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Breastfeeding Increases Sleep Duration in New Mothers and Fathers

by

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THESIS

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ABSTRACT

Objectives: This study describes sleep patterns for mothers and fathers after the birth of their first child and compares exclusive breastfeeding families with parents who used supplementation during the evening or night at three months postpartum.

Methods: As part of a randomized clinical trial, the study utilized infant feeding and sleep data at 3 months postpartum from 133 new mothers and fathers. Infant feeding type (breastmilk or formula) was determined from parent diaries. Sleep was measured objectively using wrist actigraphy and subjectively using diaries. Lee's General Sleep

Results: Parents of infants who were breastfed in the evening and/or at night slept an average of 40-45 minutes more than parents of infants given formula. Parents of infants given formula at night also self-reported more sleep disturbance than parents of infants who were exclusively breastfed at night.

Conclusions: Parents who supplement their infant feeding with formula under the impression that they will get more sleep should be encouraged to continue breastfeeding because sleep loss of more than 30 minutes each night can begin to affect daytime functioning, particularly in those parents who return to work.

Key words: breastfeeding, supplementation, sleep, mothers, fathers, actigraphy

Precis: Giving formula feedings to infants during the evening or during the night does not help new parents get more sleep and may result in sleep loss of 40-45 minutes each night.

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INTRODUCTION

Breastfeeding has been proven to have tremendous benefits to the health and wellbeing of infants, mothers, and families.¹⁻⁴ To obtain optimal health benefits, it is recommended that all infants be exclusively breastfed from birth to six months of age.^{5,6} Healthy People 2010 initiatives set goals for 75% breastfeeding in the early postpartum period with 50% continuation to six months.⁷ The in-hospital breastfeeding rates are currently reported to be 72% for primiparous women; however, at six months postpartum these rates drop to 32%.⁸

Supplementation of breastfed infants during the first months of postpartum recovery deters families from exclusively breastfeeding, and yet it remains a popular practice. Interestingly, supplementation has not been defined in the literature as a separate issue in the maintenance of breastfeeding but, rather, is frequently reported with regard to maternal fatigue or stress⁹⁻¹¹ or postpartum depression.¹² Fatigue, stress, and postpartum depression have been associated with sleep disturbance.¹³⁻¹⁵ Sleep loss is a major concern for postpartum women, yet is often overlooked as a risk factor for supplementation during the first three months of a newborn's life.

Breastfeeding in the early postpartum months requires not only optimal maternal nutrition and family support,¹⁶ but also adequate maternal sleep to restore energy and improve daytime functioning and mood state.¹⁷ Prolactin, the main hormone for milk synthesis, occurs during sleep at night and is also a hormone associated with promoting deep sleep stages in all adults.¹⁸ Although sleep is very important for physical and cognitive functioning,¹⁹ sleep loss in new parents has not been well documented in the literature. For instance, some studies examined maternal-infant sleep²⁰⁻²² while others

examined sleep in full-term infants^{23, 24} preterm infants,^{25, 26} or maternal sleep changes from late pregnancy to postpartum^{27, 28} and only one study addressed sleep in new parents.¹⁴ These studies also report conflicting results, and very rarely discuss the association between infant feeding and maternal sleep in the same sample of families. Some report that breastfed newborns had less total sleep per day than bottle-fed newborns, resulting in breastfeeding mothers having more sleep periods (i.e., more fragmented sleep) than bottle-feeding mothers.^{20, 21, 26, 29} However, the authors did not specify whether breast milk or infant formula was used in the bottle, and sleep was measured using only sleep diaries without validation with an objective measure. One study that also used a sleep diary found that breastfed infants had more continuous nighttime sleep than formula-fed infants.²² Another study that used polysomnography recordings reported no difference in the amount of sleep between infants in breastfed and formula-fed groups, but one formula feeding per day was permitted in the breastfed group.²³ The sleep of mothers has been characterized by sleep deprivation and sleep fragmentation,^{28, 30} depending on infant sleep and feeding pattern^{21, 26} or sleep locations of mother and infant.^{20, 31} Regardless of sleep measures, whether subjective or objective or both, studies concurred that maternal sleep deprivation resulted in daytime complaints of fatigue.

Maternal fatigue, also referred to as weariness, lack of energy or exhaustion, may be due to inadequate or interrupted sleep that results from frequent infant feedings during the night.^{17, 32} As evidenced by clinical observations, the incidence of supplementation during the first three months of an infant's life remains a popular practice, especially in the evening before bed time or during the night. Supplementation at this crucial period has been linked to the prevalence of fatigue complaints resulting from the physical aspect

of breastfeeding and sleep deprivation for parents, especially for mothers who resume their employment outside the home after maternity leave.³³ Using supplementation as a coping strategy for minimizing sleep loss can actually be detrimental because of its effect on prolactin hormone production and secretion. This type of physical and emotional stress associated with sleep loss can alter the synthesis and release of prolactin¹⁸ the hormone primarily responsible for maintaining milk supply and for promoting the restorative deep sleep stages in adults. Thus maintenance of breastfeeding as well as deep restorative sleep stages may be greatly compromised for new mothers who cope by supplementing infant feedings in an effort to get more sleep time.

The purpose of this study was to describe sleep patterns for mothers and fathers after the birth of their first child, and relate type of feeding and infant care during the night to problems with parental sleep and well-being. For the purpose of this study, the research question was: Does supplementing with formula in the evening before bed time, or supplementation during the night, increase nocturnal sleep time for new parents? The specific hypotheses tested in this study were: 1) at three months postpartum there will be no significant difference in total sleep time (TST) between mothers who exclusively breastfeed and mothers who use supplementation in the evening or during the night, and 2) at three months postpartum there will be no significant difference in total sleep time (TST) between fathers who have an exclusively breastfeed infant and fathers who have infants receiving supplementation in the evening or during the night.

METHODS

The data presented in this paper are part of a larger randomized clinical trial in which an educational-behavioral intervention was introduced during the third trimester

and tested for efficacy in improving new parents' sleep in the first few weeks after the birth of their first infant. The post-intervention assessments were conducted at 4, 8, and 12 weeks postpartum. To test the two hypotheses, the infant sleep and feeding logs completed by each mother at their final 12-week postpartum assessment were used to categorize the parents into two groups. The times and types of infant feeding at three months of age were recorded by mothers and then coded in four 6-hour blocks. Total sleep time for each parent was obtained by objective wrist actigraphy measures as well as self-report measures.

Participants

This study was approved by the institution's Committee on Human Research. Eligible couples included those expecting their first child, with both individuals at least 18 years of age, willing to participate, and able to read and write English. Couples were excluded if they planned to hire a live-in nanny, if either parent worked the night shift, or if the expectant mother had a history of involuntary pregnancy loss. After informed consent was obtained from each individual, data were collected from 152 couples enrolled in a randomized clinical trial. Assessments were conducted in the participants' homes, and couples were asked to complete questionnaires and sleep logs independent of their partners. All couples were paid for their participation. By the third month postpartum, the effects of the intervention on sleep outcomes did not differ by group assignment to control or intervention, therefore, this study reports on the sleep and feeding data collected in the third postpartum month (mean time after birth = 11.3 ± 1.0 weeks). There were 133 couples with complete data for this assessment point.

Measures

Feeding Type

Infant feeding type (breast milk or formula) was determined from feeding diaries filled out by the primary caregiver for a period of 48 hours. The primary caregiver indicated the time of each feeding, who fed the infant, and whether the infant was fed breast milk (at breast or in bottle), formula, or both. Feedings were recorded in 6-hour time blocks: 6p-12a, 12a-6a, 6a-12p, 12p-6p. This study reports on the feedings recorded in the evening (6p-12a) and during the night (12a-6a).

Objective Measure of Sleep

To estimate sleep and wake time, each participant was asked to wear a wrist actigraph (Ambulatory Monitoring, Inc., Ardsley, NY) for 48 hours. The wrist actigraph provides continuous motion data using a battery-operated wristwatch-size microprocessor that senses motion with a piezo-electric linear accelerometer. To facilitate interpretation of the actigraph data, participants recorded bed times, wake times, and naps in their own individual sleep log. Total sleep time (TST) was determined using the Cole-Kripke autoscoring program for sleep available in Action3 software (Ambulatory Monitoring, Inc., Ardsley, NY). Although polysomnography (electro-encephalogram, electro-oculogram, and electro-myogram recording from the scalp and face) could be used to determine actual stages of sleep, it is cumbersome, more invasive, and can negatively affect sleep, particularly on the first night of monitoring. Correlations between polysomnographic (PSG) measures and actigraphy measures indicate adequate validity and reliability when sleep is assessed in healthy young adults, including women of childbearing age³⁴⁻³⁶ with 88% agreement between the 2 methodologies. Actigraphy-

recorded total sleep time (TST) is correlated .91 with polysomnography laboratory recording for TST.³⁷

Subjective Measure of Sleep

Parents completed the 21-item General Sleep Disturbance Scale (GSDS; Lee, 1992) as a subjective measure of their sleep disturbance. This instrument lists 21 issues associated with sleep disturbance and the respondent indicates the number of days in the past week that he or she experienced that particular item. A total score on the GSDS can range between 0 and 147, and the internal consistency reliability coefficient (Cronbach alpha) was 0.82 for women and 0.76 for men in this sample.

Data Analysis

In this sample, the control and experimental groups from the larger study did not differ with respect to parent sleep or infant feeding type, and therefore analyses were not adjusted for group assignment. Independent-sample t-tests were used to compare the sleep of mothers and fathers who exclusively breastfed their infant ($n = 89$) to the sleep of those who gave their infant formula, either exclusively or as supplementation during the 48-hour monitoring period ($n = 44$). Since the group sizes were not equal in this sample, separate variance t-tests were used when the group variances differed significantly. Since there was no significant difference in total sleep time between parents who fed their infant formula exclusively and parents who fed their infants a combination of formula and breast milk, these two types of formula feeding families were grouped together for analysis in comparison with exclusive breastfeeding families. To evaluate the possible influence of the timing of formula feedings on parent sleep, comparisons were conducted in two ways: grouping parents by feeding type in the

evening between 6:00 pm and midnight, and grouping parents by feeding type during the night between midnight and 6:00 am.

Actigraphy measures of TST on the first and second night of data collection were highly correlated and not significantly different (i.e., no first-night effect or adaptation to the actigraphy monitor). Therefore, the two nights of sleep data were averaged to obtain mean TST in hours and minutes for each participant. Data were analyzed using SPSS for Windows version 12.0.2. An alpha level of 0.05 was used for significance with all statistical tests. Sample sizes for each analysis reflect the number of mothers and fathers with complete data for that outcome.

RESULTS

Of the 152 couples participating in the larger study, three couples with twins, one couple affected by apnea, and 15 couples with incomplete feeding data at the 3-month postpartum assessment were excluded from analysis, resulting in a final sample of 133 mothers and their male partners. Mothers in the sample had a mean age of 32.1 ± 4.5 yrs and fathers had a mean age of 34.2 ± 5.6 yrs. The sample ethnicity was 70% White, 15% Asian, 9% Hispanic, 2% African American, and 4% Mixed or Other. They were educated (80% completed college) and had moderate to high income. At three months postpartum, 23% of mothers and 86% of fathers were working. Parent age, delivery type, and work status were unrelated to infant feeding type at 3 months postpartum. While maternal education was unrelated to feeding type, college-educated fathers were significantly more likely $X^2[1]=9.27, p=.002$) to have infants exclusively breastfeeding (73%) compared to fathers without a college education (43%).

In this sample, 67% of the infants were fed breast milk exclusively, 23% were fed a combination of breast milk and formula, and 10% were fed exclusively formula during the 48 hours of sleep monitoring (see Table 1). Mothers who exclusively breastfed their infant during the entire 48-hour monitoring period slept an average of 40 minutes longer (7.2 ± 1.3 hrs) than the group of supplementation mothers ($6.5 + 1.3$ hrs) ($t[119] = 2.68$, $p = 0.008$), but there was no significant group difference in TST for fathers. Self-reported sleep disturbance did not differ for either mothers or fathers in the two groups. Breastfeeding was slightly more common at night, with 73% of infants being breastfed in the evening (6p-12a) and 78% being breastfed at night (12a-6a).

Table 1. Type of infant feeding by time period

	48 Hours	Evening (6p-12a)	Night (12a- 6a)
<u>Type of Infant Feeding</u>	n=133	n=133	n=121
Exclusive breastfeeding	67%	73%	78%
Combination feeding	23%	15%	11%
Exclusive formula feeding	10%	12%	11%

Evening Feeding (6:00 pm to midnight)

Mothers who fed their infants breast milk in the evening slept an average of 45 minutes more than women who gave their infants at least some formula in the evening (see Table 2). Similarly, fathers of infants given breast milk in the evening slept 44 minutes more than fathers of infants fed formula in the evening. Self-reported sleep disturbance did not differ for either parent when their infant was fed formula during the evening compared to the breastfed infants.

Table 2. Comparison of parent sleep time by infant feeding type at 3-month postpartum assessment.

	Exclusive Breast Milk	Supplementation	Statistical test
Total Sleep Time (hours)			
Mothers			
Evening (6p-12a)	7.2 ± 1.3 (n=88)	6.4 ± 1.3 (n=33)	t(119)=2.92, p=.004
Night (12 -a-6a)	7.2 ± 1.3 (n=86)	6.4 ± 1.4 (n=23)	t(107)=2.61, p=.010
Fathers			
Evening (6p-12a)	7.0 ± 1.2 (n=85)	6.3 ± 1.4 (n=33)	t(116)=2.88, p=.005
Night (12 -a-6a)	7.0 ± 1.3 (n=82)	6.3 ± 1.1 (n=24)	t(104)=2.13, p=.035
Perceived Sleep Disturbance (0-147 total possible score)			
Mothers			
Evening (6p-12a)	41 ± 17 (n=95)	41 ± 16 (n=36)	
Night (12a-6a)	40 ± 17 (n=92)	47 ± 16 (n=27)	t(117)=1.82, p=.072
Fathers			
Evening (6p-12a)	32 ± 13 (n=93)	34 ± 10 (n=33)	
Night (12a-6a)	32 ± 13 (n=89)	38 ± 11 (n=25)	t(112)=2.38, p=.019

Night Feeding (midnight to 6:00 am)

Of the 133 couples with evening feeding data, 121 also had feeding data between midnight and 6:00 am. Mothers who fed their infant breast milk at night slept an average of 47 minutes more than women who gave their infant at least some formula at night (see Table 2). Similarly, fathers of infants given breast milk in the evening slept 38 minutes more than fathers of infants fed formula at night. This finding is not surprising, given that fathers of infants fed exclusively breast milk were less likely to be involved in night feedings (6%) than fathers of formula fed infants (33%). However, the same reasoning would suggest that breastfeeding mothers would get less sleep than formula-feeding mothers. In addition to the objective wrist actigraphy recording of parents' sleep, fathers and, to a lesser extent, mothers of infants who were breastfed during the night also reported significantly less sleep disturbance compared to parents of infants who were given some formula feeding during the night (see Table 2).

To determine whether father involvement in night-time infant feeding helped mothers obtain more sleep, an additional analysis was done to examine TST for those parents who shared feeding responsibilities at night compared to those where the mother had sole responsibility for night-time feedings. Mothers who shared responsibility for night-time feeding ($n=16$) slept less (6.2 ± 1.7 hrs) than mothers who had sole responsibility for night-time feeding ($n=91$, 7.1 ± 1.2 hrs, $t[105]=2.68$, $p=.008$). Similarly, fathers who shared responsibility for night-time feeding ($n=17$) slept less (6.0 ± 1.4 hrs) than fathers whose partners had sole responsibility for night-time feeding ($n=87$, 7.0 ± 1.2 hrs, $t[102]=2.94$, $p=.004$). To control for the influence of feeding type, additional analyses were also conducted with formula-feeding parents only. Although

this sample size was small, mothers with sole responsibility for night-time formula-feeding (n=10) slept just as much, if not more (6.4 ± 1.3 hrs) than those whose partner helped with night-time formula feedings (n=12, 6.1 ± 1.0 hrs).

DISCUSSION

Results from this study demonstrate that formula-feeding not only failed to improve parent sleep, but actually resulted in parents getting less sleep, even when fathers helped during the night with supplementation feedings. These findings may be due to the inconvenience of preparing bottles of formula during the night, as well as the increased likelihood that mothers will awaken more easily even when fathers take responsibility for feeding the infant at night.

While breastfeeding initiation has increased in recent years, studies show that infants often receive formula supplementation, usually without medical necessity, as early as the first few days after birth.³⁸ This practice is also more common among ethnically and culturally diverse populations.^{39, 40} Supplementation can lead to premature weaning, various degrees of gastrointestinal problems for infants, and altered immune responses in vulnerable infants.^{15, 41-43}

Since disrupted sleep is a common complaint among new parents that is often blamed on the frequency of infant feeding and care during the night, we tested the hypotheses that sleep time for new mothers would not vary by type of feeding. If sleep time did not vary for mothers, it could be hypothesized that participation of fathers in nighttime infant care and feeding may be in effect. Neither was the case. In fact, in exclusive breastfeeding families, both mothers and fathers obtained more sleep regardless of when or how it was assessed.

The sleep deprivation experienced by new parents during the first few months of their infant's life leads to increased stress and fatigue and limits physical and cognitive functioning as well as social interactions with their new infant and other adults.⁴⁴ It has been reported in one study that the sleep of breastfeeding women is more deep (slow wave sleep stages 3 and 4) compared to controls,⁴⁵ and this may explain their ability to return to sleep more quickly after breastfeeding and obtain more sleep time as a result. The stress associated with poor infant feeding and frequent night awakening can inhibit the synthesis or release of prolactin and interfere with both lactogenesis (initiation of milk secretion) and galactopoiesis (maintenance of established milk supply).¹⁸ Infants who cry after breastfeeding in the evening or during the night usually get supplemented with formula because mothers infer from the infant's behavior that breast milk is insufficient.⁴⁶ This supplementation can easily perpetuate the dynamic between maternal sleep disturbance and perceived or actual insufficient milk supply.

Sleep deprivation among first-time parents is a prominent concern for families. Since increased breastfeeding means a potential savings of more than \$3 billion in healthcare costs per year,⁴⁷ breastfeeding promotion would be futile without addressing mothers' and fathers' need for adequate sleep. In order to promote exclusive breastfeeding during the infant's first six months of life, even a casual action of giving the infant some formula in the evening or during the night must be carefully considered, and based on results from this study, there is no empirical reason to recommend this action on the basis of potentially getting more sleep. There is a definite link between unnecessary supplementation and potential sabotage of exclusive breastfeeding efforts in the first few months postpartum, especially for new parents who are trying to discover

ways in which they can best cope with sleep loss. For nurses working with parents and infants during this time period, a stronger emphasis should be placed on learning about parents' motivations, decision making regarding feeding strategies, sleep needs, and daytime physical and cognitive functioning.

Finally, it is recommended that perinatal nurses refrain from giving formula to infants during hospitalization following birth. This practice, although intended to help new mothers get more sleep before they go home, may actually encourage families to continue supplementation at home when parents are trying to cope with sleep loss. Supplementation should be considered as sabotage for establishing lactation in the first few months postpartum and should not be condoned as a means for any family member to get more sleep.

Limitations

Participants in this study were older than typical first-time parent in the United States, and most were college-educated with higher incomes than the general population of new parents. All couples paid to attend childbirth preparation classes in the San Francisco Bay Area, and there was also a higher rate of breastfeeding in this sample compared to the general population of new parents. Findings from this study may be limited to first-time parents with similar demographic characteristics, and cannot be generalized to all first-time parents.

Nonetheless, findings in this sample of first-time parents suggest that breastfeeding can actually increase sleep duration for new mothers and fathers at three months postpartum. This finding has important implications for the promotion of breastfeeding maintenance by adding yet another health benefit to breastfeeding when healthcare

providers are discussing infant feeding options with new parents. If findings from this study are replicated in other more diverse samples, further research should include testing interventions to help parents maintain breastfeeding and promote adequate sleep to optimize the health and well-being of infants, mothers, and fathers.

CONCLUSION

Sleep loss of more than 30 minutes each night can affect daytime functioning and social interactions, particularly in those who return to work. A careful clinical assessment of the extent of sleep loss and daytime functional impairment should be made for all new parents. Since exclusive breastfeeding parents in this study averaged about 40-45 more minutes of sleep each night compared to parents who used supplementation, first-time parents who think about supplementing their infant's feeding with formula in order to obtain more sleep during the night should be encouraged to continue to breastfeed. More sleep during the night is yet another benefit to be added to the discussion with new parents when they are deciding about infant feeding practices.

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