
OBSTETRICS

Effect of Oral Ginger with Early Feeding versus Early Feeding Alone on Breast Milk Volume in Scheduled Cesarean Section: A randomized controlled trial

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ABSTRACT

Objectives: To evaluate the effect of oral ginger supplementation, in combination with early maternal oral feeding, on breast milk volume in women undergoing scheduled Cesarean section.

Materials and Methods: This randomized, double-blind, placebo-controlled trial included women scheduled for Cesarean section. Participants were allocated into two groups. At 6 hours postpartum, the intervention group received 200 mL of a sweetened clear solution along with oral ginger capsules (1.5 g daily in three divided doses), while the control group received the same solution with identical placebo capsules (1.5 g fine brown sugar). The primary outcome was breast milk volume, measured at 72 hours postpartum after a two-hour breast emptying period.

Results: Between August 2024 and May 2025, a total of 84 participants were randomized (n = 42 per group). The ginger group showed a significantly higher median breast milk volume at 72 hours postpartum (20 mL [interquartile range, IQR 14, 35]) compared to the placebo group (10.5 mL [IQR 9, 15], $p < 0.001$). The self-reported time to onset of lactation was significantly shorter in the ginger group (59 hours vs 69 hours, $p < 0.001$). No serious adverse events were noted.

Conclusion: Oral ginger supplementation combined with early maternal oral feeding significantly increased breast milk volume and shortened the time to the onset of lactation in women following scheduled Cesarean section without serious adverse events.

Keywords: ginger, early feeding, cesarean section, breastfeeding, lactation.

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ประสิทธิภาพของการรับประทานซิงเสริมร่วมกับการรับประทานอาหารเร็วเปรียบเทียบกับรับประทานอาหารเร็วอย่างเดียวต่อปริมาณน้ำนมหลังการผ่าตัดคลอดตามกำหนดการ: : การทดลองแบบสุ่มที่มีกลุ่มควบคุม

ประภาพร พันพรม, รุ่งฤดี จีระทรัพย์

บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาประสิทธิภาพของการรับประทานซิงเสริมร่วมกับการเริ่มรับประทานอาหารหลังผ่าตัดคลอดเร็วต่อปริมาณน้ำนมในมารดาที่ผ่าตัดคลอดตามกำหนดการ

วัสดุและวิธีการ: การทดลองแบบสุ่มที่มีกลุ่มควบคุมในมารดาหลังผ่าตัดคลอดตามกำหนดการ แบ่งเป็น 2 กลุ่ม 6 ชั่วโมงหลังผ่าตัดคลอด กลุ่มทดลองได้รับสารละลายไฮโดรออกไซด์ของแคลเซียม (ซึ่งขนาด 1.5 กรัมต่อวัน แบ่งรับประทานวันละ 3 ครั้ง) และกลุ่มควบคุมได้รับสารละลายเดียวกันร่วมกับยาหลอกที่ลักษณะเหมือนกัน (น้ำตาลทรายแดงผงละเอียดขนาด 1.5 กรัมต่อวัน) วัดผลเป็นปริมาณน้ำนมที่ 72 ชั่วโมงหลังคลอด ภายหลังการปั๊มนมจนเกลี้ยงเต้าสองชั่วโมง

ผลการศึกษา: มารดาจำนวน 84 รายที่ได้รับการสุ่ม (กลุ่มละ 42 ราย) ระหว่างเดือนสิงหาคม 2567 ถึงพฤษภาคม 2568 กลุ่มที่รับประทานซิงมีค่ามัธยฐานของปริมาณน้ำนมที่ 72 ชั่วโมงหลังคลอดสูงกว่าอย่างมีนัยสำคัญทางสถิติ (20 มล. [interquartile range, IQR 14, 35]) เมื่อเปรียบเทียบกับกลุ่มยาหลอก (10.5 มล. [IQR 9, 15], $p < 0.001$) เวลาการเริ่มหลั่งของน้ำนมเต็มเต้าน้อยลงอย่างมีนัยสำคัญในกลุ่มที่ได้รับการรับประทานซิง (59 ชั่วโมง เปรียบเทียบกับ 69 ชั่วโมง, $p < 0.001$) โดยไม่พบภาวะแทรกซ้อนที่รุนแรง

สรุป: การรับประทานซิงเสริมร่วมกับการเริ่มรับประทานอาหารเร็วช่วยเพิ่มปริมาณน้ำนม และลดระยะเวลาเวลาในการเริ่มมีหลังของน้ำนมเต็มเต้านในมารดาหลังการผ่าตัดคลอดแบบมีกำหนดการได้อย่างมีนัยสำคัญ โดยไม่พบเหตุการณ์ไม่พึงประสงค์ที่รุนแรง

คำสำคัญ: ซิง, การรับประทานอาหารเร็ว, กำหนดการ, การผ่าตัดคลอด, การเลี้ยงลูกด้วยนมแม่

Introduction

Cesarean section (C-section) is a significant barrier to successful lactation, and its increasing prevalence, including in Thailand, is a growing concern^(1, 2). The procedure can indirectly impact the initiation and continuation of breastfeeding due to several factors, namely, delayed skin-to-skin contact, postoperative pain and recovery, mother-infant separation, and heightened maternal stress or anxiety, all of which can disrupt the crucial early establishment of breastfeeding^(3, 4).

Two interventions that have shown promise in stimulating lactation are early oral feeding and ginger. Early oral feeding, as recommended by the enhanced recovery after surgery (ERAS) protocol, helps stimulate bowel function and promotes a faster recovery and ambulation⁽⁵⁾. Concurrently, ginger (*Zingiber officinale*) contains bioactive compounds such as gingerols, shogaol, zingerone, and paradol⁽⁶⁾. These compounds have multiple therapeutic properties, including vasodilatory effects that increase blood flow to the breasts, potentially enhancing milk production^(7, 8). Furthermore, several studies have demonstrated ginger's efficacy in improving gastrointestinal motility, with significant evidence showing a reduction in postoperative ileus following C-sections⁽⁹⁻¹¹⁾. Consequently, ginger is highly compatible with early oral feeding protocols. The United States Food and Drug Administration (FDA) has approved ginger as safe for use during pregnancy and lactation⁽¹²⁾.

Existing research studies have demonstrated that initiating oral intake within 30 minutes to 8 hours after C-section is safe and can stimulate lactation⁽¹³⁻¹⁵⁾. Although a systematic review in 2021 found that it may be beneficial for those who have had a vaginal delivery, there was no strong evidence that ginger alone increases human breast milk volume in mothers who have had a C-section⁽¹⁶⁾. Interestingly, a 2022 study found that combining ginger with early feeding significantly stimulated lactation in mothers who underwent an emergency C-section⁽¹⁷⁾. However, the

outcome measurement of this combination has been shown to shorten the onset of lactation (OL) based on maternal perception, which is subjective and relies on self-reported symptoms. Furthermore, no studies have investigated this combined intervention specifically in women undergoing scheduled C-sections, which is often characterized by a delayed onset of lactation, delayed initiation, and lower rates of breastfeeding compared to those who have emergency C-sections^(18, 19). Therefore, this study aimed to evaluate the effect of combining ginger with early feeding on lactation by objectively measuring breast milk volume in women undergoing a scheduled C-section.

Materials and Methods

A randomized, double-blind, placebo-controlled trial was conducted at Khon Kaen Hospital, Thailand, between August 2024 and May 2025. The study received ethical approval from the Khon Kaen Hospital Institutional Review Board (IRB) for Human Research (Reference No. KEF67014). Before data collection, the trial was registered with the Thai Clinical Trials Registry (Registration No. TCTR20240817006).

Eligible participants included term singleton pregnant women aged 18–45 years who underwent a scheduled C-section under spinal anesthesia with intrathecal morphine between 08:00 a.m. and 04:00 p.m. They were required to have delivered a healthy newborn ($\geq 2,500$ g and an Apgar score ≥ 7 at 1 and 5 minutes, with no major congenital anomalies^(20, 21)), intended to breastfeed, and be able to speak and understand the Thai language.

Participants were excluded if they had any contraindications to breastfeeding (e.g., maternal human immunodeficiency virus, active tuberculosis, illegal drug use, or current use of antiretroviral medications). Additional exclusion criteria included a history of breast cancer or prior breast surgery, uncontrolled medical or obstetric complications (e.g., poorly controlled chronic hypertension, preeclampsia, eclampsia, overt diabetes mellitus, or placenta previa),

postoperative complications such as postpartum hemorrhage or infection, mother-infant separation, or a known allergy to ginger.

A computer-generated randomization sequence using blocks of four was employed to assign participants to the intervention group or the placebo group. The randomization list was securely maintained in sealed, opaque, and non-transparent envelopes. To ensure blinding, a non-research nurse in the postpartum ward opened the envelope after the surgical procedure. Both the participants and the research team, including attending physicians and nurses, remained blind to the group assignments throughout the study.

The ginger powder dosage was set at 1,500 mg/day (KMP Brand, Kaewmungskornphaesaj Co., Ltd., Thailand), representing an increase from the 1,000 mg/day dose used in prior studies⁽⁷⁾. This adjustment was intended to enhance gastrointestinal motility during early oral feeding while ensuring maternal comfort by minimizing potential side effects. Both ginger and placebo capsules were manufactured under aseptic conditions by a licensed pharmacist and were identical in appearance and packaging.

The sweetened solution protocol was modeled after prior research demonstrating a significant increase in milk production among women undergoing emergency C-sections⁽¹⁵⁾. Specifically, a 200-mL serving was prepared by the hospital's nutrition and dietetics department. The solution consisted of 30 mL of red salacca-flavored syrup (Hale's Blue Boy) diluted with 170 mL of water. This preparation provides approximately 22.5–25 grams of simple carbohydrates, yielding an energy content of 90–110 kcal. This specific volume and caloric density have been shown to be well-tolerated postoperatively without increasing the risk of aspiration or nausea. Furthermore, the carbohydrates provide the essential metabolic energy to stimulate the gastrocolic reflex, mitigate postoperative insulin resistance, and support the energy-intensive process of lactogenesis⁽²²⁻²⁴⁾.

In the intervention group, at 6 hours postpartum (the standardized timing for transfer from the recovery

room to the postpartum ward), participants received an initial 200-mL serving of a sweetened clear solution along with a 500-mg ginger capsule administered orally. Subsequently, participants received ginger capsules three times daily (morning, afternoon, and evening, within 30 minutes after meals) for three days, until the assessment of breast milk volume at 72 hours postpartum.

In the placebo group, participants followed the same protocol, receiving the 200-mL sweetened clear solution alongside a 500-mg capsule containing fine brown sugar (Xongdur Brand, Xongdur Thai Organic Food Co., Ltd., Thailand) as a placebo.

To prevent dietary confounding, all participants were restricted to a standardized hospital diet, which was strictly screened to exclude ginger and other galactagogues (e.g., sweet basil or banana blossoms). Participants were instructed to avoid any outside supplementary foods or herbs during admission, with compliance monitored by the postpartum nursing staff.

All participants received standardized postpartum care, including 24-hour rooming-in and the initiation of breastfeeding within 2 hours post-delivery. Mothers were instructed to breastfeed for at least 20 minutes per session, 8-10 times per day, without routine infant formula supplementation. The dietary progression followed a systematic step from clear liquids to a soft diet and subsequently to a regular diet. Daily latch, audible swallowing, type of nipple, comfort, and hold (LATCH) scoring, neonatal weight tracking, and jaundice monitoring were performed for all participants.

The breast milk volume was measured at 72 hours postpartum. To ensure an objective and standardized measurement, a two-part pumping protocol was implemented. First, at 70 hours postpartum, participants breastfed their infants. Immediately afterwards, both breasts were fully emptied using a double-electric breast pump (Attitude Mom Little Plus Pro). A second pumping session was then performed two hours later, at 72 hours, to measure the final breast milk volume by 5-ml syringe.

The pumping process followed a standardized protocol: mode M3 was used initially for stimulation, followed by mode M4 for a thorough expression until milk flow ceased.

Secondary outcomes included the maternal perception of the OL and any adverse effects related to early feeding and ginger intervention. Following the methodology of established studies^(15, 25), OL was defined as the time when a mother first perceived specific symptoms, including breast fullness, tingling sensations, or visible milk flow/leakage^(15, 26). To enhance the reliability of these self-reports, participants were educated by the nursing staff to prioritize the observation of actual milk secretion as the primary indicator of OL. OL was recorded during the participants' hospital stay. For those who did not experience OL before discharge, daily follow-up telephone calls were conducted until OL occurred. Furthermore, adverse effects—such as gastric irritation, abdominal distension, or warm extremities—were monitored. Neonatal outcomes, including jaundice and excessive weight loss (defined as > 10% of birth weight^(15, 27)), were also recorded.

Based on a pilot study of 30 participants, the sample size was calculated using the formula mentioned above. The mean breast milk volume was 24.66 mL with a standard deviation (SD) of 16.51 in the intervention group, while the control group had a mean of 13.8 mL with an SD of 10.06. To achieve 90% power with an alpha level of 0.05 and to account for a 10% dropout rate, a total of 84 participants (42 per group) was needed.

Statistical analyses were performed using R software version 4.4.1. The Shapiro-Wilk test was used to assess data normality. Continuous data were analyzed using the student's t-test or the Wilcoxon rank-sum test. Categorical data were analyzed using Pearson's chi-squared test or Fisher's exact test. The primary outcome was presented as a median with an interquartile range (IQR). The time to the onset of lactation was analyzed using Kaplan-Meier survival curves and the log-rank test. A p value of less than 0.05 was considered statistically significant. All

analyses were conducted using the intention-to-treat (ITT) principle.

Results

This study included scheduled C-section parturient women, with a total of 108 participants assessed for eligibility. Of these, 24 were excluded: eight with serious medical conditions, nine due to mother-infant separation, and seven who declined to participate. As a result, 84 participants were randomized into two groups: the early feeding with ginger group (n = 42) and the early feeding alone group (n = 42).

After randomization, one participant from the early feeding with ginger group dropped out due to mother–infant separation. In the early feeding alone group, there were two participants who dropped out, one due to mother-infant separation and one due to non-compliance. Therefore, 41 participants in the early feeding with ginger group and 40 participants in the early feeding alone group were included in the final analysis, as illustrated in the CONSORT flow diagram (Fig. 1).

Baseline characteristics (Table 1), including maternal age, body mass index, gestational age, primiparity, indication for C-section, breastfeeding experience, type of surgical incision, estimated blood loss, neonatal birth weight, Apgar scores, and LATCH scores, were presented. There were no statistically significant differences between the two groups. The majority of participants in both groups were primiparous, with 23 women (56.1%) in the early feeding with ginger group and 23 women (57.5%) in the early feeding alone group. The most common indications for a cesarean section in both groups were cephalopelvic disproportion, followed by a history of previous C-section, breech presentation, oligohydramnios, low-lying placenta, and a history of poor obstetric outcomes. Two participants had an underlying disease. One participant with gestational diabetes mellitus was in the intervention group, and one participant with chronic hypertension was in the control group.

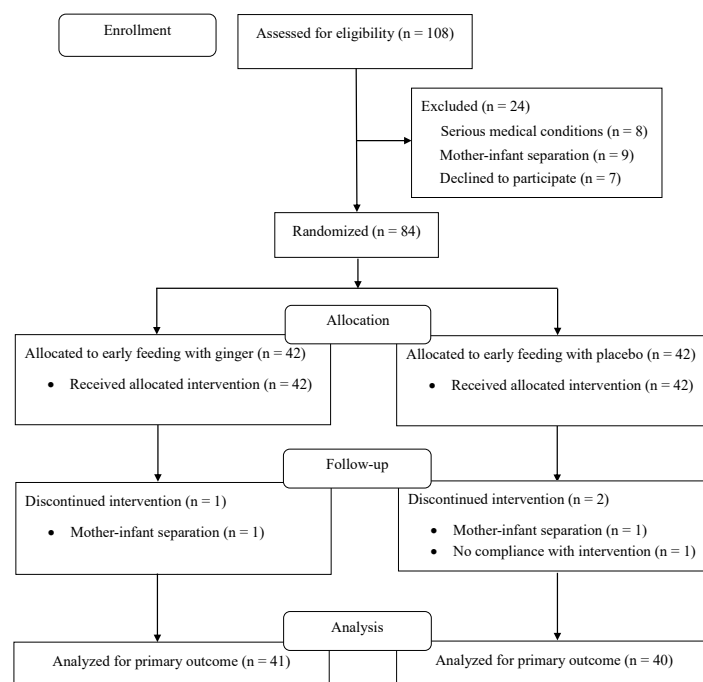


Fig. 1. CONSORT flow diagram.

Table 1. Baseline Characteristics.

Demographic profiles	Early feeding with ginger (n = 41)	Early feeding alone (n = 40)	p value
Age (years), mean $\pm$ SD	30.9 $\pm$ 5.3	30.1 $\pm$ 3.7	0.447 ^a
Body mass index (kg/m ²), mean $\pm$ SD	28.7 $\pm$ 4	27.6 $\pm$ 4	0.193 ^a
Gestational age (weeks), median (IQR)	38 (38,39)	38 (38,38.2)	0.263 ^b
Primiparity, n (%)	23 (56.1)	23 (57.5)	1.000 ^c
Breastfeeding experience, n (%)	17 (41.5)	16 (40)	1.000 ^c
C-section indication, n (%)			0.677 ^d
Previous C-section	13 (31.7)	17 (42.5)	
Cephalopelvic disproportion	24 (58.6)	18 (45.0)	
Breech presentation	2 (4.9)	1 (2.5)	
Others	2 (4.9)	4 (10)	
Type of surgical incision, n (%)			0.482 ^d
Pfannenstiel	35 (85.4)	37 (92.5)	
Low midline	6 (14.6)	3 (7.5)	
Estimated blood loss (mL), median (IQR)	300 (300, 400)	400 (300, 500)	0.338 ^b
Birth body weight (grams), mean $\pm$ SD	3,204 $\pm$ 373.7	3,151 $\pm$ 421.4	0.548 ^a
Apgar score, mean $\pm$ SD			
At 1 minute	8.2 $\pm$ 0.4	8.2 $\pm$ 0.4	0.757 ^a
At 5 minutes	9.1 $\pm$ 0.6	9.2 $\pm$ 0.4	0.493 ^a
LATCH score, median (IQR)			
At 24 hours	8 (8,8)	8 (8,8)	0.197 ^b
At 48 hours	8 (8,8)	8 (8,8)	0.328 ^b
At 72 hours	9 (9,9)	9 (9,9)	0.768 ^b

SD: standard deviation, IQR: interquartile range, C-section: cesarean section, LATCH: latch, audible swallowing, type of nipple, comfort, and hold

^a student's t-test, ^b Wilcoxon rank-sum test, ^c Pearson's Chi-squared test, ^d Fisher's exact test

The primary outcome of the study was breast milk volume at 72 hours postpartum (Table 2). The median breast milk volume was 20 mL (IQR 14, 35) in the early feeding with ginger group, compared to 10.5 mL (IQR 9, 15) in the early feeding alone group, demonstrating a statistically significant difference ($p < 0.001$).

When categorized by parity, significant differences remained consistent across both

groups. Among primiparous participants, the median milk volume in the ginger group was 20 mL (IQR 13, 36.5), compared to 10 mL (IQR 8, 14.5) in the early feeding alone group ($p < 0.001$). Similarly, for multiparous participants, the ginger group produced a median volume of 19.5 mL (IQR 15, 25.8), while the early feeding alone group produced 12 mL (IQR 10, 15, $p = 0.009$).

Table 2. Breast milk volume at 72 h postpartum.

Breast milk volume	Early feeding with ginger (n = 41)	Early feeding alone (n = 40)	p value
At 72 h postpartum (mL), median (IQR)	20 (14, 35)	10.5 (9, 15)	< 0.001 ^a
Primiparous (mL), median (IQR)	20 (13, 36.5)	10 (8, 14.5)	< 0.001 ^a
Multiparous (mL), median (IQR)	19.5 (15, 25.8)	12 (10, 15)	0.009 ^a

IQR: Interquartile range, ^a Rank-sum test

SD: standard deviation, IQR: interquartile range

Secondary outcomes are presented in Table 3. The median time to the OL, based on maternal perception, was significantly shorter in the ginger group compared to the control group (59 hours vs 69 hours, $p < 0.001$). The cumulative probability of maternal perception of OL is illustrated in Fig. 2. Delayed onset of lactation—defined as OL $\geq$ 72 hours^(28, 29)—occurred in 4 participants (9.8%) in the ginger group and 10 participants (25%) in the control group, although this difference did not reach statistical significance. Regarding gastrointestinal outcomes, the

incidence of mild abdominal distention and upset stomach was lower in the ginger group (31.7%) compared to the control group (50.0%), although this difference was not statistically significant. No cases of severe bowel ileus were observed. In terms of safety, one participant in the ginger group reported warm extremities, which were not associated with any adverse clinical outcomes. Regarding neonatal outcomes, two cases of jaundice occurred exclusively in the control group, and no instances of excessive neonatal weight loss were reported in either group.

Table 3. Time to onset of lactation, side effects, and neonatal outcomes.

Secondary outcomes	Early feeding with ginger (n = 41)	Early feeding alone (n = 40)	p value
Time to onset of lactation (h), median (95%CI)	59 (57, 65)	69 (68, 71)	< 0.001 ^a
Delayed onset of lactation, n (%)	4 (9.8)	10 (25)	0.128 ^b
Side effects, n (%)			
Mild abdominal distention/upset stomach	13 (31.7)	20 (50)	0.147 ^b
Warm extremities	1 (2.4)	0 (0)	1.000 ^c
Neonatal outcome, n (%)			
Neonatal jaundice	0 (0)	2 (5)	0.241 ^c

CI: confidence interval

^a Log-rank test, ^b Pearson's Chi-squared test, ^c Fisher's exact test

Delayed onset of lactation: onset of lactation $\geq$ 72 hours

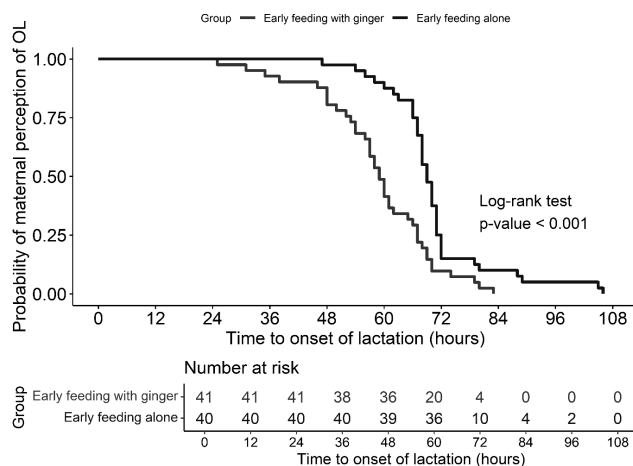


Fig. 2. The Kaplan-Meier curves of the cumulative probability of maternal perception of onset of lactation.

Discussion

This study is the first to investigate the combined effect of ginger supplementation and early oral feeding on breast milk volume in mothers following a scheduled C-section. A key strength of our study lied in the direct quantification of breast milk volume, providing a more objective and reliable measure than the subjective metrics used in several prior studies^(15, 17, 18). While previous research often relied solely on maternal perception of the OL—a tool for assessing lactogenesis II that can be prone to recall bias⁽²⁵⁾—our approach aimed to improve precision and provide a stronger evidence base by measuring actual volumetric output.

Current study results showed that women who had a scheduled C-section and received early feeding with ginger produced significantly greater breast milk volume at 72 hours postpartum compared to those who received early feeding alone (20 mL [IQR 14, 35] vs 10.5 mL [IQR 9, 15], $p < 0.001$). This finding was supported by a shorter median time to the OL in the ginger group (59 h vs 69 h, $p < 0.001$). These results were consistent with a prior study conducted in women who had emergency cesarean sections⁽¹⁷⁾, which also found that OL was significantly shorter in the early feeding with ginger group (35.3 h) compared to the early feeding alone group (41.0 h) and the

conventional feeding group (50.5 h). However, the overall time to OL in our study was comparatively longer, likely due to the difference in settings. Scheduled C-sections are known to significantly delay lactation to a greater degree than emergency C-sections because they lack the hormonal signaling that occurs during labor, particularly prolactin and oxytocin, which are crucial for milk production and secretion^(30, 31).

Additionally, the supplementation of ginger in our early feeding protocol aligned with the study of Wang Nam Yen herbal tea, which utilized the same ginger dosage of 1.5 g per day⁽³²⁾. That study demonstrated that this dosage could significantly stimulate breast milk production, showing a higher milk volume at 72 hours compared to the placebo (57.5 ± 50.7 vs. 31.9 ± 27.7 mL, $p = 0.03$), thereby confirming its efficacy as a galactagogue at this dose. However, the total milk volume in the Wang Nam Yen study was higher than in our findings, which can be explained by two main factors. First, their formulation contained four additional herbs (sappan wood, licorice, bael fruit, and jewel vine) that also stimulate milk production, likely creating a stronger synergistic effect. Second, while our study exclusively focused on scheduled C-sections, their study included emergency cases. As mentioned previously, mothers

in emergency cases may have experienced labor before surgery, triggering the hormonal surges necessary to stimulate higher initial milk production. The combined effect of early oral feeding and ginger supplementation on breast milk volume can be explained by two complementary mechanisms. First, early postoperative oral feeding—a practice supported by ERAS guidelines as safe and effective⁽⁵⁾—directly stimulates intestinal motility and shortens the duration of postoperative ileus. This improvement in gastrointestinal function enhances maternal physical comfort and reduces symptoms such as nausea and abdominal distention. By mitigating these physical stressors, early feeding creates a more favorable physiological environment, potentially reducing cortisol levels that could otherwise inhibit oxytocin release^(33, 34).

Second, ginger's known vasodilatory effects may provide a synergistic benefit by increasing systemic blood flow. Specifically, ginger can enhance circulation to the mammary glands, thereby promoting more efficient milk production⁽⁷⁾. The combination of these two mechanisms—one focused on improving maternal comfort and hormonal readiness, and the other on directly stimulating mammary gland function—likely contributed to the greater breast milk volume observed in this study.

Regarding our secondary outcome, although OL is a subjective measure based on maternal perception, it was maintained for two primary reasons. First, it ensures comparability with existing literature^(14, 15, 18, 26), allowing our findings to be integrated into the broader body of lactation research. Second, from a clinical utility perspective, maternal perception of OL is a practical and accessible indicator. In many real-world clinical settings where precise volumetric measurement tools are unavailable, OL serves as an essential tool for mothers and healthcare providers to easily monitor breastfeeding progress.

In the current study, delayed OL was observed in 9.8% of the ginger group and 25% of the early feeding alone group. These rates were notably lower

than those reported in prior research, which found delayed OL in 33.3% of women in China and 53.0% in the USA following C-sections⁽²⁹⁾. The longest time to OL recorded in our study was 108 hours postpartum. Importantly, no cases of neonatal jaundice or excessive weight loss were observed, even among participants with delayed OL.

Early postoperative oral feeding helps to accelerate the return of bowel activity, and the addition of ginger appeared to further reduce gastrointestinal discomfort and abdominal distention in the present study. This effect is likely mediated by 6-gingerol, an active compound in ginger that has been previously shown to reduce nausea and accelerate the return of bowel function post-surgery⁽¹⁰⁾. The authors hypothesized that the observed effects may not have reached the same level of statistical significance as in prior research due to the lower dosage administered in this study (1.5 g/day) compared to the higher dose (3 g/day) used in other trials, suggesting a potential dose-dependent effect. A minor side effect of warm extremities was reported by one participant in the ginger group. This observation was consistent with the known hyperthermic effect of ginger, which can induce vasodilation in the peripheral skin⁽³⁵⁾. However, this finding was not statistically significant, and the symptom did not interfere with the patient's comfort, likely due to the low dosage of ginger administered in this study.

A major strength of this study is its randomized, double-blind, placebo-controlled design, which ensures high internal validity. We used data triangulation to validate subjective maternal reports with objective breast milk volume, measured precisely after total breast emptying. This rigorous approach provided a more accurate assessment of milk production than self-reporting alone.

However, some limitations must be acknowledged. First, individual physiological variations in the rate of breast milk production could not be fully controlled, despite the use of randomization. Second, this study was not specifically designed for a subgroup analysis based on parity. Therefore, the

data for primiparous and multiparous participants are provided as descriptive observations to show the overall trend of the intervention's effect, rather than for formal statistical comparison.

Future research should explore this intervention in high-risk pregnancies and mothers of preterm infants. Additionally, investigating various dosages could identify a dose-dependent response, while further analysis of the interaction between parity and ginger's efficacy would help tailor clinical outcomes for different maternal needs.

Conclusion

Oral ginger supplementation combined with early feeding significantly increased breast milk volume and shortened the OL in women undergoing scheduled C-sections, with no serious adverse events reported. These findings suggest that ginger is a safe and effective adjunct to early postoperative feeding; however, further studies with larger, specifically powered samples are encouraged to confirm these effects across different maternal characteristics.

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Potential conflicts of interest

The authors declare no conflicts of interest.

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