

Infant Sleep and Night Feeding Patterns During Later Infancy: Association with Breastfeeding Frequency, Daytime Complementary Food Intake, and Infant Weight

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Abstract

Infant sleep is a common concern for new parents. Although many expect a newborn infant to wake frequently, encouraging a baby to sleep through the night by a few months of age is seen as both a developmental aim and a parenting success. Many new mothers believe that their infants' diet is related to their sleep; formula milk or increased levels of solid food are often given in an attempt to promote sleep. However, the impact of these in later infancy is not understood. In the current study 715 mothers with an infant 6–12 months of age reported their infants' typical night wakings and night feeds alongside any breastfeeding and frequency of solid meals. Of infants in this age range, 78.6% still regularly woke at least once a night, with 61.4% receiving one or more milk feeds. Both night wakings and night feeds decreased with age. No difference in night wakings or night feeds was found between mothers who were currently breastfeeding or formula feeding. However, infants who received more milk or solid feeds during the day were less likely to feed at night but not less likely to wake. The findings have important implications for health professionals who support new mothers with infant sleep and diet in the first year. Increasing infant calories during the day may therefore reduce the likelihood of night feeding but will not reduce the need for parents to attend to the infant in the night. Breastfeeding has no impact on infant sleep in the second 6 months postpartum.

Introduction

INFANT SLEEP, OR LACK OF IT, is a common concern of new parents. Although newborn infants are expected to wake frequently, with a typical infant waking every 2–3 hours,¹ Western nations in particular have a belief that infants should be encouraged to sleep through the night as soon as possible.^{2,3} A baby who sleeps well is perceived to be a sign of well-being and of good parenting.⁴ This Western belief is often at odds with other cultures across the world who have vastly different infant sleeping practices and expectations for infant sleep.⁵

Although sleep problems in later childhood are linked to behavioral, emotional, and academic problems,^{6,7} waking during infancy is biologically normal. Infants have a biological predisposition to want to be close to their mothers and for frequent suckling.^{8,9} Moreover, due to the small size of a newborn infant's stomach and a need to build milk supply, frequent feeds and thus wakings are needed.¹⁰ Lighter sleep may also be protective against sudden infant death syndrome in young infants.¹¹

Typically, by around the time an infant is 3 or 4 months of age, parents often believe that he or she should be sleeping through the night,¹² although the 1950s data that conclusion on which this is based are outdated.¹³ Indeed, many studies show that for infants 6–12 months of age, night waking is still common. Estimates of night waking range from around 30% to 60%.^{14–18} Scher¹⁶ found the mean number of night wakings in this age group to be 1.77, and likewise nearly half of mothers with an infant 6–12 months of age described their infant sleep as being problematic.¹⁹

Desire for the infant to sleep through the night is, however, often strong, with parents feeling that they have failed if their infant continues to wake.¹² Parents may resort to letting their child “cry it out” when he or she wakes rather than responding to the infant,^{2,18} which may raise infant cortisol levels.²⁰ Another common belief is that nutrition may affect infant sleep; mothers may stop breastfeeding as they believe it is contributing toward night wakings.^{9,21,22} Health professionals may also recommend mothers supplement with formula to get more sleep.²³ These beliefs, however, are not well explored among older infants.

In early infancy, a link between increased night wakings and feeds and milk feeding method is apparent. Formula-fed infants start to sleep for longer periods at an earlier age than breastfed infants.^{24–26} This may be explained by the more difficult digestion of cow's milk leading to a greater feeling of fullness²⁷ and greater volume of consumption.²⁸ Breastfed infants do receive more night feeds.²⁹

It is not clear, however, whether this relationship holds for older infants, despite belief that it does. Some studies find an association between breastfeeding and more frequent waking in later infancy,^{30,31} whereas others find no association^{32,33} at 8 months old. Other studies have found that although breastfed infants might wake more frequently, formula-fed infants take longer to feed and settle, leading breastfeeding mothers to have more sleep overall.^{34,35}

Mothers may also introduce solid foods at an early stage or encourage the infant to eat greater volumes during the day as they believe it will make the infant sleep for longer.^{36–39} Despite this common perception, little research has examined solid food intake and sleep. One study showed that breastfed infants were more likely to sleep through the night at 9 months old if they had been introduced to solids before 12 weeks of age,⁴⁰ although Nevarez et al.³² found an early introduction of solids associated with less sleep at 12 months old. Moreover, rice cereal added to a bottle had no impact on sleep at 4 months.⁴¹

Mothers may therefore be altering their infant feeding behavior based on unclear, sparse, and often outdated evidence. Sleeping and feeding practices have changed considerably over the last 30 years.⁹ The aim of the current study was to examine the issue of night waking and night feeds (and the distinction between them) in infants 6–12 months of age, exploring the breastfeeding and solid food consumption.

Methodology

Participants

Approval for this study was granted by a Department of Psychology Research Ethics Committee. All participants gave informed consent prior to inclusion in the study. All aspects of this study have been performed in accordance with the ethical standards set out in the 1964 Declaration of Helsinki.

Mothers of an infant 6–12 months of age completed a self-report questionnaire. Exclusion criteria included a low birth weight (< 2,500 g), premature birth (< 37 weeks), inability to consent, and infant/maternal health issues.

Mothers were recruited via local mother and baby groups based in South West Wales, United Kingdom, and through online parenting forums based in the United Kingdom. Various groups were included from community centers and private mother and baby groups across areas of varying deprivation.

For the groups, contact was made with group leaders, who distributed questionnaires to group members. Questionnaires were returned to the leader in a sealed envelope or via post to the researcher. In addition, posters were placed in centers around the city asking participants to contact the researcher for further details via e-mail, phone, or post. Questionnaires had information letters attached with details of how to contact the researcher if further information was required. Study advertisements were also placed on specific research request boards

on online message boards on parenting forums based in the United Kingdom (e.g., www.mumsnet.com or www.bounty.com) with an online link to complete the questionnaire via Survey Monkey. All participants were, however, based in the United Kingdom. Details were given for how to contact the researcher if needed.

Participants completing the questionnaire via paper or online copy were given a written debrief at the end of the questionnaire and given researcher details to contact if they wanted further information. Consent was given via tick boxes for both methods. All participants were given instruction to contact their relevant health professional if completing the questionnaire had raised any questions or issues with regard to caring for their baby.

Data collection

Mothers reported maternal demographic background (age, education, profession, marital status) and infant birth weight, gender, and age and answered a series of questions regarding infant feeding and sleep, including the following:

- Breastfeeding duration (initiation and then, if applicable, age of infant when breastfeeding was stopped, age of introduction to formula, and current frequency of formula use if still breastfeeding with response options of more than once a day, once a day, several times a week, once a week, rarely)
- Infant age in weeks when complementary foods were introduced
- How frequently their infant consumed solid meals or snacks per day
- How frequently their infant received milk feeds per day
- How frequently on average their infant woke in the night (night defined as between the hours of 8 p.m. and 6 a.m.)
- How frequently they gave their infants night feeds of milk or formula.

Data analysis

Data analyses were carried out using SPSS version 20 software (SPSS UK Ltd., Portsmouth, United Kingdom).

Initially mothers were considered to be breastfeeding if they were doing so partially or exclusively. However, if they were doing so partially, the decision was made to exclude them from the analysis if they offered supplementary formula several times a week or more as it would be unclear what milk they were giving at night. This removed 40 women from the analysis. Breastfeeding thus referred to exclusive breastfeeding.

Infant feeding method at birth (breast or formula), current breastfeeding (yes/no), and breastfeeding duration were calculated. Infant birth and current weight were converted to z scores.

Partial correlations explored association between frequency of night wakings and night feeds with age of introduction of solids, frequency of milk feeds, and frequency of solid feeds, controlling for infant age and birth weight and maternal age and education.

Multivariate analyses of variance were used to examine differences in frequency of night wakings and night feedings by current breastfeeding status (yes/no).

TABLE 1. SAMPLE DISTRIBUTION BY MATERNAL DEMOGRAPHIC FACTORS

Indicator, group	n	%
Age (years)		
≤ 19	22	3.3
20–24	90	13.6
25–29	278	42.1
30–34	194	29.4
≥ 35	76	11.5
Education		
School	113	17.1
College	174	26.4
Higher	373	56.5
Marital status		
Married	457	69.2
Cohabiting	170	25.8
Single	26	4.0
Home		
Owned	425	64.5
Rented	183	28.3
Council	33	4.5
Other	14	2.7
Maternal occupation		
Professional and managerial	267	40.5
Skilled	116	17.6
Unskilled	185	28.0
Other	48	7.3

Results

Seven hundred fifteen mothers completed the study. The mean age was 28.98 (standard deviation [SD], 5.21) years (range, 18–45 years), and the mean number of years of education was 14.26 (SD, 2.07). Of the mothers, 69.23% were primiparous. Mean age of the infant was 35.23 (SD, 11.59) weeks (range, 26–52 months). Further demographic details are given in Table 1.

Night wakings and night feeds

The mean number of times infants woke in the night was 1.76 (SD, 1.55), and the mean number of night feeds was 1.40 (SD, 1.53) for the sample as a whole. Of the sample, 21.4% did not wake at all, and 39.6% did not feed at all. For both waking and feeding the frequency ranged from zero to seven occurrences, with the most common occurrence being one or two for both waking (53.4%) and feeding (39.7%). Overall, both night wakings ($r = -0.171$, $p = 0.000$) and night feeds ($r = -0.254$, $p = 0.000$) decreased with infant age (Table 2).

There was no significant difference in either night wakings ($t_{713} = 0.810$, $p = 0.418$) or night feeds ($t_{713} = 1.62$, $p = 0.105$) for infant gender. Similarly, partial correlations showed no significant association between night wakings ($r = -0.022$, $p = 0.271$) or night feeds ($r = -0.039$, $p = 0.144$) for infant current weight.

Milk feeding

An estimate of the number of milk feeds (breast or formula milk) given during the day was given. A mean number of 5.11 (SD, 2.10) feeds was given, with a range from one to nine. Of

TABLE 2. FREQUENCY OF INFANTS EXPERIENCING NIGHT WAKINGS AND NIGHT FEEDS

Frequency	Night wakings	Night feeds
None	160 (21.1%)	309 (40.9%)
One	218 (28.8%)	144 (19.0%)
Two	185 (24.5%)	151 (20.0%)
Three	97 (12.8%)	85 (11.2%)
Four	50 (6.6%)	37 (4.9%)
Five	25 (3.3%)	10 (1.3%)
Six	14 (1.9%)	12 (1.6%)
Seven	7 (0.9%)	8 (1.1%)

the mothers, 51.9% gave three to five feeds per day. Feeds decreased with age ($r = -0.307$, $p = 0.000$).

Frequency of milk feeds (breast or formula) during the day was not associated with frequency of night feeds ($r = 0.054$, $p = 0.153$) or night wakings (Pearson's $r = 0.055$, $p = 0.14$).

Participants indicated current milk feeding status. Two hundred twenty-two mothers (31.0%) were breastfeeding, whereas 493 (69.0%) were not. Mothers who were breastfeeding gave significantly more day time feeds compared with those formula feeding independently of infant age ($F_{1, 707} = 34.28$, $p = 0.000$). Breastfeeding mothers gave an average of 5.72 feeds (SD, 2.19) compared with 4.84 (SD, 1.99) for formula-feeding mothers.

However, there was no significant difference in night wakings ($F_{1, 711} = 0.931$, $p = 0.335$) or night feeds ($F_{1, 711} = 0.434$, $p = 0.510$) between those currently breastfeeding or not, independently of infant age (Table 3).

Complementary feeding

Timing of introduction to solid foods ranged from 8 to 32 weeks (mean, 21.16; SD, 2.55). No significant association was found between age of introduction to solids and current night wakings ($r = 0.06$, $p = 0.141$). However, the older an infant was when he or she was introduced to solid foods, the more likely he or she was to feed in the night ($r = 0.095$, $p = 0.011$) (both independent of infant age).

Participants estimated number of times infants received complementary food meals during the day. The mean number of meals/snacks per day ranged from one to seven times. The majority of mothers gave two (27.0%), three (35.4%), or four (24.9%) meals, with a minority giving five to seven meals (4.0%), and 8.1% giving only one meal.

Number of complementary meals per day was not significantly associated with number of night wakings ($r = -0.054$, $p = 0.153$) but was significantly inversely associated with number of night feeds ($r = -0.147$, $p = 0.000$). The fewer solid meals the infant received, more night feeds were reported.

Total intake

Number of complementary feeds and milk feeds during the day were added together to give a total number of daytime feeds. Frequency ranged from 4 (2.0%) to 13 (1.7%) with a mean intake of 8.02 (SD, 2.12) feeds a day. Most mothers gave seven to nine feeds a day (50.0%).

Again, no significant association was seen between number of daytime feeds and night wakings ($r = -0.054$, $p = 0.153$),

TABLE 3. DIFFERENCES IN NIGHT WAKING AND NIGHT FEEDS FOR INFANTS CURRENTLY BREASTFED OR FORMULA FED BY INFANT AGE IN MONTHS

Age (months), statistics	Night waking			Night feeds		
	Whole sample	Breastfed	Not breastfed	Whole sample	Breastfed	Not breastfed
6 (n=120) F, p	2.06 (1.72)	1.94 (1.92)	2.12 (1.68)	1.80 (1.79)	1.75 (1.99)	1.86 (1.76)
		$F_{118}=1.24, p=0.405$			$F_{118}=0.556, p=0.163$	
7 (n=115) F, p	2.05 (1.76)	2.35 (1.76)	1.88 (1.72)	1.72 (1.80)	2.00 (1.78)	1.56 (1.77)
		$F_{113}=2.25, p=0.136$			$F_{113}=1.86, p=0.175$	
8 (n=128) F, p	1.59 (1.34)	1.11 (1.40)	1.71 (1.26)	1.11 (1.25)	1.09 (1.40)	1.12 (1.17)
		$F_{126}=4.31, p=0.041^a$			$F_{126}=0.014, p=0.905$	
9 (n=93) F, p	1.66 (1.26)	1.50 (1.17)	1.72 (1.29)	1.16 (1.23)	0.96 (0.91)	1.23 (1.33)
		$F_{91}=0.598, p=0.441$			$F_{91}=0.909, p=0.343$	
10 (n=85) F, p	1.47 (1.21)	1.51 (1.15)	1.45 (1.26)	1.01 (1.16)	1.11 (1.10)	0.94 (1.20)
		$F_{83}=0.077, p=0.783$			$F_{83}=0.462, p=0.499$	
11 (n=110) F, p	1.32 (1.10)	1.29 (1.08)	1.34 (1.21)	0.89 (1.07)	0.64 (1.00)	0.96 (1.09)
		$F_{108}=0.934, p=0.338$			$F_{108}=1.24, p=0.415$	
12 (n=105) F, p	1.31 (1.64)	1.27 (1.41)	1.35 (1.03)	0.60 (0.97)	0.57 (1.07)	0.63 (0.96)
		$F_{103}=0.593, p=0.445$			$F_{103}=0.046, p=0.831$	

^a $p < 0.05$ indicates a significant difference.

but number of daytime feeds was significantly negatively associated with more frequent night feeds ($r = -0.147, p = 0.000$).

Discussion

This article explored infant patterns of night waking and night feeding during the second 6 months postpartum. It showed that despite common beliefs that infants “should” be sleeping through the night and not receiving night feeds, nearly three-quarters of infants in this age range frequently woke at least once during the night, with over half receiving at least one nighttime feed. Moreover, the data showed that breastfeeding, complementary feeding, and infant weight were not associated with frequency of night waking, although an association with infant night feeding was found for lower frequency of intake.

The first issue raised by the findings is the issue of infant sleep. The data clearly showed that it is common for infants to wake and feed during the night in the second 6 months postpartum. Understanding normal patterns of sleep and waking for infants is important to supporting new mothers. Considerable pressure is put on mothers to have a “good” baby who sleeps well and is seen to be contented. One study found that infant night waking is associated with postnatal depression.⁴² Although a large variance of this is likely to be due to exhaustion, it is also possible that perceptions of “failure” are contributing to postnatal depression symptomatology. These views may be exacerbated by the attitudes of others who believe that the infant should be sleeping and not waking. Greater awareness is needed of the normality of infant night waking and feeding so that expectations, understanding, and support for new mothers can be greater.

Second, the findings challenge assumptions that breastfeeding is associated with more frequent night wakings.^{43,44} Breastfed infants did feed more frequently during the night than formula-fed infants, but they did not wake more. Formula-fed infants continued to wake but were not fed. The study did not measure total sleep time, but previous work has

shown that mothers of breastfed infants get more sleep than those of formula-fed infants overall,³⁴ particularly if they co-sleep.⁴⁵ This may be because feeding the infant soothes him or her back to sleep in a relatively quick period of time compared with settling an infant without a feed. Feeding is not simply nutrition for an infant; suckling is a natural act of comfort,⁹ and breastfed babies in particular will spend more time in sucking pauses where they are not consuming milk, but comforting themselves.⁴⁶

The findings also challenge the preconception that complementary foods will aid an infant to sleep through the exploration of reasons for introducing solid foods.^{36,37} Again, intake of solids did not affect night wakings, but it did affect whether the infant received a night feed: infants who consumed less in the day were more likely to have a night feed. This relationship also emerged for number of milk feeds in the day: infants who had more frequent feeds during the day did feed less at night, but it did not stop them waking. Moreover, later solid introduction was associated with more night feeding but not night waking (potentially due to having less solids in the day due to shorter experience). Due to the correlational relationship, it is not possible to be clear as to the relationship between this. “Filling an infant up” in the day with milk or solids may prevent night feeds due to lower hunger. However, it does not appear to prevent night waking, so a likely explanation is that mothers may be less likely to offer an infant a feed at night if he or she has consumed more during the day. Infants continue to wake for reasons unrelated to hunger, and there is a risk that encouraging an infant to consume more during the day, against his or her natural appetite, may increase risk of the infant becoming overweight as he or she becomes less skilled at regulating intake according to need.^{47,48}

The findings have important implications for health professionals and those working to support new mothers. First, the normality of infant night waking and feeding needs to be more clearly publicized. Poor infant sleep is associated with increased risk of postnatal depression^{49–51} and parenting stress.⁵² Sleep deprivation may play a role in this, but it is also

possible that mothers may perceive themselves to be a failure if their infant is not sleeping through the night. Moreover, mothers who feel out of control and unsure of their parenting are more likely to experience depression.⁵³ Understanding the normality of such nighttime behavior may help increase maternal confidence and self-esteem.

Linked to this, understanding that many infants wake frequently in the night may alter maternal behavior. A belief that an infant “should” be sleeping may lead the mother to feel that she must sleep train her infant. Allowing an infant to cry for long periods of time may negatively affect infant cortisol response²⁰ and brain development.⁵⁴ Moreover, given the findings that night wakings may be protective against sudden infant death syndrome,¹¹ the protective nature of night wakings needs to be emphasized. Mothers may choose not to sleep train if they were more aware of the normality of infant behavior.

There are important implications for infant feeding too. Stopping breastfeeding and an early introduction of complementary foods are both associated with a belief that this action will increase nighttime sleep and lead to more settled infant behavior. These data suggest that these relationships do not hold true. A breastfed infant or one who consumes less solid food may feed more frequently at night, but he or she is likely to continue to wake. Encouraging mothers to stop breastfeeding and increase solid intake could be detrimental to infant health with no clear benefit. An early introduction of solid foods is associated with poorer infant health outcomes⁵⁵ and overweight,⁵⁶ while continued breastfeeding is recommended throughout the second year and beyond by the World Health Organization.⁵⁷ Pressuring an infant to consume solids foods may break down the natural ability of an infant to regulate his or her appetite, leading to potential overweight.⁵⁸

Care must be taken with the interpretation of the findings that the more solids an infant receives in the day, then the fewer feeds he or she has at night. They must not be taken to mean that giving more food in the day will prevent night feedings, especially given that infants will likely continue to wake. It is likely that night wakings are as big an issue for new parents as night feedings are, as they still have to settle an infant without the aid of milk. There is a risk that if these findings are misinterpreted, parents will try and overfeed their infant in the day—and still have an infant who wakes at night.

The research does have its limitations. Participants were self-selecting. Mothers were older and more educated with a higher percentage of professional occupations than average.⁵⁹ The proportion of mothers who delayed solids until 6 months postpartum was higher than the U.K. average, as were levels of breastfeeding,⁶⁰ suggesting that mothers more interested in infant feeding practices may have taken part. However, a range of demographic groups was included. Care should be taken, however, in generalizing to a wider population.

Recruitment also used online methods of data collection. Although this method is now popular in health and social science research (e.g., Alcade,⁶¹ Hamilton et al.,⁶² and Ferguson and Hansen⁶³), it may lead to a bias toward older, more educated, proactive participants.⁶⁴ However, pregnant and new mothers are a well-known user group of Internet forums.⁶⁵ Use tends to be inclusive of demographic groups⁶⁶ and allows cost-effective access to a targeted sample.⁶⁷

Data were also self-reported and based on average estimations of sleep and feeding. It is also recognized that intake

of energy can only be approximated from frequency of feeds with the assumption that more feeds/meals equate to greater energy intake. Particularly for breastfeeding intake, this may not be the case. However, this was not the main variable analyzed. Nighttime was also defined as from 8 p.m. to 6 a.m. (as per previous studies such as Elias et al.⁸) as this is a typical sleep period for infants this age. However, it is recognized that some parents may not put an infant to sleep until later.

Limitations aside, these findings are of interest because they both highlight the normality of infant night waking at 6–12 months of age and illustrate that waking appears unrelated to night feedings. Breastfeeding should not be stopped, or solid intake increased, in a belief that it will improve infant sleep. Instead, more support is needed for mothers at this time to help them deal with their infants’ night waking, outside of recommendation to alter diet.

Disclosure Statement

No competing financial interests exist.

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