# A randomized controlled trial of the effects of antenatal milk expression on breastfeeding among first-time mothers in China

**yan chen**
Hainan Medical University https://orcid.org/0000-0002-6033-3507

**Li-Ping Meng**
Affiliated Hospital of Hainan Medical University

**Jiao-Jiao Zhang**
Affiliated Hospital of Hainan Medical University

**Hong-Hua Guo**
Hainan Medical University

**hongyu zhang** (hong1029@sohu.com)
Registered Midwife, Department of Obstetrics, The First Affiliated Hospital of Hainan Medical University

---

**Research**

**Keywords:** Antenatal milk expression, Breastfeeding, Self-efficiency, Location

**Posted Date:** July 24th, 2020

**DOI:** https://doi.org/10.21203/rs.3.rs-42871/v1



---

# Abstract

## Background

Limited research outside China suggest that antenatal milk expression in late pregnancy (AME) may promote breastfeeding. A few studies have evaluated the safety and efficacy of AME in women with diabetes in pregnancy, little or no evidence exists to explore its effects on breastfeeding self-efficacy and early breastfeeding, particularly in first-time mothers. The objective of this study was to explore the effect of AME on breastfeeding for the first-time mothers during the postpartum hospitalization.

## Methods

A randomized controlled trial was conducted in a tertiary hospital in Haikou, Hainan. We recruited pregnant women who had completed 37 weeks of gestation and randomly assigned them to either the intervention group (n = 45) or the control group (n = 45). The pregnant women in the intervention group were advised to rhythmic self-massage of breasts three times daily at any time. The control group was given routine midwifery and obstetric care. The breastfeeding self-efficacy scale(BSES)was used to measure the self-efficacy of breastfeeding at 37 weeks, 38 weeks and the third day postpartum. The time to lactogenesis II and the rate of exclusive breastfeeding was measured three times every day by the researcher in the ward.

## Results

Compared with the control group, the intervention group had higher breastfeeding self-efficacy scores measured by the scale of BSES($P$< 0.05), the intervention group had higher exclusive breastfeeding rate on the first day, second day, third-day postpartum, and the difference was statistically significant（$P$< 0.05). The time to lactogenesis II in the intervention group was earlier than that in the control group($P$< 0.05).

## Conclusions

Antenatal breast milk expression at term improved the confidence in the ability to breastfeed and produce milk postpartum, thus significantly improving the behavior of exclusive breastfeeding, and increasing the percentage of breastfed infants during their hospital stay, these infants were able to avoid infant formula milk in this important early period.


## Plain English Summary

Limited research outside China suggests that antenatal milk expression (AME) in late pregnancy may promote breastfeeding. A few studies have evaluated the safety and efficacy of AME in women with diabetes in pregnancy, but no one has yet to explore its effects on breastfeeding self-efficacy and early breastfeeding, particularly in first-time mothers. This study aimed to explore the effect of AME on breastfeeding for the first-time mothers during the postpartum hospitalization by undertaking a randomized controlled trial.

Women who were advised to express breastmilk from 37 weeks' gestation were more likely to be confident in ability to breastfeed and produce milk postpartum, and the proportion of infants who were exclusively breastfed in the first three days of life was larger than that receiving standard care. Moreover, This study showed evidence of a beneficial effect on lactogenesis II. The study showed that AME is an effective way to promote pregnant women confidence inability to breastfeed and produce milk postpartum, thus significantly improving the behavior of exclusive breastfeeding, and increasing the percentage of exclusively breastfed infants during their hospital stay, these infants were able to avoid infant formula milk in this important early period.

# Background

Breastfeeding is an unequaled feeding pattern for infants, having important benefits of health for mothers and their infants[1]. The WHO recommends that infants should be exclusively breastfed for 6 months and continued breastfeeding until 2 years of age or beyond[2]. However, the breastfeeding rate in china remain below, the rate of 6-month-old infants is only 29.2%[3].

Maternal breastfeeding experience from 1 hour to the first few days after delivery is critical to establish breastfeeding, and the rate of exclusive breastfeeding during postpartum hospitalization is significantly associated with the rate of exclusive breastfeeding at 6 weeks postpartum [4, 5]. Among the most prevalently cited barries to the establishment of breastfeeding are impaired breastfeeding self-efficacy and delayed lactogenesis II [6–8]. Women with low breastfeeding self-efficacy will more likely to add formula in hospital or even completely artificial feeding [9, 10] leading to premature stopping of breastfeeding[11–13]. Stopping breastfeeding within 4 weeks postpartum is associated with delayed lactation initiation[8]. Delayed lactogenesis II is usually defined as the onset of copious milk secretion 72 h postpartum. Women who delayed lactogenesis II are more likely to stop breastfeeding prematurely than that do not.

Antenatal milk expression (AME) has been suggested as a potential intervention to address these issues[14–16]. AME refers to extracting colostrum from the breast before birth by hand expressing. Limited studies have been conducted to evaluate the impact of AME intervention on breastfeeding for women with diabetes, and indicate that AME might help to enhance women's breastfeeding confidence, prevent delayed lactogenesis II and improve exclusive breastfeeding rate[17–20]. However, the impacts of AME to women who are not being with diabetes, particularly in first-time mothers have not previously been evaluated. This study was therefore designed to examine the effects of AME on the term primipara.

# Methods

### Study design and participants

We did a single-blind, two-group, randomized controlled trial at a tertiary hospital in Hainan, China. The study was approved by the human research ethics committees of the Affiliated Hospital of Hainan Medical University.

Eligible women were between 18 and 34 years old, 35 and 36 weeks' gestation with a singleton pregnancy, healthy fetus, planning to breastfeed. Exclusion criteria were any pregnancy complication, such as preterm labor, diabetes, polycystic ovarian syndrome and hypertension; severe postpartum complication, such as postpartum Bleeding; fetal growth restriction; gestational week<38 weeks of delivery; the neonatal maternal separation; newborn birth weight <2500g; shortened lingual frenulum.

Randomization was done by a computerized random number, and the random numbers were reordered. After reordering, 1~45 were assigned to the intervention group, 46~90 digits were allocated to the control group, participants were masked to block size and group allocation.

## Procedures

Women in the control group received standard care that included breastfeeding health education and guidance, as follows. (1) 28-34 weeks of gestation: benefits of breastfeeding, the importance of early contact and early sucking, breastfeeding posture method of deep inclusion. (2) 35 -37 weeks of gestation: benefits of colostrum, the size of the stomach capacity of the newborn, importance of breastfeeding on demand. (3) postpartum hospitalization: assist the mother and newborn to make early contact, suck,  instruct the mother at the bed to correctly include the nipple and evaluate the effectiveness of sucking, emphasize to mothers and primary caregivers the importance of breastfeeding on demand. (4) Postpartum follow-up: follow-up of the problems or doubts of the parturient by telephone, and give guidance.

Women in the intervention group received standard care, as well as instructions on

hand expressing breast milk: (a) Before each hand expressing, women¢s hands were washed for 1 min with soap; (b) Place the thumb above the nipple and the index finger below the nipple forming a "C" shape on the edge of the areola(usually 2-3cm away behind the nipple). Using the power of the fingertips to squeeze gently toward the chest wall, then relax and repeat building up a rhythm; (c) From the first day of 37 weeks of gestation, women were encouraged to hand expressing breast milk three times a day for 10 min until admission to hospital to give birth; and (d) In the weekly follow-up visit, women were encouraged to hand expressing breast milk under the electronic fetal monitoring, to evaluate whether it is correctly master the method of hand expressing, and monitor the fetal heart rate and uterine contraction while hand expressing. Women should continue to hand expressing, unless electronic fetal monitoring indicated that fetal intrauterine anoxia. Besides, the researcher contacted them via phone or WeChat every day.

Demographic data (including maternal age, ethnicity, height, pre-pregnancy weight, education, family monthly income) were obtained by questionnaire at recruitment before randomization. and are filled in by the research subjects on the day of admission. obstetric and neonatal medical outcomes (including gestational age of the childbirth, the mode of delivery, the sex of the newborn, the birth weight) were abstracted from the medical record after delivery.

## Measurement

Breastfeeding self-efficacy which is the confidence in the ability to breastfeed and produce milk postpartum, was assessed by the breastfeeding self-efficacy scale at 37 weeks of gestation, 38 weeks of gestation and third day postpartum[21] The scale contains two dimensions of skills and inner activity, a total of 30 items, using a Likert 5-point scale (1~5 points), a total score of 30~150 points, the higher the score, the higher the maternal confidence in breastfeeding. The Cronbach'S a coefficient of this scale is 0.93, and the split-half reliability coefficient is 0.91.

Time to Lactogenesis II was evaluated three times daily began at 24 h pp by mother's perception of the onset of lactation which is a valid public health indicator of lactogenesis stage II [22]. The researcher evaluated the clinical symptoms of Lactogenesis II(i.e., breast fullness, swelling, leakage), and the time to Lactogenesis II was recorded to the nearest hour.

Exclusive breastfeeding rate was used to evaluate feeding methods during the first three days of life, according to the retrospective method within 24 hours. Exclusive breastfeeding indicates that the infant received only breast milk, allowing for vitamin/mineral drops and medications [23].

### Statistical analysis

Data were gathered by reachers and entered into Excel for analysis. The data analysis was performed using the SPSS 22.0 software, A p-value of less than 0.05 was considered significant. Measurement data normality was expressed as mean ± SD, tested with t-test or repeated-measures analysis of variance. Data that did not pass the variance test were compared with a nonparametric two-tailed Mann–Whitney rank-sum test. The enumeration data were expressed as n (%)and compared between groups by the or Fisher exact test, as appropriate.

## Results

### Characteristics of participants

Between March 10, 2019, and August 30, 2019, we recruited 90 women who were randomly assigned to treatment: 45 to the intervention group and 45 to the control group (Fig.1). Six cases assigned to the intervention group were excluded for macrosomia in 1 case, delivered in another hospital in 1case, admission to NICU in 4 cases. Nine cases were excluded from the control group for one withdrew, delivered in another hospital in 2 cases, low birth weight infants in 1case, postpartum hemorrhage in 2 cases, admission to NICU in 3 cases. Finally, leaving 75 cases available for the primary analysis (39 in the intervention group and 36 in the control group).

Baseline characteristics for women and babies were similar between groups(Table 1), including maternal age, education, income, breastfeeding self-efficacy at 37 weeks of gestation, pre-pregnancy BMI, gestational weight gain, gestational week, delivery method, analgesia method, sex of baby and birth weight. There was no significant difference in the two groups ($P$>0.05).

### Breastfeeding self-efficacy scores changes between the two groups

There was no significant difference in the scores of breastfeeding self-efficacy between the two groups before intervention($P$>0.05), while the postintervention scores were higher than those of the control group at 38 weeks and the third day after delivery ($P$<0.05)(Table 2). The breastfeeding self-efficacy scores in both groups increases with time. There were interaction effects between groups and a time effect of the breastfeeding self-efficacy scores. The intervention group shows a stronger increase in breastfeeding self-efficacy scores over time than the control group($P$<0.05).

### Comparison of the differences in time to lactogenesis II between the two groups

Out of the 39 women in the intervention group, 19(48.7%) of the cases established full lactation 24 to 48 hours after delivery, whereas in the control group, out of 36 only 8 (22.2 %) of cases had established full lactation, indicating that the time to lactogenesis II in the intervention group was earlier than that in the control group ($P$<0.05) (Table 3). Besides, the higher the frequency of expressing, the earlier the onset of lactogenesis II (Table 4).

### Feeding mode during the first three days of life

Of the women allocated to the intervention group, 22(56.4%) of 39 infants were feeding with exclusive breastfeeding on the first-day pp, while the control group was mainly breastfeeding, accounting for 80.6%. On the second day pp, the exclusive breastfeeding rate of intervention group was 76.9%, while the control group was only 19.4%. On the third day pp, the exclusive breastfeeding rate in the intervention group was higher than that in the control group, and 22(61.1%) of 36 infants in the control group did not feeding with exclusive breastfeeding. There were statistically significant differences between the exclusive breastfeeding rate during the first three days of life in the two groups(Table 5).

## Discussion

This is the first randomised controlled trial to report on the effects of antenatal expressing milk among first-time mothers in China. We found that women who allocated to hand express three times daily from 37 weeks of gestation had a more positive influence on breastfeeding self-efficacy. For those who completed the confidence measure, significantly increased breastfeeding self-efficacy scores were found in the intervention group between pre- and postintervention, but not in the control group. Explained by Bandura’s social cognitive theory, direct experience is the positive reinforcement process by which individuals improve their skills through cognitive, behavioral, and self-discipline efforts, and is the main source of self-efficacy[10]. By repeatedly practicing hand expressing, pregnant women not only enrich breastfeeding knowledge, but also acquire important skills for breastfeeding, which is a concrete manifestation of direct experience. Also, Visualizing milk during AME, particularly when volume increases were observed, they evoked a sense of appreciation for one's body/breasts and gradually believed that they could produce milk postpartum. The high level of breastfeeding self-efficacy, the more conducive to the establishment and sustainability of breastfeeding[25].

An interesting finding of this study was AME promoted the lactogenesis II, and the time to lactogenesis II was advanced with the increase of AME frequency. Though another study had documented AME shortens the time taken to from initiation to full establishment of lactation, but the relationship between the frequency of AME and lactogenesis II was not been analyzed[16]. The baby sucking on the mother's nipple and effectively removes the milk plays a major role in the lactogenesis II [17]. Hand expressing through nerve reflexes, reflexive stimulation of serum prolactin (PRL) secretion increases, creating conditions for lactogenesis II, hand expressing effectively removes milk [26]. PRL is one of the lactation-related hormones and the most important breast synthesis hormone, which is essential for initiating and maintaining lactation. Hand expressing can be used as an effective measure to increase the frequency of milk removal, particularly when the newborn sucking is not well.

Our study showed significant improvements in exclusive breastfeeding rates among first-time mothers during their hospital stay. This finding is in line with another study that advised women with diabetes in pregnancy to express breastmilk in late pregnancy, suggesting that AME may have a positive effect on breastfeeding [15]. This may have been the result of the deployment of breastfeeding self-efficacy at prenatal. Mothers who have a high level of breastfeeding self-efficacy are more likely to breastfeed after delivery and are more likely to respond in a positive way when encountering breastfeeding difficulties [27]. Although breastfeeding is a natural process, studies have shown that more than 80% of primiparas will experience one or more breastfeeding difficulties, and many of them say breastfeeding is more difficult than expected [28]. Common breastfeeding difficulties such as getting the baby to latch on, nipple pain, maternal fatigue, perception of insufficient milk, and impaired breastfeeding self-efficacy were especially prominent in the early breastfeeding period [29].

Moreover, the time to lactogenesis II is advanced. Timing of maternal perception of onset of lactogenesis II generally begins 48 to 72 hours postpartum [30], but 17% to 44% of primiparas later than 72h [31-33]. Delayed onset of lactogenesis II（DOL）is an important reason for early exclusive breastfeeding failure [34]. Delayed onset of lactogenesis II, mothers often show anxiety and think that they cannot produce adequate milk, so that supply with formula for babies in hospital, which prevents the establishment of early breastfeeding. In this study, the time to lactogenesis II in the intervention group was earlier than that in the control group, which was not only conducive to the mother 's own firm belief in insisting on exclusive breastfeeding, but also conducive to the mother 's overcoming from the caregiver and his family that the early postpartum milk secretion could not meet the needs of the newborn.

### Limitations

Our study mainly explored the impact of AME on breastfeeding during postpartum hospitalization. However, due to time, manpower, and financial constraints, no discharge follow-up was conducted, and the effect of AME on long-term breastfeeding could not be discussed. Therefore, in future research, large-scale, long-term and lactation support studies are needed to explore its long-term effects.

## Conclusion

AME is an effective way to promote pregnant women confidence inability to breastfeed and produce milk postpartum, thus significantly improving the behavior of exclusive breastfeeding, and increasing the percentage of breastfed infants during their hospital stay, these infants were able to avoid infant formula milk in this important early period.

# Abbreviations

AME: Antenatal milk expression; BMI: Body mass index; NICU: Neonatal Intensive Care Unit; BSE: Breastfeeding self-efficacy; BSES: The breastfeeding self-efficacy scale

# Declarations


### Acknowledgments

The authors would like to thank the mothers for participating in the study. We thank the physicians and nurses from the Affiliated Hospital of Hainan Medical University.


### Authors' contributions

YC-study conception and survey design, cleaned and analysed the data, prepared the initial manuscript draft and revised the manuscript. LPM and JJZ-recruited participants. HHG-contributed to data analysis. HYZ-study conception and survey design, revised the manuscript. All the authors read and approved the final manuscript.


### Funding

This work was supported by the Natural Science Foundation of Hainan Province (SQ2019QNJJ0440).


### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

### Ethics approval and consent to participate

Ethical approval was obtained from the Affiliated Hospital of Hainan Medical University Research Ethics Committee.

### Consent for publication

Not applicable

### Competing interests

The authors declare that they have no competing interests.

# References


1. Del Ciampo LA, Del Ciampo IRL. Breastfeeding and the Benefits of Lactation for Women's Health. Aleitamento materno e seus benefícios para a saúde da mulher. Rev Bras Ginecol Obstet. 2018;40(6):354–359. http://doi.org/10.1055/s-0038-1657766.
2. The optimal duration of exclusive breastfeeding. Report of the expert consultation.Geneva:WHO;2001.http://apps.who.int/iris/bitstream/10665/67219/1/WHO_NHD_01.09.pdf?ua=1. Accessed 10 Sept 2016
3. China Development Research Foundation. Survey of the Influence factors of Breastfeeding in China. China Development Research Foundation, 2019. https://www.cdrf.org.cn/jjhdt/4853.jhtml.
4. Hankel MA, Kunseler FC, Oosterman M. Early Breastfeeding Experiences Predict Maternal Self-Efficacy During the Transition to Parenthood. Breastfeed Med,2019,14(8):568–574. https://org/10.1089/bfm.2019.0023.
5. Centers for Disease Control and Prevention (CDC). Vital signs: hospital practices to support breastfeeding-United States, 2007 and 2009. MMWR Morb Mortal Wkly Rep. 2011;60(30):1020–1025.
6. Bahorski JS, Childs GD, Loan LA, et al. Self-efficacy, infant feeding practices, and infant weight gain: An integrative review. J Child Health Care. 2019;23(2):286–310. https://doi.org/10.1177/1367493518788466.
7. Ren Haiyan, Liang Yu, left Pengxiang. Analysis of the factors of breastfeeding based on logistic regression and decision-making tree models. Chinese Journal of Health Statistics. 2019;36(04):532-534.
8. Brownell E, Howard CR, Lawrence RA, Dozier AM. Delayed onset lactogenesis II predicts the cessation of any or exclusive breastfeeding. J Pediatr. 2012;161(4):608–614. https://doi.org/10.1016/j.jpeds.2012.03.035.
9. Tuthill EL, McGrath JM, Graber M, Cusson RM, Young SL. Breastfeeding Self-efficacy: A Critical Review of Available Instruments. J Hum Lact. 2016;32(1):35–45. https:// doi.org/10.1177/0890334415599533.
10. Dennis CL. Identifying predictors of breastfeeding self-efficacy in the immediate postpartum period. Res Nurs Health. 2006;29(4):256–268. https:// doi.org/10.1002/nur.20140.
11. Pineda R, Luong A, Ryckman J, Smith J. Pacifier use in newborns: related to socioeconomic status but not to early feeding performance. Acta Paediatr. 2018;107(5):806–810. https:// doi.org/10.1111/apa.14253.
12. Rosen-Carole C, Allen K, Fagnano M, Dozier A, Halterman J. Mothers' Concerns for Personal Safety and Privacy While Breastfeeding: An Unexplored Phenomenon. Breastfeed Med. 2018;13(3):181–188. https://doi.org/10.1089/bfm.2017.0187.

13. Colin WB, Scott JA. Breastfeeding: reasons for starting, reasons for stopping and problems along the way. Breastfeed Rev. 2002;10(2):13–19.
14. Cox SG. Expressing and storing colostrum antenatally for use in the newborn period. Breastfeed Rev. 2006;14(3):11–16.
15. Forster DA, Moorhead AM, Jacobs SE, et al. Advising women with diabetes in pregnancy to express breastmilk in late pregnancy (Diabetes and Antenatal Milk Expressing [DAME]): a multicentre, unblinded, randomised controlled trial. Lancet. 2017;389(10085):2204–2213. https://doi.org/10.1016/S0140-6736(17)31373-9.
16. Lamba S, Chopra S, Negi M. Effect of Antenatal Breast Milk Expression at Term Pregnancy to Improve Post Natal Lactational Performance. J Obstet Gynaecol India. 2016;66(1):30–34. https://doi.org/10.1007/s13224-014-0648-7.
17. Connolly EL,Reinkowsky M,Giglia R,et al. Education on antenatal colostrum expression and the baby friendly health initiative in an Australian hospital: An audit of birth and breastfeeding outcomes. Breastfeed Rev,2019, 21-30.
18. Zhang Zhijia, Qian Jun, Single Spring Sword. Effect of Prenatal Colostrum Collection on Perinatal Serum Prolactin Levelsin GDM Women Based on Radioimmunoassay. Medical Engineering Technology. 2018;S1:23-25. https://doi.org/10.3969/j.issn.1674-1633.2018.S1.012.
19. East CE, Dolan WJ, Forster DA. Antenatal breast milk expression by women with diabetes for improving infant outcomes. Cochrane Database Syst Rev. 2014;(7):CD010408. Published 2014 Jul 30. https://doi.org/1002/14651858.CD010408.pub2.
20. Fair FJ, Watson H, Gardner R, Soltani H. Women's perspectives on antenatal breast expression: a cross-sectional survey. Reprod Health. 2018;15(1):58. Published 2018 Apr 4. https:// doi.org/1186/s12978-018-0497-4.
21. Dai Xiaona,Cindy-Lee Dennis, Chen Xu, et al. Application of the Breastfeeding Self-Efficacy Scale in Nursing Practice.Chinese Journal of Nursing. 2004;39(6):407-409.
22. Chapman DJ, Pérez-Escamilla R. Maternal perception of the onset of lactation is a valid, public health indicator of lactogenesis stage II. J Nutr. 2000;130(12):2972–2980. https://doi.org/10.1093/jn/130.12.2972.
23. Indicators for assessing infant and young child feeding practices:conclusions of a consensus meeting held 6-8 November 2007 in Washington DC, USA [M]. World Health Organization (WHO), 2008.
24. Gao M, Wei YX, Lyu J, et al. The Cut-Off Points of Body Mass Index and Waist Circumference for Predicting Metabolic Risk Factors in Chinese Adults.Zhonghua Liu Xing Bing Xue Za Zhi,2019,40(12):1533–1540.
25. Awaliyah SN, Rachmawati IN, Rahmah H. Breastfeeding self-efficacy as a dominant factor affecting maternal breastfeeding satisfaction. BMC Nurs. 2019;18(Suppl 1):30. Published 2019 Aug 16. https://doi.org/10.1186/s12912-019-0359-6.
26. Anderson L, Kynoch K, Kildea S, Lee N. Effectiveness of breast massage for the treatment of women with breastfeeding problems: a systematic review. JBI Database System Rev Implement Rep. 2019;17(8):1668–1694. https:// doi.org/11124/JBISRIR-2017-003932.
27. Sheng Ximan, Hong Jingfang, Wang Weili, etc. Advances in the study of self-efficacy of breastfeeding□ Maternal and Child Health Care of China.2014;29(29)□4854-4856□https:// doi.org/ 7620/zgfybj. j. issn.

1001‐4411. 2014. 29. 65.

28. Demirci JR, Bogen DL. An Ecological Momentary Assessment of Primiparous Women's Breastfeeding Behavior and Problems From Birth to 8 Weeks. J Hum Lact. 2017;33(2):285–295. https:// doi.org/10.1177/0890334417695206.
29. Feenstra MM, Jørgine Kirkeby M, Thygesen M, Danbjørg DB, Kronborg H. Early breastfeeding problems: A mixed method study of mothers' experiences. Sex Reprod Healthc. 2018;16:167–174. https:// doi.org/10.1016/j.srhc.2018.04.003.
30. Haile ZT, Chavan BB, Teweldeberhan A, Chertok IR. Association Between Gestational Weight Gain and Delayed Onset of Lactation: The Moderating Effects of Race/Ethnicity. Breastfeed Med. 2017;12:79–85. https:// doi.org/10.1089/bfm.2016.0134.
31. Dewey KG, Nommsen-Rivers LA, Heinig MJ, Cohen RJ. Risk factors for suboptimal infant breastfeeding behavior, delayed onset of lactation, and excess neonatal weight loss. Pediatrics. 2003;112(3 Pt 1):607–619. https:// doi.org/10.1542/peds.112.3.607.
32. Fein SB, Labiner-Wolfe J, Shealy KR, Li R, Chen J, Grummer-Strawn LM. Infant Feeding Practices Study II: study methods. Pediatrics. 2008;122 Suppl 2:S28–S35. https:// doi.org/10.1542/peds.2008-1315c.
33. Nommsen-Rivers LA, Chantry CJ, Peerson JM, Cohen RJ, Dewey KG. Delayed onset of lactogenesis among first-time mothers is related to maternal obesity and factors associated with ineffective breastfeeding. Am J Clin Nutr. 2010;92(3):574–584. https:// doi.org/10.3945/ajcn.2010.29192.
34. Hruschka DJ, Sellen DW, Stein AD, Martorell R. Delayed onset of lactation and risk of ending full breast-feeding early in rural Guatemala. J Nutr. 2003;133(8):2592–2599. https:// doi.org/10.1093/jn/133.8.2592.

# Tables

**Table 1** Characteristics data for all participants

| Characteristics | Intervention group (n=39) | Control group (n=36) | *P*-value |
|---|---|---|---|
| Maternal age (years) (Mean; SD) | 27.05(3.41) | 26.94(2.79) | 0.883 |
| BSE scores at 37 weeks of gestation (Mean; SD) | 90.13(21.9) | 94.19(18.7) | 0.392 |
| Gestational weight gain ( kg) (Mean; SD) | 12.93(4.93) | 14.21(6.60) | 0.234 |
| Birth weight (grams) (Mean; SD) | 3245.9(358.11) | 3227.5(375.50) | 0.829 |
| Education level | | | 0.660 |
| High school | 14(35.9%) | 9(25.0%) | |
| Undergraduate | 24(61.5%) | 26(72.2%) | |
| Master | 1(2.6%) | 1(2.8%) | |
| Income | | | 0.306 |
| 1000~2999 | 3(7.7%) | 7(19.4%) | |
| 3000~4999 | 17(43.6%) | 15(41.7%) | |
| ≥5000 | 19(48.7%) | 14(38.9%) | |
| Pre-pregnancy BMI($kg/m^2$)* | | | 0.803 |
| <18.5 | 10(25.6%) | 12(33.3%) | |
| 18.5~23.9 | 28(71.8%) | 23(63.9%) | |
| 24.0~27.9 | 1(2.6%) | 1(2.8%) | |
| Gestational age delivery(weeks) | 39.51(0.76) | 39.28(0.85) | 0.245 |
| Mode of delivery | | | 0.880 |
| Vaginal delivery | 33(84.6%) | 30(83.3%) | |
| Cesarean section | 6(15.4%) | 6(16.7%) | |
| Painless labor | | | 0.913 |
| Yes | 17(45.9%) | 17(47.2%) | |
| No | 20(54.1%) | 19(52.8%) | |
| Doula labor | | | 0.665 |
| Yes | 12(32.4%) | 10(27.8%) | |
| No | 25(67.6%) | 26(72.2%) | |
| Sex of baby | | | 0.644 |
| Man | 24(61.5%) | 24(66.7%) | |
| Female | 15(38.5%) | 12(33.3%) | |

*The Working Group on Obesity in China (WGOC) of International Life Sciences Institute Focal [23]

**Table 2** Comparison of the differences in breastfeeding self-efficacy scores at different times between the two groups

| Groups | Time | | | Total | *F* | *P-value* |
|---|---|---|---|---|---|---|
| | 37 weeks of gestation | 38 weeks of gestation | day 3 post-partum | | | |
| Group 1 | 90.13±3.28 | 102.67±2.62 | 106.51±3.06 | 99.77±2.77 | 23.579[a] | 0.001[a] |
| Group 2 | 94.36±3.41 | 93.97±2.72 | 98.14±3.19 | 95.49±2.89 | 7.046[a] | 0.010[a] |
| Total | 92.25±2.37 | 98.32±1.89 | 102.33±2.21 | 97.63±2.00 | 25.324[b] | 0.001[b] |
| t/Z | -0.895 | 2.303 | -2.074 | -1.831 | 13.357[c] | 0.001[c] |
| *P-value* | 0.374 | 0.024 | 0.038 | 0.067 | | |

a.F-value and P-value by repeated analysis of variance; b.The main effect of F value and P-value; c. F-value and P-value by the interaction effects.

**Table 3** Comparison of the differences in time to lactogenesis II between two groups

| Time to lactogenesis II | Intervention group□n=39□ | Control group □n=36□ | | *P-value* |
|---|---|---|---|---|
| ≤24h | 5□12.8□ | 0□0□ | 13.693 | 0.002 |
| 24~48h | 19□48.7□ | 8□22.2□ | | |
| 48~72h | 10□25.6□ | 15□41.7□ | | |
| □72h | 5□12.8□ | 13□36.1□ | | |

**Table 4** Frequency of expressing and time to lactogenesis II by cross-tabulation

| | | Frequency of expressing | | |
|---|---|---|---|---|
| | | 1-5times | 6-19times | ≥20 times |
| Time to lactogenesis | ≤24h | 1□33.3□ | 0□0.0□ | 4□13.8□ |
| | 24-48h | 1□33.3□ | 1□14.3□ | 17□58.6□ |
| | 48-72h | 0□0.0□ | 5□71.4□ | 5□17.2□ |
| | □72h | 1□33.3□ | 1□14.3□ | 3□10.3□ |
| | 11.281 | | | |
| *P-value* | 0.024 | | | |

**Table 5** Comparison of the differences in the exclusive breastfeeding rate at three days pp

| Time | | Intervention group (n=39) | Control group (n=36) | | *P-value* |
|---|---|---|---|---|---|
| Day 1 | EBF | 22(56.4) | 7(19.4) | 10.786 | 0.001 |
| | BF | 17(43.6) | 29(80.6) | | |
| Day 2 | EBF | 30(76.9) | 7(19.4) | 24.743 | 0.001 |
| | BF | 9(23.1) | 29(80.6) | | |
| Day 3 | EBF | 33(84.6) | 14(38.9) | 16.730 | 0.001 |
| | BF | 6(15.4) | 22(61.1) | | |

# Figures

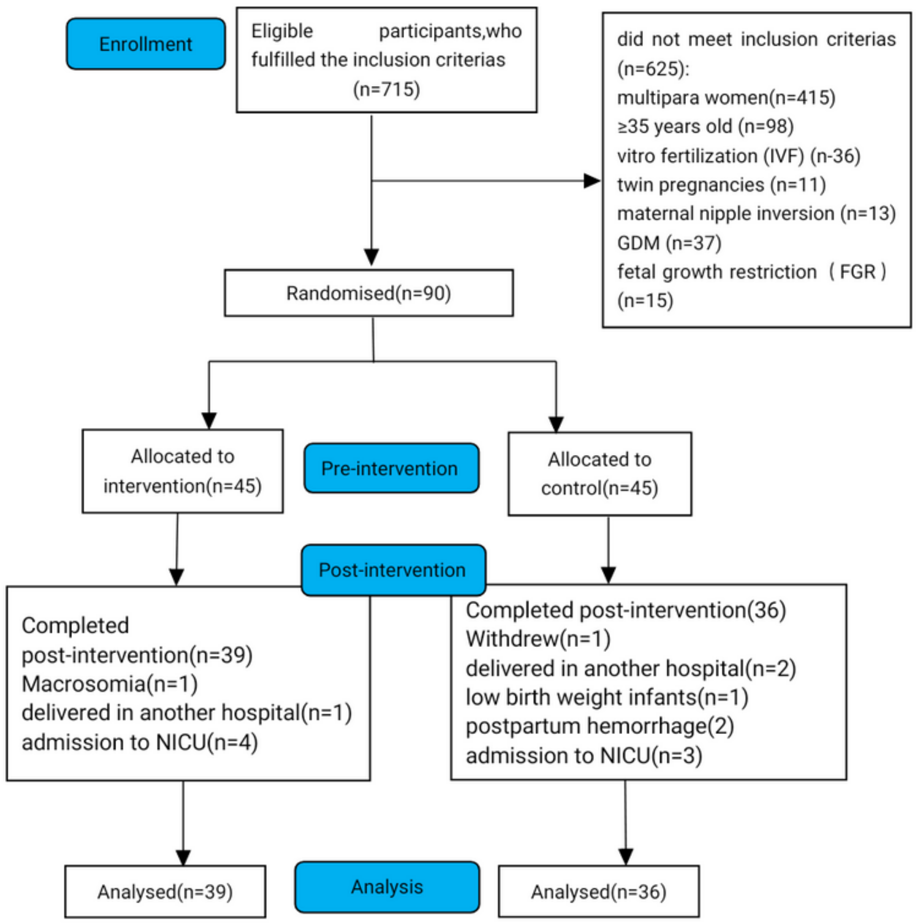


Fig. 1 Inclusion of participants for the study.

## Figure 1

Flowchart