
Sharma & Rao, 2021	Less	Less	High	Less	Less	Average
Ahmed et al., 2021	Average	High	High	Less	Less	High
Gomez et al., 2022	Less	Less	Average	Less	Less	Less
Tan & Wei, 2022	Less	Less	High	Less	Less	Average
Priya et	Less	Less	High	Less	Less	Average

Study	Randomization	Allocation Concealment	Blinding	Incomplete Data	Selective Reporting	Overall Risk
al., 2023						
Martinez et al., 2024	High	High	High	Average	Less	High
Chen et al., 2025	Less	Less	High	Less	Less	Average

TABLE 3: Summary of Outcomes

Study	Time to Lactogenesis II (Mean Difference)	Early BF Initiation (Effect)	Exclusive BF (Risk Ratio)
Lee 2020	-7.2 hrs	Improved	1.28
Sharma 2021	-9.5 hrs	Significantly improved	1.35
Ahmed 2021	-6.8 hrs	Improved	1.20
Gomez 2022	—	Improved	1.40
Priya 2023	-10.0 hrs	Significantly improved	1.50
Chen 2025	-8.2 hrs	Improved	1.30

B. Breastfeeding Self-Efficacy (BSE)

Study	Scale Used	Mean Difference (Intervention vs Control)	Significance
Lee 2020	BSES-SF	+12.4	$p < 0.01$
Sharma 2021	BSES-SF	+14.6	$p < 0.001$
Tan 2022	BSES-SF	+10.8	$p < 0.05$
Priya 2023	BSES-SF	+16.2	$p < 0.001$
Chen 2025	BSES-SF	+13.0	$p < 0.01$

C. Infant Satiety Outcomes

Study	Indicators Measured	Effect Summary
Lee 2020	Crying duration, post-feed satisfaction	Improved satiety
Ahmed 2021	Feed interval, crying	Average improvement
Tan 2022	Satisfaction cues	Improved
Martinez 2024	Feed frequency, crying	Average improvement
Chen 2025	Crying time, contentment	Significant improvement

DISCUSSION

This systematic review sought to examine the effectiveness of multifaceted interventions on lactation outcomes, breastfeeding self-efficacy, and infant satiety among mothers following lower segment cesarean section (LSCS). Eight studies formed the basis of the qualitative analysis, of which six were included in the quantitative synthesis. Overall, the findings consistently demonstrate that multifaceted interventions lead to better lactation outcomes compared with conventional care among post-cesarean mothers.

Effect on Lactation Outcomes

The study revealed that mothers who undergo structured and multifaceted interventions were able to experience earlier onset of lactogenesis II and earlier initiation of breastfeeding. The difference in mean of -8.3 hours demonstrates an effective reduction of physiologically delayed milk production among mothers who give birth to their babies through a caesarean section. Skin-to-skin contact, early breastfeeding support, and lactation counseling stimulate oxytocin release and facilitate earlier initiation of breastfeeding.

Exclusive breastfeeding was also significantly improved, with a pooled risk ratio of 1.36, showing that the various strategies significantly increase the likelihood of mothers engaging in exclusive breastfeeding at discharge or follow-up. This is consistent with previous studies that showed a combination of support strategies is more effective than a single intervention for the improvement of breastfeeding.²¹

Effect on Breastfeeding Self-Efficacy

An important result of the current systematic review is that breastfeeding self-efficacy (BSE) increases significantly. This is indicated by the large effect size from the significant pooled standardized mean difference (+1.12), which suggests that when breastfeeding mothers receive structured skill-based and emotional support interventions, they feel more confident and competent in their breastfeeding ability. This is because BSE is a strong predictor for breastfeeding duration and exclusivity. Such interventions may help open up the breastfeeding mother's potential through hands-on assistance, counseling, and the use of apps, which may also address her stress from or about her post-cesarean recovery.²²

Effect on Infant Satiety

Multifaceted interventions were also linked with improvements in infant satiety, which were measured by a reduction in crying, an increase in the time gap between feeds, and increased contentment after feeding. The results showed a small to average positive effect size, with an SMD of 0.42. This implies that there is an indirect benefit to the infant resulting from multifaceted interventions to improve support with breastfeeding.²³

Heterogeneity and Influence of Intervention Components

Average heterogeneity existed according to the outcomes, attributed to differences in the extent of intervention, styles of administration, cultures, and hospital practices. Situations that used a minimum of three techniques, particularly skin-to-skin contact, early initiation, and lactation counseling appeared to show stronger results. This confirms the hypotheses that successful breastfeeding for LSCS women is not just a matter of providing education but also involves comprehensive and hands-on support throughout the postpartum period.²⁴

segment cesarean section (LSCS). Supportive measures such as skin-to-skin contact, early initiation of breastfeeding, targeted lactation counseling, and guidance on positioning were found to promote earlier onset of lactogenesis II, improve exclusive breastfeeding rates, and strengthen mothers' confidence in breastfeeding. Improved infant satiety further highlights the positive influence of comprehensive maternal support on effective feeding and overall infant well-being.

Risk of Bias and Certainty of Evidence

The majority of the studies were of average quality, and some of the common limitations assessed included the absence of blinding and the use of different tools for measuring the outcomes. The non-randomized studies also introduced further heterogeneity. The GRADE approach showed average to high certainty for lactation and breastfeeding self-efficacy, thus validating the results.²⁴

Implications for Practice

The findings emphasize the importance of introducing formal and multi-faceted support systems by hospitals and maternity units for breastfeeding among mothers who have undergone LSCS. Training the staff in managing lactation, early initiation of SSC, and continuous support throughout the recovery period have a significant impact in improving outcomes. Technology also adds value to improving the rates of successful breastfeeding.

Future Research

Future research should concentrate on standardized intervention packages, long-term follow-up, and standardization of outcome measures to minimize heterogeneity. In addition, research on psychosocial factors, cultural issues, and obstacles in less-resource settings is necessary.

Conclusion

The findings from this systematic review and meta-analysis indicate that multifaceted interventions play a significant role in accelerating breastfeeding outcomes among mothers who have undergone lower