

Rate of Breastfeeding for 4 Months and Promoting Factors: A Cohort Study of Mothers of Preterm Infants at Siriraj Hospital

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ABSTRACT

Background: Breast milk is widely accepted as the best nutrition for all newborn infants. Preterm infants probably gain more benefits from breast milk than term infants because they are at higher risk for having several morbidities.

Objective: To determine the rate of 4-month exclusive or predominant breastfeeding and partial breastfeeding in preterm infants, and to determine the promoting factors of successful breastfeeding.

Methods: This was a cohort study in mothers of preterm infants with gestational age ≤ 34 weeks and birth weight ≤ 2000 grams. The mother-infant dyads were followed until 4 months of age.

Results: The study period was between 1 March 2009 and 28 February 2010. There were 90 mothers recruited. Data of 74 mothers with complete follow up were analyzed. The mean maternal age was 29.67 ± 7.43 years old. The median gestational age at delivery was 31 (interquartile range 4) weeks. Mean infants birth weight was 1412.71 ± 339.18 grams. The rates of exclusive or predominant and partial breastfeeding were 32.4% and 29.7%, respectively. Mother works at home, maternity leave, mothers stay with infants during hospitalization and exclusive breastfeeding in the last 24 hours before discharge were associated with 4-month exclusive or predominant breastfeeding. After multiple logistic regression analysis, factors significantly associated with successful exclusive breastfeeding were mothers work at home (adjusted OR 6.77, 95%CI 1.80-25.55), previous breastfeeding experience (5.09, 95%CI 1.39-18.65), mothers stay with infants during hospitalization (4.22, 1.17-15.22) and exclusive breastfeeding in the last 24 hours before discharge (4.70, 1.17-18.89).

Conclusion: Exclusive breastfeeding in preterm infants is possible. Mothers stay with their infants during long hospitalization and exclusive breastfeeding during the last 24 hours before discharge are significant promoting factors that should be supported by health personnel. Mother works at home is the other significant promoting factor of successful 4-months exclusive or predominant breastfeeding.

Keywords: Breastfeeding, preterm infants, promoting factors

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Plenty of researches have documented the diverse advantages from breastfeeding. Human milk feeding decreases the incidence and/or severity of a wide range of infectious diseases including bacterial meningitis, bacteremia, diarrhea, respiratory tract infection, necrotizing enterocolitis, otitis media, urinary tract infection, and late-onset sepsis. Moreover, breastfeeding has been associated with enhanced performance on tests of cognitive development.¹

Preterm infants probably gain more benefits from breast milk than term infants because they are at higher risk for having several morbidities. Human milk-fed premature infants receive significant benefits of less

infection, for example, necrotizing enterocolitis, late-onset sepsis; and improved neurodevelopmental outcomes compared with formula-fed premature infants.¹⁻³ The American Academy of Pediatrics has recommended human milk for premature infants either by direct breastfeeding and/or using expressed breast milk.¹

At Siriraj Hospital, we encourage all mothers of high-risk infants to provide breast milk for their sick newborn infants. If the mother's choice of nutrition for her infant is breast milk, we will help her with the process of milk expression. When they are clinically more stable, enteral feeding is usually started at minimal volume via an orogastric tube. We will allow the infant to suck on the breast when he or she is clinically stable enough and physiologically mature enough. Co-ordination between sucking, swallowing and breathing is

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achieved around 32 to 34 weeks postconceptional age. This delay in onset of breastfeeding together with prolonged breast milk expression may have an effect on early decrease in breast milk volume. We conducted this study to determine the rate of 4-month-exclusive or predominant breastfeeding and partial breastfeeding in mothers of preterm infants at Siriraj Hospital and to determine the promoting factors of successful 4-month exclusive or predominant breastfeeding.

MATERIALS AND METHODS

This is a preliminary report of a cohort study of mothers of preterm infants for a rate of 6-month exclusive or predominant breastfeeding. The study was approved by the Siriraj Ethics Committee. This study was conducted at the Department of Pediatrics, Faculty of Medicine Siriraj Hospital. The study period was between March 2009 and February 2010. We enrolled mothers of preterm infants of gestational age ≤ 34 weeks and birth weight $\leq 2,000$ grams and written informed consents were obtained. We excluded mothers with contraindications for breastfeeding, mother of infants with life-threatening congenital anomalies and mothers who were not possible to contact after discharge.

Data were obtained from medical records and parental interview. The mother-infant dyads were followed until 4 months after birth at the Preterm clinic or by phone. Data analysis was done with SPSS Version 11.5. The association between factors of interest and outcome were tested by unpaired t-test, non-parametric test, chi-square test or Fisher's exact test as appropriate. Multiple logistic regression analysis was used to determine promoting factors of successful breastfeeding.

Operational definitions: 1) "Exclusive breastfeeding" means the infant received only breast milk regardless of feeding method 4-month exclusive or predominant breastfeeding means exclusive breastfeeding is continued from discharge to 4 months of age. 2) "Predominant breastfeeding" means the infant received breast milk and certain liquids (water) regardless of the feeding method. 3) "Partial breastfeeding" means the infant received breast milk and formula regardless of feeding method and may also received solid food. 4) "Mother stayed in hospital" means the mother stayed in a place provided by the hospital more than 70% of the time during infants hospitalization.

RESULTS

During the study period, there were 107 eligible mothers and 120 infants. Ninety mothers and 103 infants were included in the study. The reasons for not participating in the study were 1 maternal systemic lupus erythematosus, 1 infant with complete cleft lip and cleft palate, 1 maternal language barrier, 1 refused to participate, 3 missed by the investigator and 10 deaths during hospitalization. Fourteen mothers and 18 infants were lost to follow up. Two infants died before completing 4-month follow up as shown in Fig 1.

There were 74 mothers who completed the 4-month follow up. The mean maternal age was 29.67 ± 7.43 years. Three mothers did not allow history of their spouses. The mean paternal age was 32.49 ± 7.95 years. The demographic data of the 74 parents were demonstrated in Table 1. There were 85 infants included in

the study, including 7 sets of twins and 1 set of triplets. Two infants died at home before 4 months of age. The mean gestational age and birth weights were 30.75 ± 2.62 weeks and 1412.71 ± 339.18 grams, respectively. Forty one percent were male. The median (interquartile range) Apgar scores were 7 (4) and 9 (2) at 1 and 5 minutes, respectively. Demographic data of the 83 infants were demonstrated in Table 2.

Throughout hospitalization, all mothers expressed breast milk for their infants. At the end of the 4-month follow up, 62.2% (46/74 mothers) of the mothers still breastfed their infants. The rate of 4-month exclusive or predominant and partial breastfeeding were 32.4% and 29.7%, respectively. There were 3 mothers who never breastfed at home. The mean duration of any breastfeeding in 25 mothers who totally stopped breastfeeding before 4 months was 2.71 ± 0.88 months. The major reasons for starting formula or stopping breastfeeding before 4 months were inadequate breast milk in 60% and mother went back to work in 40%.

Of 24 mothers who succeeded 4-month exclusive or predominant breastfeeding, 6 mothers (25%) fed their infants with some water (predominant breastfeeding). Supplementary food was started before completing 4 months of age in 2 infants. The supplementary foods given were boiling milk-like water and banana.

Suspected promoting factors of successful breastfeeding in this study included mainly socioeconomic status, maternal breastfeeding behavior and length of stay. Univariate analysis of suspected promoting factors of successful 4-month exclusive or predominant breastfeeding were shown in Table 3. Factors that were significantly associated with successful 4-month exclusive or predominant breastfeeding at p level < 0.05 were mother worked at home, maternity leave, mother stayed in hospital and exclusive breastfeeding during the last 24 hours before discharge (Table 3).

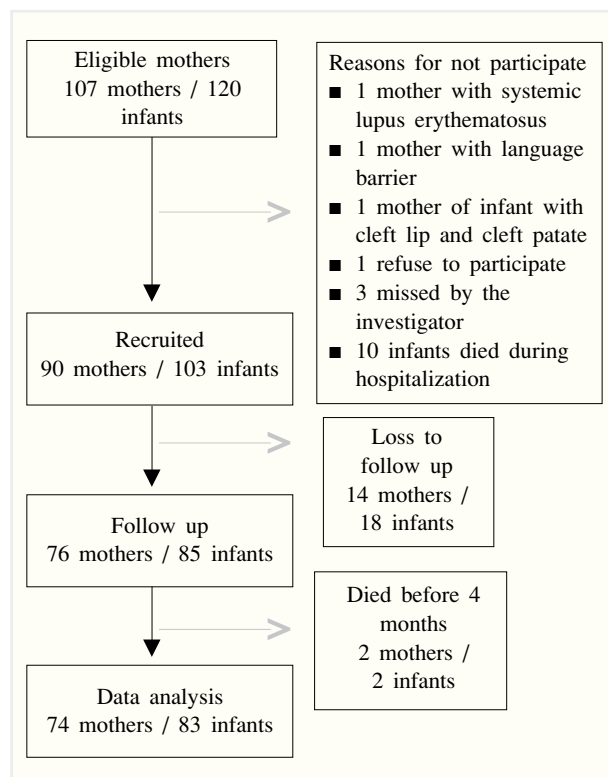


Fig 1. Flow of the study participants.

TABLE 1. Demographic data of the mothers.

	4-month exclusive or predominant breastfeeding		p-value
	Non-successful (n=50)	Successful (n=24)	
Maternal age* (y)	28.80 ± 7.51	30.67 ± 7.01	0.31
First-time mother†			0.01§
Yes	32 (82.1%)	7 (17.9%)	
No	18 (51.4%)	17 (48.6%)	
Pregnancy†			0.15
Single	41 (64.1%)	23 (35.9%)	
Multiple	9 (90.0%)	1 (10.0%)	
Gestational age‡ (wk)	31.0 (4)	32.0 (5)	0.34
Mode of delivery†			0.45
Vaginal delivery	19 (61.3%)	12 (38.7%)	
Cesarean section	31 (72.1%)	12 (27.9%)	
Place of delivery†			0.32
Inborn	50 (68.5%)	23 (31.5%)	
Outborn	0	1 (100%)	
Paternal age* (n=71)	32.28 ± 7.68	32.25 ± 8.56	0.99

*Data were presented as mean ± standard deviation. †Data were presented as frequency (percentage). ‡Data were presented as median (interquartile range). §Significant at p-value < 0.05

Those factors with a p-value less than 0.2 from univariate analysis were included in the multiple logistic regression analysis. After being adjusted for mother worked at home, multiple pregnancy, previous experience of breastfeeding, mother stayed in hospital and exclusive breastfeeding during 24-hours before discharge, significant promoting factors for successful breastfeeding were mother worked at home, previous breastfeeding experience, exclusive breastfeeding during the last 24 hours before discharge and mother stayed during infant hospitalization. (Table 4) Since those mothers who had maternity leave were mothers who worked outside, hence maternity leave was not included in the multiple logistic regression analysis. The goodness of fit was tested using the Hosmer Lemeshow test and revealed a p-value of 0.90.

DISCUSSION

The benefits of breast milk for preterm infants are very promising as evidenced by several studies.^{1,2,4-8} Breastfeeding in preterm infants has been documented as possible and has been encouraged, no matter how

TABLE 2. Demographic data of the infants.

	4-month exclusive or predominant breastfeeding		p-value
	Non-successful (n=58)	Successful (n=25)	
Infant gender†			0.10
Female	30 (62.5%)	18 (37.5%)	
Male	28 (80.0%)	7 (20.0%)	
Birth weight (g)*	1390.52 ± 343.95	1490.40 ± 314.58	0.22
1-min Apgar score‡	7.5 (4)	7 (4)	0.90
5-min Apgar score‡	9 (2)	8 (3)	0.14

*Data were presented as mean ± standard deviation. †Data were presented as frequency (percentage). ‡Data were presented as median (interquartile range).

TABLE 3. Factors associated with successful breastfeeding: Univariable analysis.

	4-month exclusive or predominant breastfeeding		p-value
	Non-successful (n=50)	Successful (n=24)	
Socioeconomic variables			
Maternal education†			0.46
Primary school	11 (68.8%)	5 (31.2%)	
Secondary/Vocational school	29 (63.0%)	17 (37.0%)	
Bachelor up	10 (83.3%)	2 (16.7%)	
Single mother†			1.0
No	47 (67.1%)	23 (32.9%)	
Yes	3 (75.0%)	1 (25%)	
Mother work†			0.03
Outside	33 (78.6%)	9 (21.4%)	
At home	17 (53.1%)	15 (46.9%)	
Maternity leave†			0.03
No	23 (56.1%)	18 (43.9%)	
Yes	27 (81.8%)	6 (18.2%)	
Pregnancy†			0.15
Single	41 (64.1%)	23 (35.9%)	
Multiple	9 (90.0%)	1 (10.0%)	
Paternal education† (n=71)			0.46
Primary school	9 (56.3%)	7 (43.8%)	
Secondary/Vocational school	32 (66.7%)	16 (33.3%)	
Bachelor up	6 (85.7)	1 (14.3%)	
Breastfeeding behavior			
Previous experience of BF†			.05
No	32 (78%)	9 (22%)	
Yes	18 (54.5%)	15 (45.5%)	
Mother stay during infants hospitalization†			.03
No	31 (79.5%)	8 (20.5%)	
Yes	19 (54.3%)	16 (45.7%)	
Milk received during hospitalization†			1.0
BF	8 (66.7%)	4 (33.3%)	
Combined BF/ formula	42 (67.7%)	20 (32.3%)	
Milk received 24-hr before discharge†			0.03
BF	21 (53.8%)	18 (46.2%)	
Combined BF/ formula	22 (84.6%)	4 (15.4%)	
Formula	7 (77.8%)	2 (22.2%)	
Length of stay‡§ (d)	45 (47)	36 (43)	0.56

†Data were presented as frequency (percentage). ‡Data were presented as median (interquartile range). §Length of stay of the 85 infants.

TABLE 4. Factors associated with successful breastfeeding: Multivariable analysis.

	p-value	Adjusted Odds ratio	95% confidence interval	
			Lower	Upper
Multiple pregnancy	0.25	0.25	0.02	2.65
Mother work at home	0.01	6.77	1.80	25.55
Previous experience of BF	0.01	5.09	1.39	18.65
Mother stay with infants during hospitalization	0.03	4.22	1.17	15.22
Only EBM/BF during 24-hr before discharge	0.03	4.70	1.17	18.89

EBM = expressed breast milk; BF = breastfeeding

small the infant is.⁹⁻¹³ Our hospital has been a Baby-Friendly Hospital since 1993 and has been following the ten steps to successful breastfeeding. The rate of 4-month exclusive breastfeeding in term infants born at this hospital in 2003 was 36%, while a 20.7% rate was reported by the Thai Ministry of Public Health in 2005.^{14,15}

We recruited mothers of preterm infants by using the criteria of both gestational age and birth weight to prevent contamination from intrauterine growth restricted infants, who might be different from the same size immature infants. Approximately 16% of the recruited mothers were lost to follow up. We analyzed only those who completed the follow up study. The disadvantages of this approach are the loss of efficiency due to discarding the incomplete observations and may cause some biases in estimation.

The rate of successful 4-month exclusive or predominant breastfeeding in our study is 32.4%, which is comparable to term infants born at the same hospital.¹⁴ For high-risk infants, we use family-centered care, which mimics some parts of the ten steps to successful breastfeeding. Our breastfeeding rate in preterm infants is also comparable to studies from the same level of university hospital in other parts of the world. Our rate is better than 17.7% in Benevenuto's study, which recruited a wider range of preterm infants between 26 and 36 weeks gestation and used WHO criteria of exclusive breastfeeding, which means receiving breast milk directly from the breast or expressed.¹² If we count those mothers who were lost to follow up as non-successful 4-month exclusive or predominant breastfeeding (a worst case scenario analysis), the rate of successful 4-month exclusive or predominant breastfeeding would be approximately 27%, which is still better than Benevenuto's study. Our rate of any breastfeeding until 4 months is approximately 62%, which is comparable to 62% and 60.2% in studies from Sweden and Brazil, respectively.^{10,12} The reasons to stop breastfeeding or start formula before 4 months in this study are inadequate milk in 60% and the mother went back to work in 40%.

All preterm infants in this study received breast milk during hospitalization. Sixteen percent of the mothers succeeded exclusive breastfeeding throughout hospitalization. The type of milk received throughout hospitalization is not associated with successful 4-month exclusive or predominant breastfeeding. It may be difficult for the mothers to exclusively breastfeed their infants throughout hospitalization. Preterm infants have a much longer length of stay than healthy full-term infants, and 68% of the infants in this study stayed in hospital over a month. Furthermore, separation of the mother-infant dyads due to neonatal illness is related to maternal stress and it may affect milk supply.^{16,17} Thus it is hypothesized that breast milk deficiency in mothers of very low birth weight infants is mediated in part by stress-induced suppression of prolactin secretion through an adrenergic mechanism.¹⁸ Also due to our strict definition of exclusive breastfeeding that the infant must receive only breast milk since birth, if the mothers started expressing breast milk later than the first feed, they will be counted as receiving combined milk.

The length of hospital stay in our study was not associated with successful 4-month exclusive or predominant breastfeeding. We also cannot demonstrate association between maternal and infant demographic data and successful breastfeeding. This is the same as some

other studies which demonstrated that gestational age, birth weight and neonatal disorders or length of hospital stay did not show significant associations with breastfeeding duration.^{10,12} Although, an earlier study revealed that older maternal age, white race and infants of higher 5-minute Apgar score are important predictors of breast milk feeding in hospital,¹⁹ we speculate that the illness and length of stay of a preterm infant does not necessarily impair the mother's ability to breastfeed. It is more important that attitudes and nursing practices of health care personnel in the neonatal units support these mothers to maintain their lactation. The maternal stay in hospital does affect the type of milk received during hospitalization.

The rate of exclusive breastfeeding throughout hospitalization is 16% and increases to 53% in the last 24-hours before going home. The type of milk received in the last 24 hours before going home does associate with the successful 4-month exclusive or predominant breastfeeding. Those mothers who exclusively breastfed their infants during the last 24 hours were 5 times more likely to succeed than those who did not. This is another critical period for successful breastfeeding in preterm infants. Feeding at breast, in preterm infants, is possible when they are clinically stable and physiologically mature enough. Blaymore Bier, et al., demonstrated that breastfeeding is possible even in extremely low birth weight infants.¹¹ Breastfeeding is a more physiological feeding method than bottle feeding for preterm infants.²⁰ During the last 24 hours, the mothers will be fully supported by the nurses until they feel confident of effective breastfeeding.

Other important promoting factors of successful breastfeeding demonstrated in our study are maternal stay in hospital with the infants during hospitalization and previous experience of breastfeeding. Maternal stay in hospital may mimic rooming-in, which is demonstrated to improve breastfeeding practices of the mothers.²¹⁻²³ Hospital admission of preterm infants usually starts in the neonatal intensive care unit (NICU). The NICU settings are great barriers for the mothers to practice their roles as mothers and to develop bonding. At our hospital, we provide space for the mothers who are willing to stay in the neonatal unit area and the mother is allowed to stay at the infants' bed-side as much as they want. The mother will also learn from the nurses how to take care of these small infants. As their infants are getting more clinically stable, they are taught and allowed to do some nursing job under close supervision of the nurses, for example, feeding via orogastric tube, changing diapers and taking a bath. The mother will get self-confidence and feel more comfortable after going home. They can take their roles as mothers of their infants, not only visiting them. Rooming-in also helps the mothers to develop good mother-infant relationships and bonding.^{24,25} None of the mothers recruited in this study abandoned their infants in hospital. It was shown by a retrospective study that the rate of newborn abandonment in hospital reduced from 1.8 to 0.1 per 1000 live births two years after rooming-in started.²⁶ At least a comfortable room for breast milk expression is very helpful. Those mothers who did not stay in hospital, but regularly come to visit their infants were able to express their milk and keep it in a refrigerator.

Mothers with previous breastfeeding experience were 5 times more likely to succeed than those without experience. Benevenuto, et al., also raised the impor-

tance of previous experience of breastfeeding, though it is no longer significant after a multivariate analysis.¹² The only factor found in Benevenuto's study to affect the duration of breastfeeding is the use of a pacifier. We do not include a pacifier use because of the uncommon use in our country.

Flacking's study, from a university hospital in Sweden, revealed that lower socioeconomic status, including lower educational level and unemployment, receiving social welfare and low income were significantly associated with earlier weaning. However, after being adjusted by multivariate analysis, only social welfare had significant association.¹⁰ Our subjects were mainly from lower educational level, only 16% had finished university. We can not demonstrate any difference of educational level between groups of successful and non-successful breastfeeding. We speculate that educational level may not directly affect breastfeeding, since knowledge about breastfeeding can be taught outside school, starting at the antenatal care unit. After delivery, the valuable information about the benefits of breast milk for preterm infants can be emphasized by doctors and nurses. We speculate that the educational level might have an indirect effect on the mothers' job. For a lower income family, both parents may have to work to get adequate income for the family since there is no good system of social welfare in Thailand. Many mothers decided to work and so did 40% of the mothers who did not succeed 4 months exclusive breastfeeding in this study. However, mothers working at home are approximately 7 times more likely to succeed in 4-month exclusive or predominant breastfeeding.

Maternity leave was possible in 44.6% of the mothers studied with a mean duration of 2.52 ± 0.78 months. Maternity leave was associated with lower success in breastfeeding. We speculate that this time limit is not supportive of breastfeeding. Some mothers had to go back to work before their infants were discharged from the hospital. There was a survey on mothers who were on or planning to go on maternity leave in the next 6 months or within 6 months of return from maternity leave in England. Interestingly, approximately 75% of mothers recruited were able to maintain breastfeeding for at least 6 months after returning to work, but almost 90% of the respondents requested for more breastfeeding support. This included access to facilities to express and to store breast milk, to enable them to work flexible hours and to take rest breaks during working hours.²⁷

In conclusion, we want to emphasize that exclusive breastfeeding is possible even in preterm infants as demonstrated in our study and others. The hospital should provide a supporting environment for breastfeeding. A place for the mothers to stay during infant long hospitalization together with a warm and encouraging attitude from health care personnel seems to be most important.

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