The Effect of Music-Based Listening Interventions on the Volume, Fat Content, and Caloric Content of Breast Milk–Produced by Mothers of Premature and Critically Ill Infants

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ABSTRACT

PURPOSE: Maternal breast milk is considered the nutritional "gold standard" for all infants, especially premature infants. However, preterm mothers are at risk of not producing adequate milk. Multiple factors affect the production of milk, including stress, fatigue, and the separation of the breastfeeding dyad—for example, when mother or infant is hospitalized. The purpose of this study was to examine the effects of listening and visual interventions on the quantity and quality of breast milk produced by mothers using a double electric breast pump.

SUBJECTS: Mothers of 162 preterm infants were randomly assigned to 1 of 4 groups.

METHODS: The control group received standard nursing care, whereas mothers in the 3 experimental groups additionally listened to a recording of 1 of 3 music-based listening interventions while using the pump.

RESULTS: Mothers in the experimental groups produced significantly more milk ($P < .0012$). Mothers in these groups also produced milk with significantly higher fat content during the first 6 days of the study.

KEY WORDS: breast milk, guided imagery, lactation, music therapy, neonatal, premature infants, stress

The American Academy of Pediatrics[1] recommends human milk as the "gold standard" for infant nutrition. Human milk is produced naturally by the mother's body, providing the healthiest, most natural food for human infants at essentially no cost. Breast milk provides both long-term and short-term benefits to infants. In the short term, it protects against enteral feeding intolerance, nosocomial infection, and necrotizing enterocolitis, all of which are causes of morbidity, especially among low-birth-weight infants.[2] In the long term, human milk protects against diabetes, lymphoma, leukemia, and Hodgkin's disease, while reducing obesity, high cholesterol, and asthma, and improving cognitive development.[1] Only a small number of mothers are discouraged from breastfeeding, including women taking illicit drugs,women infected with HIV, women taking antiretroviral medications, those with active tuberculosis, or those who are undergoing radiation or chemotherapy treatment for cancer.[3]

Lactogenesis, the production of breast milk, occurs in 3 stages. It involves hormonal changes in the mother and interaction between the mother and the infant. Stage I occurs during the last 12 weeks of a term pregnancy. During stage I, the mother's body produces higher levels of prolactin, a hormone that stimulates milk production. At the same time, the number of prolactin receptors in the breasts increases. Also, at the same time, levels of estrogen and

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progesterone increase hormones that inhibit the production of milk and prevent the mother from producing milk before her baby is born. Stage II begins when the mother expels the placenta, which causes the mother's estrogen and progesterone levels to drop dramatically, allowing prolactin to stimulate the mother's body to produce milk independent of infant stimulation. However, during stage II, when the baby stimulates the breast during feeding, or the mother stimulates the breast when pumping, more prolactin receptor sites are created in the mother's breast. Stage III is the establishment of a mature milk supply.[4] At this stage, milk secretion is essentially governed by the stimulation of the breast.

Whereas prolactin is important in initiating and maintaining a supply of milk, oxytocin is more closely involved with milk ejection. Oxytocin has been described as the "love hormone," because it is secreted by the body during intense, pleasurable experiences.[5] The secretion of milk during a feeding or pumping session involves the *letdown* reflex, which is caused by oxytocin. During milk secretion, oxytocin is released in short pulses, beginning before the baby is put to the breast, and continuing as the baby suckles. Physiologically, it acts on the muscles of the alveoli, which force the fat-rich *hindmilk* into the ducts, and the baby receives this milk (along with the *foremilk*, which is lower in fat content and nutrition value) from the nipple. Oxytocin has a positive correlation with milk volume[6]; thus, interventions that increase oxytocin secretion could lead to higher milk volume.

A functional letdown reflex is critical to nourishing an infant; it makes sure that the infant receives adequate nutrition. However, letdown is not a static process, and actions by both the infant and the mother can affect it. The more frequently the infant feeds, the higher the average fat content.[7] Notably, lactation also suppresses the stress response in mothers; suckling is associated with a decline in plasma cortisol.[8] To summarize, the main factors in lactation are the maternal hormones and the stimulation of the breast (typically the work of the infant). Changes in any of these factors may affect the lactation process, and prematurity typically affects some or all of these factors.

The Centers for Disease Control and Prevention[3] estimates that more than 500,000 infants are born prematurely in the United States every year. These infants require extensive medical treatment, over and above the care typically provided to newborns. Premature infants are often hospitalized for long periods of time, sometimes months. During this time period, the primary goal of medical treatment is development and physical growth. The process of providing milk to premature infants is different from the process that mothers of term infants experience in several ways and can be more difficult. The mother of a preterm infant who wishes to provide breast milk must make a conscious decision to undertake the process of manual expression of milk. Althoguh milk production is typically a joint effort between the mother-infant dyad, in these cases, a mother must initiate, establish, and maintain the milk supply on her own. Because her pregnancy was shortened, her body has had less time to develop prolactin receptor sites. If her infant was born quite early, she may need to express milk manually for a few months, until the infant is developmentally able to suckle at the breast. Breast pumping represents a substantial time commitment, along with the frequent visit to the neonatal intensive care unit (NICU) setting to deliver the milk.[10(p225)] Finally, mothers of premature infants experience a different stress pattern from term mothers[11] following release from hospitals.

Mothers of term infants typically produce between 600 mL and 900 mL of milk per day during the first 4 months of an infant's life. Preterm mothers are 2.8 times more at risk of not producing adequate milk than term mothers.[12(p22)] In addition, milk output among preterm mothers is more variable than that of term mothers.[12(p26)] In this study, milk production for term mothers steadily increased over time, whereas that of preterm mothers tended to decline or remain relatively stable.[12(p29)]

The reasons for lower production rates of milk among preterm mothers are complex. However, 1 obvious factor is the separation of mother and infant, especially the premature infant. When the mother and the infant are separated, the infant is not available to stimulate the breast for purposes of breastfeeding. Less-frequent stimulation is known to lead to reduced milk production.[12(pp28-29)] Correspondingly, more frequent stimulation of the breast may lead to a more stable milk supply. Another factor is the emotional health of the mother. Stress and fatigue are considered to inhibit lactation, and mothers of premature infants are known to be 3 times as likely to experience clinically significant psychological distress than are those of the normative population.[13]

Because of the substantial nutritional needs of premature infants, researchers have also explored the fat content of milk produced by mothers of preterm infants, with varying results. One study found considerable (but not significant) variability in fat content at different times of day.[14] A more recent study confirmed significant variability in fat content of breast milk produced by mothers of preterm infants, both within and between subjects. Notably, these researchers found that fat content was significantly lower in samples taken during the morning. The researchers found no correlation between gestational age and fat content.[15] In 2 very recent studies,[16,17] milk produced by preterm mothers was found to have significantly higher fat content than milk produced by term mothers. Taken together, these results suggest that fat

content of breast milk varies considerably from 1 mother to another.

Hospitals provide several interventions to improve breast milk production, particularly through the services of lactation specialists, a subspecialization among nurses. These specialists enhance mothers' success in a variety of ways, including education, emotional support, providing positive feedback regarding infant growth and condition, instruction in the use of breast pumps, encouraging skin-to-skin care (also known as kangaroo care),[18] and relaxation methods.[10] Despite these interventions, inadequate milk supply is still a major problem for both mothers and infants and is the most frequently cited reason for discontinuation of breast feeding in the NICU and after discharge.[19] The degree of inconsistency in breast milk output of mothers of preterm infants suggests that there are many causes for lactation insufficiency,[11(p95)] and thus many avenues for intervention.

Music therapy offers a long history of clinical practice and research that supports the use of music therapy to reduce or manage stress, fatigue, and accompanying symptoms. A meta-analysis of 22 quantitative studies revealed that music therapy is an effective means of reducing stress.[20] An additional study[21] analyzed 183 studies in a meta-analysis of music therapy in medical settings, but this meta-analysis did not include any studies relevant to the clinical challenges of lactating mothers. In fact, few references are found in the literature relating to music therapy or music listening and breastfeeding, despite a growing body of research on music therapy with premature infants.[22-24] Procelli[25] examined the effects of music therapy and relaxation techniques with first-time mothers who were breastfeeding and found that the music therapy interventions significantly reduced anxiety-related behaviors of mothers who experienced music therapy before breastfeeding. In 1 earlier study,[26] researchers examined the effect of a guided relaxation audio tape (no music) on the volume and fat content of milk expressed by mothers of premature infants. The researchers measured 1 expression of breast milk at the hospital approximately 1 week after release. The audiotape improved volume but not fat content, and the volume of breast milk was also correlated with the number of times the mothers listened to the audiotape.

One nonmusic therapy study[27] explored the effects of music listening on perceived pain by surgical patients. The researchers discussed the relationship between music listening and oxytocin and their combined role in the management of pain, theorizing that aesthetic experiences of listening to preferred music may increase oxytocin production. However, actual effects of music listening experiences on oxytocin production have not been explored.

Because it has been established that stress causes a reduction in oxytocin, thus inhibiting lactation,[8] and because music therapy and music listening interventions have been established as effective means of stress reduction, we theorized that a listening intervention could impact milk production by mothers using a breast pump, despite the unclear role of music experiences on oxytocin production. We also wished to know whether music listening interventions would have an effect on the quality of maternal milk. Therefore, the purpose of this study was to explore the effects of 3 listening interventions on the quantity and quality of breast milk produced by mothers of premature infants.

The following research questions guided this study:

A. Are music-listening interventions efficacious in increasing the amount of milk produced by preterm mothers?
B. Are music-listening interventions efficacious in improving the quality of breast milk as measured by fat content or caloric content?

Methods

Ethical Review

This study was reviewed and approved by the institutional review board of the academic institution and hospital where the primary investigators are affiliated. This research was conducted in accordance with the ethical standards of the Helsinki Declaration of 1975 (revised 2008).

Recruitment of Participants

The research team, who all completed an online course in the protection of human subjects, consisted of nurses who worked in the NICU and in the lactation department. A member of the research team approached mothers of infants admitted to the NICU who had decided to provide breast milk for their infants. The nurse obtained informed consent. Inclusion criteria were that the infant was born preterm (before 38 weeks)[28] or critically ill and the decision to provide breast milk. Exclusion criteria included mothers receiving medications known to alter breast milk production, mothers experiencing mastitis, mothers with prior breast surgery, and mothers who smoke.

Procedures

Mothers who chose to participate were randomized into 4 groups, using simple randomization, on the basis of a randomization schedule.[29] Each group received standard medical, nursing, lactation education, and support in initiating and maintaining breast milk production. Generally, mothers were encouraged to pump 8 times daily for about 10 minutes.[30(p368)] All mothers received a double electric

TABLE 1. Descriptive Statistics

	Mean (SD)			
Variable	Group A	Group B	Group C	Group D
Gestational age, wk	32.5 (5.1)	31.7 (4.0)	31.7 (4.9)	31.3 (3.8)
Apgar score at 1 min	6.0 (2.4)	5.8 (2.4)	5.3 (2.8)	5.9 (2.1)
Apgar score at 5 min	7.5 (1.3)	7.6 (1.4)	7.6 (1.9)	7.6 (1.4)
Day of life	1.8 (1.5)	2.1 (2.3)	1.4 (0.6)	1.4 (1.0)
Mother's age, y	27.5 (5.7)	24.6 (5.8)	26.3 (6.4)	29.1 (6.9)
Gravida [min, max]	3.6 (2.4) [1, 10]	2.5 (1.6) [1, 7]	2.8 (1.9) [1, 7]	3.2 (2.1) [1, 8]
Parity [min, max]	2.6 (1.7) [1, 6]	2.1 (1.1) [1, 5]	2.3 (1.4) [1, 6]	2.2 (1.4) [1, 7]
Abortion [min, max]	0.90 (1.55) [0, 8]	0.50 (0.94) [0, 4]	0.55 (0.80) [0, 3]	0.94 (1.41) [0, 5]
Male, %	51.2	52.4	45	54.3
Twin, %	16.3	12.5	12.5	14.3

breast pump from the hospital for use at home. Data were collected for 14 days with each participant.

The control group received only the standard support as previously defined. The other 3 experimental groups received mp3 players with a recording of approximately 12 minutes in duration. All recordings consisted of a spoken progressive muscle relaxation protocol, followed by a guided imagery protocol. The guided imagery section included descriptions of relaxing images and supportive messages about breastfeeding. The guided imagery protocol was based on a CD designed for breastfeeding mothers,[31] but altered slightly for women using a pump. Each mother was asked to listen to the mp3 player through the use of headphones as often as possible while using the breast pump.

Each experimental group received 1 of 3 different listening protocols. For the first experimental group, the intervention consisted exclusively of the protocol described earlier. For the second experimental group, the guided relaxation section was accompanied by selections of lullabies for guitar.[32] For the third experimental group, the protocol was accompanied both by the guitar music and by a series of images of the mother's infant. Participants in this group used a video-capable mp3 player. In the NICU where the research took place, it is a standard procedure to provide photographs of the newborn infant to the baby's family on admission; thus, these photographs were available to be incorporated into this video, if the mother consented to their use. Mothers in this group were asked to watch the video in a hands-free stand while using the double electric breast pump.

Data collection began immediately on enrollment of mothers in the study. Research participants provided data on the number of times they pumped, and the volume of milk produced, using a pumping record, a standard tool provided by lactation consultant nurses. Mothers received 14 small syringes, which they used to collect a 1-mL sample of composite breast milk daily, from the milk expressed closest to noon. Evidence exists that fat content is typically lower in milk expressed during the morning,[15] but the primary reason for the choice of this time was consistency. Mothers brought the syringes to the hospital during visits to the NICU, or at the end of their involvement in the study.

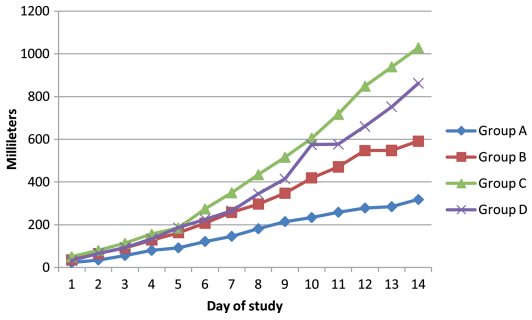
After obtaining the syringes and mothers' pumping records, research assistants added the amount of milk produced each day. After the milk was thawed, a pipette was used to obtain a sample of milk from each syringe. The samples were spun in a Creamatocrit Plus centrifuge, designed to measure the caloric and lipid content of breast milk. Data collectors performing the Creamatocrit measurement were blinded to group membership of the participants. Research team members also collected demographic data, including gestational age, gender, birth weight, and admitting diagnosis.

Results

Descriptive Data

Mothers of 162 infants completed the study. Table 1 describes the characteristics of the infants and their mothers for each group. There was no statistical difference with respect to gestational age, Apgar scores, day of life, gender, twin, gravida, parity, and abortion; however, there was a statistical difference with respect to the mother's age in that there was a detectable difference between the age of mothers in group D and group B. As a result, the age of the mother was

FIGURE 1.



Average milk quantity.

treated as a covariate in the repeated-measures analysis of variance. No statistically significant difference was found in the number of times mothers used pumps, or in the number of times they used the listening intervention (experimental groups only).

Comparisons

All statistical calculations were completed using the SAS STAT 9.2.[33] A repeated-measures analysis of variance was performed for all dependent variables, which included calories, fat, milk volume, and infant weight. As the research questions concerned the efficacy of the experimental treatments, each experimental treatment was compared with the control treatment at each day. Because there are 3 experimental treatments and 14 days, 42 comparisons were made to assess efficacy. As a result, we adjusted the alpha level, using a Bonferroni correction. This correction altered the nominal alpha level from .05 to .0012. Under these conditions, milk volume (mL) and fat content produced clinically meaningful and statistically significant results.

Milk Volume

Figure 1 displays the average quantity of milk produced by participants in all groups. All groups, including the control group, showed a substantial increase in milk volume throughout the 14-day trial.

Table 2 displays mean milliliters of milk produced daily (and standard error). In addition, for the experimental groups, the percent of the control group is also displayed. Mothers in the control group produced the lowest amount of milk throughout. In all cases, the 3 experimental groups displayed a significant increase in breast milk production.

Fat Content

Figure 2 displays the mean fat content of milk produced by all participants. Fat content followed the same pattern as milk volume; that is, mothers in the control group had the lower fat content than the 3 experimental groups (Figure 2).

Table 3 displays mean grams of fat per liter (and standard error). In addition, for the experimental groups, the percent of the control group is also displayed. Mothers in the control group produced milk with the lowest fat content throughout. The only statistically significant and clinically meaningful results occurred in groups D (verbal protocol) and C (verbal protocol + music + images). In these groups, the fat content of milk produced was significantly higher than that in the control group, during the first 6 days of the study. Because the variability of fat content increased dramatically over time, it was difficult to establish statistically significant differences, despite the visually striking increase apparent in group C

Caloric Content

Repeated-measures analysis of variance revealed no statistically significant differences between groups in regard to caloric content.

Discussion

The results suggest that all 3 levels or variations of intervention used in this study effectively improved the quantity of breast milk over the standard of care. In particular, the intervention that included a slide show of images of the mother's child improved breast milk quantity substantially more than the others. Given the importance of establishing an adequate supply of breast milk during the first days of an infant's life, listening interventions such as the ones used in this pilot study represent an efficacious, simple, and cost-effective adjunctive tool for mothers who are using a breast pump.

The theoretical model underlying this study was that listening interventions designed to promote relaxation would lead to reduced stress, leading to increased quantity and quality of breast milk. Although the results clearly suggest that such interventions are effective at improving quantity (less so quality), this pilot study did not identify the specific causes of these changes. That is, it remains unclear whether the changes resulted from increased oxytocin or from some other factor(s). Future studies are needed to explore the relationship to music experiences and oxytocin.

The contrast between groups B (verbal protocol + music) and D (verbal protocol only), in terms of breast milk volume, may be worthy of further exploration. Contrary to the researchers' expectations, the results suggest that mothers who heard the verbal-only protocol produced more milk than those who heard both verbal and music. This brings up at least 1 question: did the simultaneous presentation of 2 audio stimuli represent a distraction for the participants? A further

TABLE 2. Quantity of Milk Produced (Milliliter)

Day	Group A (Control) (n = 43), Mean (SE)	Group B (n = 42) Mean (SE) (% of A)	*P*	Group C (n = 40) Mean (SE) (% of A)	*P*	Group D (n = 35) Mean (SE) (% of A)	*P*
1	22.6 (3.9)	35.3 (4.0) (156)	.0252	**50.6 (4.1) (224)**	**.0001**[a]	32.3 (4.4) (143)	.1032
2	35.2 (5.8)	**64.8 (5.8) (184)**	**.0004**[a]	**79.9 (6.0) (227)**	**.0001**[a]	**65.6 (6.4) (186)**	**.0005**[a]
3	56.3 (8.9)	91.2 (9.0) (162)	.0066	**113.8 (9.2) (202)**	**.0001**[a]	93.9 (9.9) (167)	.0053
4	80.0 (11.7)	128.0 (11.8) (160)	.0044	**156.4 (12.1) (196)**	**.0001**[a]	134.1 (12.9) (168)	.0033
5	92.1 (12.4)	**162.1 (12.6) (176)**	**.0001**[a]	**185.3 (12.9) (201)**	**.0001**[a]	**186.0 (13.8) (202)**	**.0001**[a]
6	121.7 (17.7)	**207.5 (17.9) (171)**	**.0009**[a]	**274.4 (18.4) (225)**	**.0001**[a]	225.5 (19.7) (185)	.0013
7	146.0 (19.8)	**257.6 (20.1) (176)**	**.0001**[a]	**350.0 (20.6) (240)**	**.0001**[a]	**265.6 (22.0) (182)**	**.0001**[a]
8	181.2 (24.1)	**296.3 (24.4) (164)**	**.0010**[a]	**434.9 (25.0) (240)**	**.0001**[a]	**344.4 (26.8) (190)**	**.0001**[a]
9	214.9 (28.9)	347.6 (29.2) (162)	.0015	**516.0 (29.9) (240)**	**.0001**[a]	**414.6 (32.0) (193)**	**.0001**[a]
10	233.9 (35.7)	**418.6 (36.2) (179)**	**.0004**[a]	**605.3 (37.1) (259)**	**.0001**[a]	**575.1 (39.6) (246)**	**.0001**[a]
11	258.7 (40.1)	**470.7 (40.6) (182)**	**.0003**	**716.7 (41.6) (277)**	**.0001**[a]	**576.3 (44.5) (223)**	**.0001**[a]
12	278.4 (43.9)	**546.8 (44.4) (196)**	**.0001**[a]	**848.3 (45.5) (305)**	**.0001**[a]	**659.7 (48.7) (237)**	**.0001**[a]
13	284.7 (43.7)	**547.5 (44.2) (192)**	**.0001**[a]	**938.9 (45.3) (330)**	**.0001**[a]	**752.5 (48.4) (264)**	**.0001**[a]
14	318.2 (47.1)	**591.4 (47.6) (186)**	**.0001**[a]	**1028.0 (48.8) (323)**	**.0001**[a]	**861.7 (52.2) (271)**	**.0001**[a]

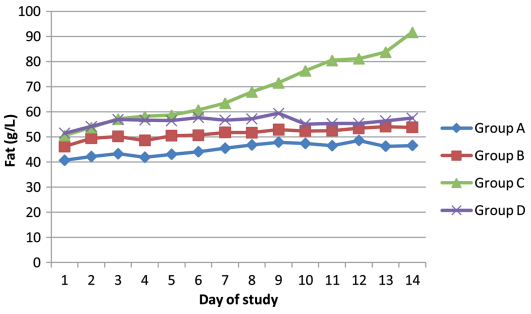
[a]All *P* values in bold are statistically significant after adjusting via a false discovery rate of 0.05.

study might wish to compare verbal-only protocol with music-only protocol.

It would be useful to explore the effects of listening interventions on fat content further. In particular, the fat content in experimental group C (verbal protocol + music + images) was significantly different from the control condition for the first 6 days of the study, and for the remainder of the study, the levels approached statistical significance. It appears that the visual reminder of the mother's baby, coupled with the audio stimuli, may be the cause for this difference. In the future, it would be interesting to compare versions of this experimental condition, for example, verbal protocol + images versus music + images.

From the perspective of the field of music therapy, client-preferred music is generally considered a better choice than music prescribed by a therapist.[34] Although it was not possible to incorporate participant-preferred music in the interventions used in this study, it would certainly be useful to compare the effects of music chosen by the participants with those of music chosen a priori by a researcher. This would be of particular interest regarding oxytocin, for

FIGURE 2.



Average fat content.

example, do various types of music experiences (listening vs creating, for example) have different effects on oxytocin?

From the perspective of nurses and research assistants involved in this study, the provision of maternal milk is 1 of the most sought-after interventions in the NICU. The impact of providing breast milk exclusively is well documented to have long-lasting immediate and longitudinal benefits on the morbidities and mortality of infants. However, lactation requires multidisciplinary support from medicine, nursing, and lactation specialists. Separating mothers from infants increases stress on both parties, adding to the stress of having a critically ill and preterm infant.

TABLE 3. Fat Content of Milk Produced (%)

Day	Group A (n = 42) Mean (SE)	Group B (n = 42) Mean (SE) (% of A)	*P*	Group C (n = 40) Mean (SE) (% of A)	*P*	Group D (n = 35) Mean (SE) (% of A)	*P*
1	40.9 (2.2)	46.2 (2.1) (113%)	.079	**49.9 (2.2) (122%)**	**.0040**[a]	**52.1 (2.4) (127%)**	**.0007**[a]
2	42.6 (2.1)	**49.5 (2.0) (116%)**	**.019**[a]	**53.2 (2.1) (125%)**	**.0005**[a]	**54.8 (2.3) (129%)**	**.0001**[a]
3	43.7 (2.2)	50.2 (2.2) (115%)	.042	**56.7 (2.3) (130%)**	**.0001**[a]	**58.1 (2.5) (133%)**	**.0001**[a]
4	42.1 (2.5)	48.6 (2.5) (115%)	.069	**58.0 (2.6) (138%)**	**.0001**[a]	**58.2 (2.8) (138%)**	**.0001**[a]
5	43.2 (3.1)	50.5 (3.0) (117%)	.096	**58.5 (3.2) (135%)**	**.0007**[a]	**57.5 (3.5) (133%)**	**.0024**[a]
6	44.2 (3.5)	50.7 (3.4) (115%)	.186	**60.7 (3.5) (137%)**	**.0011**[a]	**58.9 (3.9) (133%)**	**.0054**[a]
7	46.0 (4.2)	51.8 (4.1) (113%)	.326	**63.4 (4.3) (138%)**	**.0042**[a]	57.6 (4.7) (125%)	.068
8	47.3 (5.8)	51.6 (5.7) (109%)	.596	**68.3 (5.9) (144%)**	**.0125**[a]	58.1 (6.5) (123%)	.218
9	48.5 (6.6)	52.9 (6.5) (109%)	.639	**72.0 (6.7) (148%)**	**.0143**[a]	60.5 (7.4) (125%)	.231
10	47.7 (8.3)	52.4 (8.1) (110%)	.684	**76.8 (8.4) (161%)**	**.0151**[a]	56.0 (9.3) (117%)	.505
11	46.5 (10.0)	52.5 (9.8) (113%)	.667	**81.0 (10.1) (174%)**	**.0163**[a]	56.3 (11.2) (121%)	.513
12	48.4 (10.8)	53.5 (10.6) (111%)	.736	81.6 (11.0) (169%)	.0321	56.3 (12.1) (116%)	.624
13	45.9(13.3)	54.1 (13.0) (118%)	.663	84.4 (13.5) (184%)	.0441	57.2 (14.9) (125%)	.573
14	45.9(17.7)	53.8 (17.3) (117%)	.751	92.4 (17.9) (201%)	.0669	58.3 (19.8) (127%)	.642

[a]All *P* values in bold are statistically significant after adjusting via a false discovery rate of 0.05.

In the unit where this research took place, mothers' milk has been observed to decrease gradually over time. This decrease is impacted by many factors. Lactation support, skin-to-skin care, open visitation, access to hospital grade breast pumps, support from medicine and nursing, and access of the mother to her infant at any time are not sufficient in many instances to support mothers' milk supply. Interventions such as the ones in this study are welcome augmentations to the current standard of care.

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