

The relationship of sleep problems and sleep-associated feeding to nursing caries

Shachi D. Shantinath, DDS, MPH David Breiger, PhD Bryan J. Williams, DDS, MSD
Joseph E. Hasazi, PhD

Abstract

The purpose of this study was to examine the role of sleep problems in the etiology of nursing caries. Two-hundred mothers of children (104 with nursing caries and 96 caries free) from ages 2 to 4.5 years were surveyed to determine whether difficulty with child sleep and ensuing sleep-associated feeding might be related to the presence of nursing caries. Differences were noted between these two groups regarding: average number of nights the child slept through the night ($P < 0.001$); total hours of sleep per night ($P < 0.05$); frequency of night waking episodes ($P < 0.01$); feeding on demand upon waking ($P < 0.01$); using a bottle to assist with falling asleep at night ($P < 0.001$); and feeding in association with nap time ($P < 0.001$). Differences also were noted in regard to average age of weaning ($P < 0.001$). Our findings suggest that sleep problems among young children are a behavioral risk factor for night-time bottle use and early childhood caries. (Pediatr Dent 18:375-78, 1996)

Nursing caries is a term that refers to a particular pattern of dental caries observed in late infancy and early childhood. Within the United States, prevalence rates vary and are alarmingly high among minority populations. Kelly and Breurd¹ found that the disease affected 53% of Native American children enrolled in Head Start programs in Alaska and Oklahoma. Another study² of Native American children found that 72% of Navajo children examined in Arizona and 55% of Cherokee children examined in Oklahoma exhibited signs of nursing caries. A study of Mexican-American migrant farm workers in Washington³ found a disease prevalence of approximately 30%. Even within fluoridated communities, the prevalence of nursing caries has been found to be as high as 11% among children enrolled in Head Start programs.⁴

Ample evidence implicates behavioral factors such as prolonged bottle or breast feeding, feeding associated with bedtime, and use of cariogenic liquids (e.g., milk, juice, or formula) in the development of this dis-

ease,⁵⁻⁷ but relatively little is known about the circumstances under which such feeding behaviors might arise. Many health care providers view nursing caries as something that could be eliminated if parents would wean in a timely manner. While most efforts to reduce the incidence of nursing caries have sought to educate parents and other caretakers about the adverse consequences of inappropriate feeding, the focus of this counseling is usually along the lines of telling parents to stop bottle use and to substitute water for milk or juice if the child is unwilling to give up the bottle. Such an approach does not take into consideration the behavioral difficulties families may encounter when asked to abruptly change their own and their child's habits. Furthermore, while this may be effective for some families, it does not address the range of psychological and social differences that have a bearing upon feeding practices.

Since nursing caries is a problem linked to feeding, the contribution of parenting practices and psychosocial factors seem to be an important area for research. To date, a limited number of studies have examined the role of psychosocial factors in the etiology of nursing caries. These studies have found children with nursing caries to have parents with lower education levels,⁵ who were less likely to have attended college and more likely to be pessimistic about their own dental health.⁶ A study of migrant farm workers in Washington noted that certain temperamental factors distinguished children with nursing caries from children without: those with nursing caries were viewed as reacting strongly in a disagreeable situation and more likely to harass their caregivers than nondiseased children.³ Marino et al.⁹ noted that children with nursing caries were more likely to have sleep difficulties and a strong temper than were children without dental disease. This study, combined with clinical observations and parents' reports, suggests the need for more in-depth examination of the association between sleep problems and nursing caries.

Although it is common for parents of toddlers to report problems with their child's sleep, prevalence data are limited for this population. Richman¹⁰ examined the prevalence of child sleep problems in a community sample of families in a London borough and found that in a sample of children 1–2 years of age, 24% woke two to four nights per week and an additional 20% woke five to seven nights per week. Johnson¹¹ conducted a survey of parents in the United States and found that among children 12–35 months of age, 42% resisted going to bed and 35% awoke and cried during the night. His observations of sleep management strategies lend support to our view that bottle use may be associated with sleep management in toddlers, which in turn, is a contributory factor in the etiology of nursing caries.

The purpose of this study was to examine the role of child sleep problems in the initiation and maintenance of sleep-associated feeding, particularly as it relates to nursing caries. We sought to examine differences in sleep habits and associated feeding practices between children with and without nursing caries. We hypothesized that mothers of children with nursing caries would be more likely to report problems with night waking, more likely to use feeding as a means of managing sleep problems, and that their children would be more likely to be weaned later than those in the comparison group.

Methods

This study used a retrospective design to look at differences in child sleep and associated management strategies among children with and without nursing caries. Participants were chosen from among mothers of children who presented for dental care at a primary care facility in a low-income neighborhood in Seattle.

Children ages 2–4 1/2 years were examined by staff dentists who identified a child as having nursing caries or being caries free. Children who were found to have carious involvement of one or more maxillary anterior teeth, were assigned to the nursing caries group. Children were assigned to the comparison group if their maxillary teeth were caries free. This classification is consistent with what has been described in the literature.^{6,8} Additionally, the mothers had to be able to read and understand English in order to answer a set of questionnaires.

The questionnaires administered to the mothers covered their child's sleep habits, feeding practices, and other psychosocial variables. An instrument was created for this study, since there is no standardized instrument to evaluate child sleep among toddlers, and was based (with permission) upon two questionnaires used in recent studies of toddler sleep management.^{11,12} We sought to address differences in sleep management strategies and their relative frequency of use.

Mothers were asked to choose from among 17 sleep management strategies and to indicate the frequency of use on a three-point scale corresponding to never, sometimes, and often. Choices consisted of a variety of management techniques including various forms of sleep-associated feeding behaviors, and nonfood related approaches such as bringing the child into the parent's bed, rocking the child, allowing the child to cry it out, or using white noise. Additionally, we added questions to assess the nature and frequency of sleep problems. This questionnaire was pilot tested on 15 mothers and revised after feedback.

Because there is no standardized instrument to assess feeding practices, particularly as they relate to nursing caries, a questionnaire was developed for use in this study with items based upon variables that have been identified so far in the literature such as age of weaning and method of bottle use.

Results

Two-hundred mothers (104 in the caries group and 96 in the comparison group) participated in the study. No significant differences were noted with regard to demographic variables between the two groups, and results are summarized in Table 1. The distribution of ethnicity reflects the composition of the clinic's catchment area, excluding those who require an interpreter during a dental visit.

TABLE 1. DEMOGRAPHICS OF SAMPLE

Category	Mean Age	
Children in disease group	38.24 ± 10.6 months	
Children in comparison group	38.65 ± 9.1 months	
Mothers in both groups combined	28.2 ± 6.7 years	
Fathers in both groups combined	31.1 ± 8.2 years	
<i>Parental Educational Level</i>	<i>Mothers</i>	<i>Fathers</i>
Not completed high school	17.0%	16.5%
Completed high school	30.0%	34.0%
Postsecondary education (includes technical school)	51.0%	32.0%
<i>Ethnicity</i>	<i>%</i>	
African American	62.5%	
European American	18.0%	
Asian American	6.5%	
Native American	5.0%	
Latino/Hispanic	3.5%	
Mixed ethnicity	4.0%	

Analyses of variance (ANOVA) were conducted to determine differences between groups in regard to sleeping patterns, reports of sleep problems, method of management of sleep problems, and feeding and weaning habits. Results are summarized in Table 2. An examination of sleep patterns revealed that children in the caries group were reported to have a greater number of night waking episodes (comparison group 0.7

TABLE 2. SLEEP PATTERNS, SLEEP MANAGEMENT STRATEGIES, AND FEEDING AND WEANING PRACTICES

<i>Sleep Patterns</i>	<i>F</i>	<i>DF</i>	<i>Significance</i>
Night waking episodes	9.3	1,196	†
Hours of sleep per night	7.1	1,194	•
Days of week slept through the night	13.2	1,190	‡
<i>Sleep Management Strategies</i>			
Feeding to help fall asleep	15.2	1,197	‡
Feed on demand in response to crying or night waking	9.6	1,198	†
Feeding in association with naptime	12.6	1,197	‡
<i>Feeding and Weaning Practices</i>			
Age of weaning from bottle	25.9 (χ^2)	1,177	‡
Juice in bottle during day-time	7.8		†
Formula in bottle at night-time	10.7		†
Child held bottle while falling asleep (propping)	18.8		‡

* $P < 0.05$. † $P < 0.01$. ‡ $P < 0.001$.

versus caries group 1.15) and had, on average fewer hours of sleep per night (comparison group 9.6 versus caries group 9.0). It was also found that children in the comparison group slept through the night an average of almost one day more per week than did children in the caries group (6.5 versus 5.6, respectively).

An examination of sleep management strategies revealed that the two groups differed most in terms of the use of feeding to assist with sleep. Mothers in the caries group were significantly more likely to have fed the child on demand in response to crying or waking, given a bottle to help the child fall asleep at night, and fed in association with nap time.

Differences also were noted with respect to feeding and weaning practices, with the average age of weaning being 6 months earlier for the comparison group than for the caries group (comparison group: 14.5 versus caries group: 21.1). Chi-square analyses were performed to determine differences in bottle content between the two groups. A higher percentage of the mothers in the caries group reported using juice in a bottle during the day and milk or formula at night. Children in the caries group also were more likely to have been allowed to fall asleep holding a bottle in their hand (i.e. "bottle propping"). However there were no differences between groups regarding reports of an adult routinely holding a bottle for the child while falling asleep.

Discussion

This study compared children with and without nursing caries in regard to behavioral and parenting variables. As hypothesized, children with nursing caries were found to demonstrate more sleep problems

than children in the comparison group. Specifically, children with nursing caries were reported by their mothers to sleep fewer hours per night and to sleep through the night without awakening less often than children without nursing caries. In addition, the mothers of children in the caries group reported that they used bottle feeding as a method of addressing sleep problems more often than did the mothers of children in the comparison group, even though they otherwise did not differ in the use of other sleep management strategies.

The picture of the child with nursing caries that emerges from these findings is one of a child with increased sleep problems who is more likely to be fed as a means of addressing these problems. As such, our findings have implications for understanding of the etiology of nursing caries and its prevention, and the findings lend support to a broader model of caries etiology that includes behavioral factors. While bacteria and substrates play a role in caries etiology, our study suggests a means by which the cariogenic substrate, essential for caries development, is introduced

into the oral environment. We were able to demonstrate that in this population, the presence of sleep problems is related to the use of sleep-associated feeding as a means of sleep management.

While a difference of half an hour more of sleep per night or one additional night of sleep per week may not appear to be significant, it can be for parents who are faced with a multitude of demands associated with parenting. Interestingly, there were no differences between the groups for the use of sleep management strategies not associated with food. This may suggest that parents turn to feeding to help their child because it is easily implemented and/or is effective in achieving the desired goals.

One effective means of dealing with a child's sleep refusal and/or night waking is allowing the child to cry it out. However, this technique — usually learned by parents either from their child's health care provider or from books — is not considered to be common knowledge and requires some degree of patience and trust. In contrast, feeding seems to be an appealing means of dealing with a child's sleep problems. A parent may have serendipitously come upon feeding as a means of addressing a recurring sleep problem or may even intentionally choose feeding as a means of sleep management because of its calming effect in other settings. This may also serve to explain why some parents choose to feed a young child at bedtime, despite being aware of the possible hazards to their child's dentition.

Given the pervasiveness of sleep problems within the toddler population,^{10, 11} further research is warranted to examine the relationship between the ways parents manage their child's sleep problems and the

potentially negative oral outcomes of these methods. Although the methodology used in our study is a well-established means of making causal inferences about a disease, there are some potential limitations to this approach. While the tendency for parents to provide socially desirable answers was minimized through the use of questionnaires (as opposed to in-person interviews), their answers may be subjected to recall bias when asked to recollect past events. Because of the cross-sectional nature of this study, it is conceivable that a child who is caries free now could eventually develop caries. There is also the possibility that for a few of the children, caries preceded attempts to pacify the child by use of feeding. This study is a first step toward understanding the relationship between sleep problems and nursing caries. Subsequent investigations of this association might use a prospective, longitudinal design to more clearly address the problem of recall bias and temporality. We also recognize that parenting behaviors can be influenced by cultural norms which, in turn, impact a child's sleep and feeding. Further research is needed to extend and replicate these findings across different cultures and to assess the varying contributions of psychological and cultural factors in influencing caries risk.

The etiology of caries in early childhood is multifactorial. Our findings suggest that timely parent training in sleep management, before the establishment of bedtime routines or the onset of sleep problems might be an avenue to consider in preventing early childhood caries. In addition to pediatric dentists, other health care providers who come in contact with infants and young children need to be alerted to the oral health benefits that might come about as a result of timely screening of sleep problems among their patients.

Conclusions

Using a retrospective design, this study noted the following among children with and without nursing caries:

1. Differences in reports of sleep problems, with children in the caries group exhibiting on average, greater frequency of night waking and fewer hours of sleep per night.
2. Differences in the frequency of bottle feeding as a means of managing child sleep problems, with children in the caries group being managed in this manner more often than were children in the control group.

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Reprint requests to: J. Hasazi, PhD, Department of Psychology, Dewey Hall, UVM, Burlington, VT 05405.

Dr. Shantinath is a doctoral candidate in clinical psychology, department of psychology, University of Vermont; at the time of this study, she was also a senior fellow, department of dental public health sciences, University of Washington, Seattle. Dr. Breiger is director of the psychological assessment service, Children's Hospital and Medical Center, Seattle. Dr. Williams is director, department of dental medicine, Children's Hospital and Medical Center, Seattle. Dr. Hasazi is associate professor and director of clinical training, department of psychology, University of Vermont, Burlington.

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