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Association of Timing of Initiation of Breastmilk Expression on Milk Volume and Timing of Lactogenesis Stage II Among Mothers of Very Low-Birth-Weight Infants

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Abstract

Background: Feeding breastmilk to premature infants decreases morbidity but is often limited owing to an insufficient milk supply and delayed attainment of lactogenesis stage II. Early initiation of milk expression following delivery has been shown to increase milk production in mothers of very low-birth-weight (VLBW) infants. Although recommendations for milk expression in this population include initiation within 6 hours following delivery, little evidence exists to support these guidelines. This study compared milk volume and timing of lactogenesis stage II in mothers of VLBW infants who initiated milk expression within 6 hours following delivery versus those who initiated expression after 6 hours.

Subjects and Methods: Forty mothers of VLBW infants were grouped according to when they initiated milk expression following delivery. Group I began milk expression within 6 hours, and Group II began expression after 6 hours. Milk volume was measured daily for the first 7 days and on Days 21 and 42. Timing of lactogenesis stage II was determined through mothers' perceptions of sudden breast fullness.

Results: Group I produced more breastmilk during the initial expression session and on Days 6, 7, and 42. No difference in timing of lactogenesis stage II was observed. When mothers who began milk expression prior to 1 hour following delivery were removed from analysis, benefits of milk expression within 6 hours were no longer apparent.

Conclusions: Initiation of milk expression within 6 hours following delivery may not improve lactation success in mothers of VLBW infants unless initiated within the first hour.

Introduction

Because of the gastrointestinal and immunological immaturity of immature infants, breastmilk provides vast protection to such infants,[1] especially those weighing less than 1,500 g at birth or very low birth weight (VLBW). Benefits include a decreased incidence of feeding intolerance, late-onset sepsis, and necrotizing enterocolitis,[2–4] as well as decreased length of hospital stay, improved neurodevelopmental outcomes, and maternal psychological benefits.[5–8] Unfortunately, mothers of VLBW infants often have difficulty achieving lactation success and are less likely to initiate[9] and more likely to discontinue breastfeeding or milk expression earlier than mothers of term infants.[10] As a result, infants who may receive the most advantage from breastmilk are often deprived of its benefits.

One factor contributing to this insufficient milk supply is a delay in the attainment of lactogenesis stage II, which begins with the production of copious amounts of breastmilk following delivery.[11] A delay in lactogenesis stage II is common in term infants, especially if initiation of breastfeeding is delayed following delivery,[12,13] and has been associated with decreased lactation success.[14] Delivery of a premature infant is associated with a delay in the achievement of lactogenesis stage II,[15,16] and such a delay can result in an inadequate volume of breastmilk for feeding, causing a postponement of feeding initiation or advancement or the necessity of feeding the infant formula.[10]

Another contributor to an insufficient milk supply is the correlation between gestational age and breast volume.[16,17] Although recent research has shown that mothers of VLBW infants are able to produce adequate amounts of breastmilk,

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many continue to struggle with inadequate production.[18,19] Decreased milk production may be owing to decreased mammary gland development as well as decreased exposure to prolactin, cortisol, and other hormones that normally occur during a full-term pregnancy.[15] Although mechanical breast pumps to enhance milk expression may be used, they do not replicate the sucking mechanics of breastfeeding infants, potentially decreasing the production of breastmilk and/or delaying lactogenesis stage II.[20]

A possible solution to these obstacles is earlier initiation of milk expression, which may increase breastmilk production and facilitate attainment of lactogenesis stage II. In term infants, earlier initiation of breastfeeding following delivery is associated with an extended duration of breastfeeding, increased milk volume on Day 5, and earlier onset of lactogenesis stage II.[21,22] Similarly, in mothers of VLBW infants, earlier initiation of milk expression has been associated with increased milk volume and an earlier lactogenesis stage II.[23–27] Despite the fact that current recommendations suggest that milk expression should begin no later than 6 hours following delivery,[21] mothers of VLBW infants often delay milk expression, with expression often beginning over 24 hours following delivery. These recommendations are based on an observational study by Furman et al.[23] that reported a positive correlation between early initiation of milk expression and prolonged lactation over 40 weeks' postmenstrual age. However, these authors did not measure the impact of initiation prior to 6 hours on either milk volume or timing of lactogenesis stage II, both of which are vital to establishing the evidence for early initiation of milk expression.

In previous studies, we have shown an increased milk volume and an earlier lactogenesis stage II in mothers of VLBW infants who initiate milk expression within an hour following delivery.[28] Unfortunately, owing to the often critical clinical status of the mother and frequent need for cesarean section, initiation of milk expression this early following delivery may not always be feasible. Therefore, the purpose of this prospective cohort pilot study was to compare milk volume and timing of lactogenesis stage II in mothers of VLBW infants who initiated breastmilk expression within 6 hours following delivery versus those who initiated milk expression after 6 hours of delivery.

Subjects and Methods

Study sample

Following institutional review board approval, a convenience sample of 40 women who delivered an infant with a gestational age of less than 32 weeks and weighing less than 1,500 g at birth were recruited from either the labor and delivery unit or a Level III tertiary neonatal intensive care unit (NICU) from January 2010 to February 2011. Exclusion criteria consisted of the following: (1) less than 18 years of age, (2) no intention to breastfeed, (3) non-English speaking, (4) presence of major infant anomalies, (5) illicit maternal drug use, (6) history of breast reduction or augmentation, (7) positive human immunodeficiency virus status, or (8) the infant is not expected to live over 2 weeks following delivery. Mothers were invited to participate either prior to delivery or while visiting their infant in the NICU; if they assented, they were asked to sign a written consent form.

Mothers were placed into two groups based on when they began milk expression following delivery. Group I (early initiation) ($n = 20$) participants, who began milk expression within 6 hours following delivery, were part of our previous study that compared the impact of timing of initiation of milk expression within 1 hour to initiation between 1–6 hours following delivery.[28] Group II (late initiation) ($n = 20$) participants commenced milk expression after 6 hours following delivery per usual hospital protocol, which varied depending on parent preference as well as the availability of nursing staff.

Milk collection and volume measurement

Mothers in both groups received the same standard written and verbal pumping information, including instructions to pump their breasts at least eight times per day and to pump for 15 minutes. If milk was still flowing when the allotted time expired, mothers were instructed to continue pumping for 2 minutes after milk flow ceased. All mothers used a simultaneous electric Symphony® breast pump (Medela, McHenry, IL) during hospitalization and infant visitation and an equivalent simultaneous breast pump for use at home. Mothers had access to lactation services that were provided upon request from the nurse or physician. The use of hand expression was not assessed and was not a standard of care in this institution.

The written instructions were listed in a pamphlet given to all mothers and included explicit procedures for milk expression, collection, and storage per NICU protocol. For example, mothers were to store their expressed breastmilk in a collection vial provided to them by the NICU and to date and time their collection vial of breastmilk from each expression session. Furthermore, when they visited their infants, they were instructed to bring the vials of expressed breastmilk to the NICU, where the vials would be stored in a hospital freezer. Finally, mothers were asked questions regarding when they made the decision to breastfeed or provide breastmilk for their infant, how long they planned to continue breastfeeding or providing breastmilk for their infant, and whether or not they had ever pumped breastmilk or breastfed a previous infant.

Measurement of 24-hour milk volumes were obtained on Days 1–7, Day 21, and Day 42 by weighing each vial of expressed breastmilk brought to the NICU by the mother on an electronic digital scale (Scout Balance, Florham Park, NJ) to the nearest 0.1 g and summing together all milk expressed during the 24-hour time period. It is important to note that weight of breastmilk in grams is equivalent to its volume in milliliters and is a precise measurement to determine the volume produced.[29] Frequency and length of skin-to-skin contact (e.g., holding of an infant dressed only in a diaper upon a mother's bare chest) were recorded by either the nurse or the mother during hospitalization. If the infant breastfed during the 24-hour milk volume measurement session, the nurse measured intake through test weighing (e.g., weighing infants prior to and following breastfeeding), which has been shown to be an accurate method to determine intake during breastfeeding in preterm infants.[30]

Determination of lactogenesis stage II

Beginning at 24 hours following delivery and continuing daily until initiation of lactogenesis stage II, mothers were questioned regarding if and when they noticed a sudden

feeling of fullness in their breasts. Timing was recorded in 12-hour increments as either occurring 0800–2000 h or 2000–0800 h. This is a traditional method of determining timing of lactogenesis stage II and has been shown to correlate with actual timing of this stage.[31]

Data analysis

Data entry and analysis were performed using SAS version 9.2 software (SAS Institute, Cary, NC). Means, standard deviations, and proportions were used to describe demographic and clinical characteristics of the study sample. Differences between the groups were compared for continuous variables using pooled *t* tests for continuous data, the Satterthwaite test for unequal variance, and chi-squared tests for nominal data. Owing to non-normal distribution of the outcome data as determined by use of skewness, kurtosis, Shapiro–Wilk tests, and P-P plots, milk volumes for each of the 24–hour periods and timing of lactogenesis stage II were compared using nonparametric Wilcoxon rank sum tests. Values of $p < 0.05$ were considered statistically significant. In addition, to account for the correlated nature of the repeated measurements within the study participants as well as missing data, a general linear mixed model (GLMM) approach was used to explore the relationship of breastmilk amounts with time point of breastmilk initiation over time.

Results

The convenience sample for this pilot study consisted of 40 mothers who delivered VLBW infants less than 32 weeks' gestation. The mean gestational age of infants whose mothers enrolled in this study was 27.7 weeks, with a mean birth weight of 958 g. Groups were demographically similar except for a statistically significant difference in parity and mother's weight at delivery. No statistically significant differences were observed between provision of skin-to-skin contact and expression frequency (overall and during the first 7 days) between groups (Table 1).

Milk volume during Week 1

Mothers who began milk expression within 6 hours following delivery produced consistently more milk during each of the first 7 days with a statistically significant difference at the initial expression session ($p = 0.001$) on Day 6 ($p = 0.002$) and Day 7 ($p = 0.006$) (Table 2). Total milk volume expressed by mothers in the early expression group during the first week was nearly twice that of mothers in the late expression group: 803.8 and 394.4 mL, respectively; however, the difference in total volume was not statistically significant.

Milk volume at Weeks 3 and 6

Women who began milk expression within the first 6 hours following delivery produced more breastmilk at 6 weeks ($p = 0.05$) following delivery compared with the late initiation group (Table 2).

Duration of lactation

Only 25% of the participants expressed milk for the duration of the 6-week study. Among mothers in the early initiation group, 70% ($n = 14$) continued milk expression for 3 weeks

Table 1. Demographic and Clinical Characteristics

	Early initiation	*Late initiation*	p *value*
Birth weight (g)	974.9 ± 321.5	943.5 ± 234.6	0.731
Gestational age (weeks)	27.4 ± 2.4	28.0 ± 2.1	0.424
Delivery (cesarean section)	65% (13/20)	80% (16/20)	0.288
Breastmilk expression frequency (times/day)	6.0 ± 1.2	6.5 ± 1.6	0.288
Episodes of skin-to-skin contact (times/day)	3.7 ± 4.4	3.5 ± 4.7	0.890
Timing of maternal decision to breastfeed			0.150
At conception	65% (13/20)	35% (7/20)	
During pregnancy	20% (4/20)	30% (6/20)	
Immediately before or after delivery	15% (3/20)	35% (7/20)	
Anticipated length of breastfeeding			0.121
Only pumping	5% (1/20)	30% (6/20)	
6 months	20% (4/20)	20% (4/20)	
1 year or as long as possible	75% (15/20)	50% (10/20)	
Previous breastfeeding experience	10% (2/20)	20% (4/20)	0.661
Maternal age (years)	26.9 ± 6.4	27.7 ± 6.3	0.710
Education (years)	13.1 ± 1.5	13.0 ± 1.4	0.740
Married	45% (9/20)	45% (9/20)	1.0
Employed	60% (12/20)	30% (6/20)	0.057
Parity			0.048[a]
0	0	20.0% (4/20)	
1	55.0% (11/20)	25.0% (5/20)	
>2	45.0% (9/20)	55.0% (11/20)	
Prepregnancy weight (pounds)	196.9 ± 65.9	160.3 ± 37.6	0.039[a]
Weight gain during pregnancy (pounds)	17.0 ± 10.1	19.2 ± 12.0	0.533
Maternal diabetes	10% (2/20)	5% (1/20)	1.0
Antenatal steroids	95% (19/20)	95% (19/20)	1.0

Data are mean ± standard deviation or percentage values as indicated.
[a]Statistically significant difference.

Table 2. Breastmilk Amounts over Time and Lactogenesis Stage II by Initiation Group (n = 40)

	Early initiation	*Late initiation*	p *value*
Breastmilk (mL)			
Initial amount	0.1 (0.0–0.15)	0.0 (0.0–0.0)	0.001[a]
Day 1	0.27 (0.0–7.4)	0.0 (0.0–3.5)	0.392
Day 2	3.1 (0.14–16.0)	4.3 (1.5–17.1)	0.550
Day 3	25.7 (6.0–138.2)	11.5 (1.5–45.4)	0.148
Day 4	51.5 (19.4–205.3)	49.4 (13.9–183.4)	0.764
Day 5	117.3 (38.5–245.6)	112.1 (50.5–162.4)	0.738
Day 6	259.6 (108.4–302.7)	87.1 (50.4–140.2)	0.002[a]
Day 7	252.7 (133.5–381.5)	125.7 (65.3–192.7)	0.006[a]
Week 1	803.8 (377.9–1,166.0)	394.3 (249.0–669.6)	0.076
Week 3 (n = 23)	454.0 (238.9–591.8)	224.2 (100.7–334.8)	0.056
Week 6 (n = 14)	355.2 (328.6–457.7)	258.7 (124.3–284.7)	0.050
Lactogenesis stage II (hours)	114 (66–137)	78 (60–108)	0.207
Lactating at			
3 weeks	70% (14/20)	45% (9/20)	0.110
6 weeks	50% (10/20)	20% (4/20)	0.047[a]

Data are median (interquartile range [25th–75th percentile]) or percentage values as indicated. The values for *p* were obtained from Wilcoxon rank sum tests.
[a]Statistically significant difference.

and 45% ($n = 9$) for 6 weeks. In the late initiation group, only 50% of mothers ($n = 10$) continued milk expression for 3 weeks and 20% ($n = 4$) for 6 weeks. Mothers in the early group were more likely to be lactating at 6 weeks ($p = 0.047$).

Timing of lactogenesis stage II

No statistically significant difference in timing of lactogenesis stage II was observed between groups ($p = 0.207$). In both groups substantial variation in timing of lactogenesis stage II was noted, with timing beginning at 69 to 137 hours, with a median of 97.15 hours, following delivery.

Initiation of expression after 24 hours following delivery

Analyses were repeated excluding three women who initiated milk expression greater than 24 hours postdelivery. Results were consistent except differences in milk volume were no longer significant for Week 6; however, differences are nonsignificant likely because of the reduced sample size.

Initiation of milk expression between 1 and 6 hours versus over 6 hours following delivery

To determine whether differences in milk volume between groups were significantly influenced by the 10 mothers who began milk expression within 1 hour following delivery, milk volume and timing of lactogenesis stage II were compared among mothers who began milk expression < 1 hour, 1–6 hours, and > 6 hours following delivery. Breastmilk volume was statistically significantly different among the three groups with increased volume in the < 1 hour group (Table 3). When mothers who initiated milk expression within 1

Table 3. Values for Three Categories of Initiation Time Point of Breastmilk Expression for Comparison with Two Categories (Up to 6 Hours Versus More Than 6 Hours)

	Within 1 hour (n = 10)	*> 1 and ≤ 6 hours (n = 10)*	*After 6 hours (n = 20)*	p *value*[a]
Breastmilk (mL)				
Initial amount	0.1 (0–0.3)	0 (0–0.1)	0 (0–0)	0.002
Day 1	7.0 (0–28.8)	0.01 (0–0.4)	0 (0–3.5)	0.122
Day 2	16.0 (4.1–106.7)	0.5 (0–2.0)	4.3 (1.5–17.1)	0.009
Day 3	88.0 (14.2–208.8)	19.5 (0–45.2)	11.5 (1.5–45.4)	0.099
Day 4	88.5 (62.2–399.7)	28.2 (15.3–40.8)	49.4 (13.9–183.4)	0.213
Day 5	232.4 (95.2–405.7)	71.3 (34.9–117.8)	112.1 (50.5–162.4)	0.099
Day 6	294.0 (182.8–370.7)	217.7 (79.2–267.0)	87.1 (50.4–140.2)	0.003
Day 7	306.2 (244.0–384.3)	180.7 (80.8–253.2)	125.7 (65.3–192.7)	0.005
Week 3 ($n = 23$)	543.5 (466.1–818.1)	238.9 (87.8–442.0)	224.3 (100.7–334.8)	0.007
Week 6 ($n = 14$)[b]	440.0 (352.1–526.4)	209.0 (64.1–355.8)	258.7 (124.3–284.7)	0.024
Lactogenesis stage II (hours)	90 (24–120)	126 (108–204)	72 (60–108)	0.047
Lactating at				
3 weeks	70% (7/10)	70% (7/10)	45% (9/20)	0.343
6 weeks	60% (6/10)	40% (4/10)	20% (4/20)	0.080

Data are median (interquartile range [25th–75th percentile]) or percentage values as indicated.
[a]*p* values obtained from the Kruskal–Wallis test.
[b]Sample size for Week 6: within 1 hour, $n = 3$; > 1 and ≤ 6 hours, $n = 7$; and after 6 hours: $n = 4$.

Table 4. Values for Two Categories of Initiation Time Point of Breastmilk Expression

	>1 and ≤6 hours (n=*10*)	*>6 hours* (n=*20*)	p *value*[a]
Breastmilk (mL)			
Initial amount	0 (0–0.1)	0 (0–0)	0.036
Day 1	0.01 (0–0.4)	0 (0–4)	0.791
Day 2	0.5 (0–2)	4 (2–17)	0.025
Day 3	20 (0–45)	12 (2–45)	0.827
Day 4	28 (15–41)	49 (13–183)	0.487
Day 5	71 (35–118)	112 (51–162)	0.310
Day 6	218 (79–267)	87 (50–140)	0.110
Day 7	181 (81–253)	126 (65–193)	0.290
Week 3 (n=17)	239 (88–442)	224 (101–335)	0.810
Week 6 (n=8)[b]	209 (64–356)	259 (124–285)	0.678
Lactogenesis stage II (hours)	126 (108–204)	78 (60–108)	0.029
Lactating at			
3 weeks	70% (7/10)	45% (9/20)	0.260
6 weeks	40% (4/10)	20% (4/20)	0.384

Data are median (interquartile range [25th–75th percentile]) or percentage values as indicated.
[a]*p* values obtained from the Wilcoxon rank sum test
[b]Sample size for Week 6: >1 and ≤6 hours, $n=4$; >6 hours, $n=2$.

hour following delivery were removed from the analysis, no difference in milk volume existed between groups except at the initial milk expression session, when mothers who began expression within 1 hour produced more breastmilk ($p=0.036$), and on Day 2, when mothers who began expression after 6 hours produced more milk ($p=0.025$). Timing of lactogenesis stage II was also earlier in mothers who began pumping after 6 hours following delivery (Table 4). It is important to note that among mothers who initiated milk expression between 1 and 6 hours following delivery, only one mother began milk expression prior to 5 hours, with the remainder initiating expression between 5 and 6 hours following delivery.

The between-groups test from longitudinal analysis using GLMM indicated that initiation time was statistically significant ($p<0.0001$); however, the within-subject test did not show a significant time effect ($p=0.571$). In addition, the time-by-group (>1 and ≤6 hours versus >6 hours) was found to be significant ($p=0.044$), indicating that the groups are changing over times but in different ways. A comparison of least-squares means at the individual time points of breastmilk measurements (i.e., days) showed that Day 6 breastmilk amounts were statistically significantly different between the >1 and ≤6 hours and the >6 hours initiation groups ($p<0.023$) (Table 5). Figure 1 indicates that milk volume increased faster in the group initiating milk expression later but that after Day 5 volumes increased more and remained higher in the earlier initiation group compared with the mothers initiating after 6 hours.

Discussion

To our knowledge, this is the first study investigating the association of breastmilk expression within 6 hours following the delivery of a premature VLBW infant with milk volume and timing of lactogenesis stage II. Although this was an observational pilot study with a small sample size, findings suggest initiation of milk expression prior to 6 hours following delivery may not be associated with an increased milk volume during the first 7 days, at 3 weeks, and 6 weeks or with an earlier lactogenesis stage II compared with initiation of milk expression after 6 hours following delivery unless the mother initiates milk expression within the first hour following delivery.

Milk volume

Mothers in the early milk initiation group produced greater milk volumes at the initial milk expression session and at every 24-hour period during the first 7 days following delivery. Differences in milk volume between groups were statistically significant on Days 6 and 7. However, after removal from analysis of the 10 mothers who began milk expression within 1 hour, these differences were no longer apparent. A large variation in timing of initial expression occurred in Group II, with initial expression occurring between 6 and 41 hours following delivery; however, exclusion of mothers who began milk expression greater than 24 hours following delivery did not significantly impact results. Although the difference was not significant, mothers who began

Table 5. Breastmilk Amounts by Initiation Group (>1 and ≤6 Hours Versus >6 Hours) over Time from the General Linear Mixed Model

	Breastmilk (mL) by timing of initiation		
Day	*>1 and ≤6 hours*	*>6 hours*	p *value*
0	0.07±29	2±20	0.949
1	0.7±29	7±20	0.860
2	2±29	16±20	0.703
3	45±29	44±20	0.968
4	70±29	104±20	0.331
5	86±29	130±20	0.213
6	189±29	108±20	0.023
7	192±29	135±20	0.108
21	296±32	240±26	0.180
42	193±41	165±39	0.630

Data are mean±standard error values.

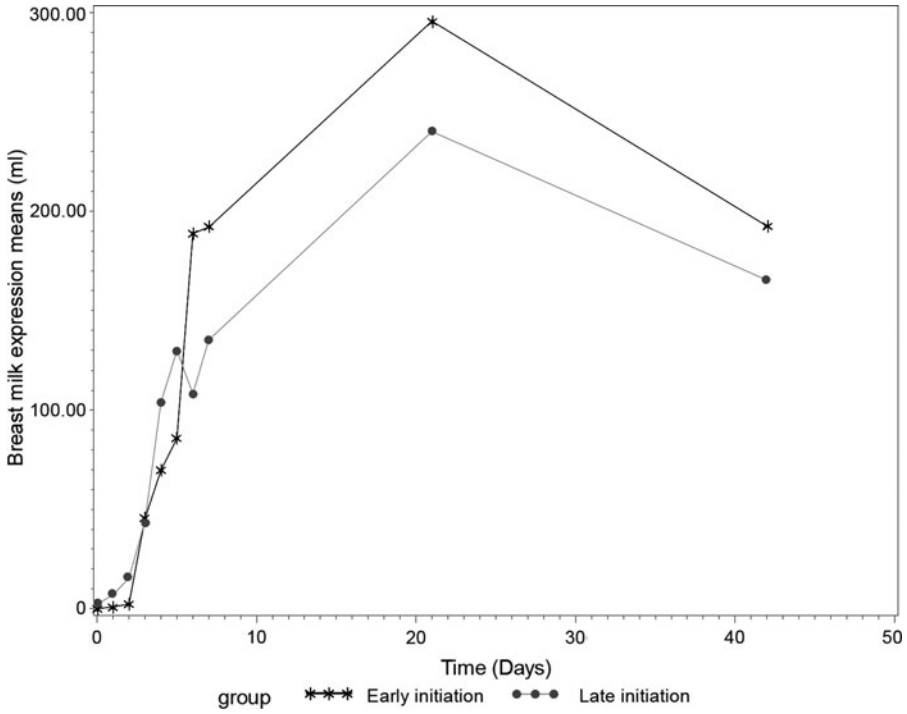

FIG. 1. Mean values for breastmilk amounts by initiation groups (>1 and ≤ 6 hours versus >6 hours) over time from the general linear mixed model.

milk expression within 6 hours were more likely to have made the breastfeeding decision during pregnancy and to have planned a longer duration of breastfeeding.Moreover, differences between groups not appreciated owing to the small sample size may have impacted milk volume.

Although results from this study are not congruent with other study findings regarding a relationship between earlier initiation of milk expression and increased milk volume,[24–27] they do support our previous report of an increased milk volume in mothers who begin milk expression within 1 hour following delivery.[28] In addition, differences in milk volume and timing of lactogenesis stage II may have been apparent had mothers initiated milk expression earlier in the 1–6-hour time frame. Although this study is the first to investigate the influence of milk expression within 6 hours following delivery on milk volume and timing of lactogenesis stage II in mothers of VLBW infants, Furman et al.[23] found a positive association between initiation of milk expression prior to 6 hours following delivery and prolonged lactation over 40 weeks' postmenstrual age.

Lactogenesis stage II

No statistically significant difference in timing of lactogenesis stage II was observed between groups; in fact, after removal of mothers who initiated milk expression within 1 hour, mothers who began milk expression after 6 hours following delivery had an earlier onset of lactogenesis stage II. This contrasts an earlier finding indicating an earlier lactogenesis stage II in mothers who began milk expression earlier following delivery.[28] Determination of lactogenesis stage II was through maternal report of a sudden feeling of breast fullness. Although this may be a valid indicator of the onset of lactogenesis stage II in mothers of term infants, it is unknown whether the same is true in mothers who deliver prematurely.[31] Although timing of initiation of milk expression may not be the only factor determining the onset of lactogenesis stage II, these results suggest that initiation of milk expression within 6 hours following delivery may not be early enough to influence timing of lactogenesis stage II. Not only is an impaired lactogenesis stage II associated with a decreased milk volume in mothers of VLBW infants, it also reduces the amount of breastmilk available for infant consumption, possibly necessitating a delay of feeding initiation or sreplacing breastmilk with formula.[15]

In this study, women experienced a delay in timing of lactogenesis stage II, which generally begins by approximately 36 hours following delivery and is completed by approximately 4 days in term mothers.[11] However, women delivering premature VLBW infants initiated lactogenesis stage II an average of 97.15 hours following delivery, indicating a delay in initiation of this stage. This delay is consistent with the findings of Cregan et al.,[15] who found that 82% of mothers delivering premature infants had an impaired lactogenesis stage II, as well as the findings of Henderson et al.,[16] who reported a 1-day delay in the onset of lactogenesis stage II in mothers of premature infants.

Milk volume at 3 and 6 weeks

Mothers who deliver VLBW infants often experience a reduction in breastmilk volume at 3–4 weeks following delivery, thereby limiting their ability to provide exclusive breastmilk feedings for their infants.[17] Women in the earlier initiation group produced more breastmilk at 6 weeks following delivery; however, when mothers who initiated expression within 1 hour were removed from the analysis, differences were no longer apparent. Because only 25% of

women continued milk expression for the entire 6-week study, the statistical significance of differences in milk volumes is questionable. This contradicts findings of Hill et al.,[17] who reported an association between an earlier initiation of milk expression and milk volume in Week 1 but not Weeks 2–6. Conversely, Hill et al.[25] found an association between timing of expression initiation and adequate milk production (defined as milk output of $\geq 3{,}500$ mL/week) in Weeks 2–6.

Duration of lactation

Fifty percent (15% initiated milk expression within 1 hour following delivery) of mothers who initiated milk expression within 6 hours continued lactation for 6 weeks compared with 20% of those who initiated expression after 6 hours following delivery. Although the difference was not statistically significant, these findings are consistent with those of Furman et al.,[23] who in an observational study found initiation of milk expression prior to 6 hours of delivery was associated with an increased number of women who continued lactating at 40 weeks' postconceptual age.

Implications

Because milk volume during the first week following delivery is associated with later milk production in mothers of VLBW infants, it is critical that strategies to increase milk production are begun soon after delivery to promote optimal breastmilk production.[17,24] In addition, many factors negatively influencing milk production in these mothers are nonmodifiable, making interventions to increase milk production in this population critically important.[21] Although initiation of milk expression prior to 1 hour following delivery appears to increase milk production in mothers of VLBW infants,[26–28] these mothers often delay milk expression for many hours to days following delivery, likely reducing volume of milk produced. Recommendations for early initiation of milk expression should be incorporated into breastfeeding protocols, and mothers should be encouraged and provided with support to initiate milk expression as soon after delivery as possible. Although results of this study suggest milk expression within 6 hours following delivery did not impact lactation success unless the mother began expression within 1 hour following delivery, only one mother began milk expression prior to 5 hours of age. It is possible that initiation of milk expression between 1 and 5 hours may increase milk volume and promote an earlier lactogenesis stage II. An appropriate powered randomized controlled trial is essential to determine the optimal time following delivery to initiate milk expression to improve lactation success in this population.

Conclusions

This study is the first to our knowledge that examined the relationship between milk expression within 6 hours and milk volume and timing of lactogenesis stage II in mothers of VLBW infants. Findings suggest initiation of milk expression within 6 hours following delivery may not be associated with an increased milk volume unless milk expression is initiated within the first hour following delivery. The association between initiation of milk expression between 1 and 5 hours following delivery on lactation success is unknown, and additional research including a randomized clinical trial is needed to more clearly delineate the more optimal timing of initiation of milk expression in this vulnerable population.

Disclosure Statement

No competing financial interests exist.

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