

Associations of pacifier use, digit sucking, and child care attendance with cessation of breastfeeding

Steven M. Levy, DDS, MPH; Susan L. Slager, PhD; John J. Warren, DDS, MS; Barcey T. Levy, PhD, MD; Arthur J. Nowak, DMD, MA

Iowa City, Iowa

From The University of Iowa Colleges of Dentistry, (S.M.L., S.L.S., J.J.W., A.J.N.), Public Health (S.M.L.), and Medicine (B.T.L.), Iowa City. Earlier versions of this paper were presented at the 1997 annual meetings of the International Association for Dental Research and the American Association of Public Health Dentistry. The authors report no competing interests.

- **OBJECTIVE:** Breast milk is the recommended method of nutrition for newborns and infants. Several studies have investigated factors associated with the cessation of breastfeeding. This study assessed the associations between pacifier use, digit sucking, child care attendance, and breastfeeding cessation among 1387 infants in the Iowa Fluoride Study.
- **STUDY DESIGN:** This was a longitudinal questionnaire survey. Mothers completed mailed questionnaires sent at age 6 weeks, 3 months, and 6 months.
- **POPULATION:** Parents were recruited postpartum at 8 Iowa hospitals.
- **OUTCOMES MEASURED:** Survival analysis (using Cox proportional hazards model) assessed the time covariate effects of pacifier use, digit sucking, and child care attendance on cessation of breastfeeding, while adjusting for other possible confounding variables (not planning to breastfeed, maternal smoking, infants' sex and antibiotic use, maternal and paternal age and education, and income group).
- **RESULTS:** Percentages of women who did any breastfeeding were 46%, 36%, and 27%, at 6 weeks, 3 months, and 6 months, respectively. Percentages using pacifiers were 81%, 71%, and 59%. Combinations of pacifier use and digit sucking for various levels of child care had statistically significant associations with cessation of breastfeeding, with the effect being strongest for pacifier users and digit suckers with no child care days (hazard ratio = 1.88; 95% CI, 1.36-2.62).
- **CONCLUSIONS:** Pacifier use and digit sucking were associated with cessation of breastfeeding, with results dependent on the level of child care attendance. The strongest associations were found for those not attending child care and for combined use of pacifier with digit sucking.

key words Non-nutritive sucking; breastfeeding; childcare; pacifier use; digit sucking. (J Fam Pract 2002; 51:465)

Breastfeeding is associated with lower rates of infant mortality and morbidity,¹⁻⁶ a reduced rate of sudden infant death syndrome (SIDS),^{7,8} delayed resumption of fertility,⁹ and reduced health care cost.^{10,11} The American Academy of Family Physicians has issued a policy statement supporting breastfeeding as the optimal form of nutrition for infants¹²

and the American Academy of Pediatrics recommends that infants should be breastfed for at least 12 months.¹³ Therefore, it is important to understand the factors associated with reduced breastfeeding. In previous studies, the factors associated with reduced breastfeeding included maternal employment,¹⁴ child care attendance,¹⁵ maternal smoking,^{14,16,17} and demographic factors.^{16,18,19}

Several recent studies have also identified an association between non-nutritive sucking (eg, pacifiers) and reduced breastfeeding²⁰⁻³⁵ that is consistent with the World Health Organization (and UNICEF) recommendation that pacifiers not be used by breastfeeding infants.³⁶ Cross-sectional investigations in Sweden,²⁰⁻²² Brazil,²³ New Zealand,²⁴ England,²⁵ Greece,²⁶ and Sweden and Norway²⁷ found strong associations between pacifier use and reduced breastfeeding (either less exclusive breastfeeding, shorter duration of breastfeeding, or breastfeeding problems), with only one²⁶ not reporting statistically significant findings.

Of particular interest were several longitudinal studies in Brazil (2 studies), Sweden, Italy, and the United States. In Brazil, one found that pacifier users had an adjusted relative risk of 2.87 for weaning,²⁸ and the other an adjusted odds ratio of 2.5 for the cessation of breastfeeding associated with pacifier use.²⁹

Hörnell and colleagues³⁰ and Aarts and colleagues³¹ reported longitudinal data from 506 mothers' daily infant feeding practices in Uppsala, Sweden. All mothers had at least one previous child breastfed at least 4 months and were planning to breastfeed the study child for at least 6 months. Thumb sucking was not associated with the breastfeeding pattern, but infants using a pacifier frequently had approximately 1 less breastfeeding session and 15 minutes to 30 minutes less total breastfeeding time per day than those not using a pacifier at 2, 4, 8, and 12-week follow-up points. Cross-sectional and survival analyses of breastfeeding at 4 months compared with non-nutritive sucking at 1 month showed no significant relationship with thumb sucking, but a significant relationship with pacifier use, with increasing frequency of pacifier use related to a decline in breastfeeding duration. Riva and coworkers³² studied 1601 women in Italy and showed that pacifier use was associated with an elevated hazard ratio of 1.18 (95% confidence interval [CI], 1.04-1.34) for breastfeeding cessation in adjusted analyses.

In the only published US study, Howard and colleagues³³ reported on the effects of early pacifier use on breastfeeding duration among 265 infants in the Rochester, New York area on the basis of maternal telephone interviews at 2, 6, 12, and 24 weeks and every 90 days thereafter until the breastfeeding ended. Results were adjusted for factors such as maternal age, breastfeeding goals, and plans to work. Pacifier introduction by 6 weeks was significantly associated with shortened duration of some breastfeeding (hazard ratio [HR] = 1.61; 95% CI, 1.19-2.19; P = .002), as was a plan to return to work (HR = 1.42). Digit sucking was not examined and interactions were not assessed.

We found only one prospective study³¹ that considered the effects of both pacifier and digit sucking, and one study that considered the effects of pacifier and plans to return to work³³ on breastfeeding duration. However, no studies simultaneously looked at the effects of maternal employment or child care, pacifier use, digit sucking, and any potential interactions, although they have been shown to be individually associated with cessation of breastfeeding. Thus, the purpose of this study was to assess the associations of non-nutritive sucking (pacifiers and fingers) with cessation of breastfeeding, while considering child care attendance, from birth to age 6 months, using a longitudinal study design in a sample of children in the United States.

■ METHODS

The data were collected as part of a larger, prospective study of a birth cohort assessing fluoride exposures longitudinally and relationships with dental caries and dental fluorosis.^{16,37-43} Mothers were recruited at the time of their infants' births at 8 hospitals in eastern Iowa from March 1992 to February 1995, using appropriate informed consent procedures approved by the Institutional Review Board. The recruitment questionnaire assessed household smoking patterns during pregnancy, whether women planned to breastfeed, and other demographic factors.

Information regarding infants' weight, feeding practices (breastfeeding vs bottle-feeding), non-nutritive sucking (pacifier use and sucking thumb or fingers), child care attendance (number of full or half days), maternal smoking, otitis media experience, and antibiotic use was collected by mailed questionnaire sent at 6 weeks, 3 months, and 6 months of age.

Each questionnaire concerned the preceding time period. Nonrespondents received follow-up mailings after 3 weeks and telephone follow-up after 6 weeks. Direct validation of responses was not conducted, but subjects were contacted by mail or telephone, when necessary, to clarify or correct responses. Data were double-entered and verified.

Breastfeeding and bottle-feeding practices for each period were summarized in 3 ways: (1) exclusive breastfeeding, (2) any breastfeeding, and (3) mostly bottle-feeding (defined as at least 75% of estimated total calories based on body weight from formula, milk, or juice). These definitions generally correspond to those proposed by Labbok and Krasovec⁴⁴ of full, almost exclusive breastfeeding, and low, partial breastfeeding, respectively.

Time until cessation of all breastfeeding was modeled using the Cox proportional hazard regression model⁴⁵ against 3 main factors of interest: pacifier use (yes/no), digit sucking (yes/no), and child care attendance (total number of child care days). Since no information was collected regarding maternal employment, we considered child care attendance as a proxy. Pacifier use and digit sucking were coded “yes” if the child started using the pacifier or sucking on the digit, respectively, any time during the first 6 weeks of life. Main effects, 2-way interactions among these variables, and nonlinear effects of child care days were tested while adjusting for maternal and paternal age and education, family income, breastfeeding plans, maternal smoking, infant’s sex, and infant antibiotic use. We used the likelihood ratio test to assess significance at an alpha level of 0.05, and the statistical analyses were conducted using PROC PHREG in SAS software.⁴⁶

■ RESULTS

The number of mothers who were successfully recruited and who provided at least one subsequent completed questionnaire was 1387. There were 1236 (89%) respondents at 6 weeks, 1196 (86%) at 3 months, and 1048 (76%) at 6 months.

Table 1 summarizes the study sample at baseline recruitment. Approximately two thirds of mothers and fathers had at least some college education; 76% had family income of at least \$20,000; 95% were white; 43% of the infants were the mother’s first-born child; and 65% of the mothers said they were planning to breastfeed their infants.

Table 2 summarizes the breastfeeding practices of the cohort by presenting the percentages of infants at each time point with different feeding practices. Approximately 46% reported some breastfeeding on the 6-week questionnaire, declining to 36% at 3 months and 27% at 6 months. Only 16% of the infants were exclusively breastfed at 6 weeks, dropping to 1% by 6 months. A high percentage of infants were mostly bottle fed at each of the 3 corresponding time periods.

Table 2 also summarizes the patterns of non-nutritive sucking across the infant ages. A high percentage of the infants practiced some form of non-nutritive sucking during each period (86.3%, 92.0%, and 86.3% at 6 weeks, 3 months, and 6 months, respectively). From the 6-week to 6-month responses, pacifier use declined from 81% to 59%, while digit sucking increased from 50% to 83% and then declined to 76%. **Table 3** summarizes child care attendance during the 6 months, with half days and full days of child care added together. Thirty-four percent of the infants attended some child care, with approximately 12% receiving more than 25 full days of child care by the age of 6 months or the time of censor/failure, where censor in this case is loss to follow-up prior to reaching 6 months of age.

We next analyzed the data using Cox regression, an analysis method designed for longitudinal data on event times, such as time until death. The outcome variable was time until cessation of all breastfeeding. The median failure time (cessation) was 72 days (95% CI, 68-78) with interquartile range from 53 to 192 days. Seventy-four percent had ceased breastfeeding by 6 months and 26% were censored because of continued breastfeeding at 6 months when analysis ended or earlier loss to follow-up.

Table 4 reports the relative hazard ratios and 95% confidence intervals at various levels of child care, pacifier use, and digit sucking, while adjusting for the other potential confounders considered (see Methods section). The baseline category (or reference cell) is a child with no child care and no non-nutritive sucking. We see from **Table 4** that the estimated risk of breastfeeding cessation is the highest, with a value of 1.88 (95% CI, 1.36-2.62), for a child who sucks on both pacifier and digit at no child care days. This hazard ratio drops to 1.52 (95% CI, 1.03-2.25) at 15 child care days and then becomes nonsignificant at 30 and 60 child care days.

Our results in **Table 4** also show that pacifier use at zero child care days has a significant effect in that a child who sucks only on a pacifier has a 67% increase in the hazard of cessation of breastfeeding, compared with a child with no non-nutritive sucking. At higher levels of child care days, this effect changes and becomes a protective effect, although this effect was not significant at 15 child care days, was significant at 30 child care days, and was borderline significant at 60 child care days. Finally, the effect of digit sucking and child care by themselves tended not to be significant at the 0.05 level, with the one exception at 15 child care days where there is a significant effect of 1.41 (95% CI, 1.02-1.96).

■ DISCUSSION

Our findings concerning pacifiers are generally consistent with several recent studies that have demonstrated associations between pacifier use and reduced breastfeeding, including the few reported longitudinal studies. However, these other studies did not control for child care attendance. We found that the effect of pacifier use changed with increasing number of child care days. For example, in the absence of child care, children who sucked on a pacifier were about 1.7 times as likely to cease breastfeeding than children who did not use a pacifier. For 15 days to 60 days of child care, the hazard ratios were less than 1.0, with results statistically significant at only 30 days.

Furthermore, our analyses showed the joint effect of pacifier use and digit sucking at various child care days. We found a significant reduction in breastfeeding for children who use both pacifier and a digit by the age of 6 weeks. But this joint non-nutritive effect reduces to being nonsignificant with 30 or more child care days. Although we found that digit sucking and child care days by themselves had little effect on cessation of breastfeeding, it was important to consider them because these variables significantly interacted with pacifier use.

Our study found that for infants who did not attend child care, pacifier use significantly increased the odds of breastfeeding cessation, as did the combination of pacifier use and digit sucking. However, digit sucking with no pacifier use in the absence of child care did not increase the odds of breastfeeding cessation. In contrast, for infants who attended child care for 30 days in the first 6 months of life, pacifier use alone appeared to be somewhat protective in maintaining breastfeeding, while digit sucking, either alone or in combination with pacifier, increased the odds of breastfeeding cessation, with significance at 15 days. It is possible that pacifiers were used sparingly in child care, whereas digits were available and more widely used, so that non-nutritive sucking interference with breastfeeding was more strongly influenced by digit sucking. Alternatively, it is possible that mothers who placed their infants in child care early in life used pacifiers differently than mothers who did not. That is, for non-child care infants, pacifiers may have been part of a planned strategy to wean from breastfeeding, whereas for children in child care, pacifiers may have been part of a planned strategy to encourage sucking behavior and comfort children until the mother was available for breastfeeding. In such a scenario, digit sucking was less under parental control, particularly at child care, so that it may have interfered with breastfeeding despite parental planning or desires.

Limitations

There are several limitations when considering our study's findings. The study group was not a probability sample fully representative of a defined population. It was of generally high socioeconomic status and, representative of Iowa, had little minority inclusion. Respondents were more educated than nonrespondents.³⁹ Although response rates were generally favorable, approximately 100 to 300 did not respond at a given time point, resulting in censoring of 26% of the cases. Data on breastfeeding, sucking, childcare, and so forth were collected at 3 discrete time points and not on a more frequent, daily, weekly, or monthly basis. Although recall bias was limited by the short-term nature of recall with 6-week and 3-month intervals, it could have an effect on results. Since so few infants exclusively breastfed, any breastfeeding was the only suitable dependent variable. No maternal employment data were collected and quantification of pacifier use was not included.

Only our study and that of Howard and colleagues³³ reported results from the United States. The statistical analyses by Howard and colleagues concerning pacifier use adjusted for a number of factors, including plans to return to work, family and paternal preferences for breastfeeding, and breastfeeding goal. Our study adjusted for plans to breastfeed and

demographic factors while assessing the effects of pacifier use, digit sucking, and number of child care days. However, neither study specifically assessed reasons for use of the pacifier, in particular, in relation to work and child care requirements. So pacifiers could have been used to facilitate weaning, thus resulting in the association with reduced breastfeeding. Also, there may be other confounding differences between those using pacifiers and those who did not.

Although decisions by mothers to return to work, or for other reasons, have their infants attend child care were not generally associated with reductions in breastfeeding, our results suggest that child care has an important impact on determining the relationships between non-nutritive sucking behaviors and cessation of breastfeeding. It has been suggested that infants' abilities to easily and successfully breastfeed are adversely affected by non-nutritive sucking, resulting in reductions in the frequency and consistency of the breastfeeding sessions. Our data support the concept. However, it is important to acknowledge that decisions to stop breastfeeding (often prior to return to work) may have preceded and led to the increase in non-nutritive sucking, rather than sucking leading to cessation of breastfeeding. That is, after the decision has been made to stop breastfeeding, a pacifier may be introduced to ease the transition to bottle feeding.

Additional studies involving in-depth interviews concerning initial and subsequent breastfeeding, employment, and child care plans would be warranted to address this question further. In addition, more controlled studies to determine whether there is any biological relationship between non-nutritive sucking and breastfeeding difficulties are warranted. Clearly, the social, biological, and economic factors involved in decisions to initiate and cease breastfeeding are complex and will require more study, both in the United States and throughout the world.

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All correspondence should be addressed to Dr. Steven M. Levy, University of Iowa College of Dentistry, Department of Preventive & Community Dentistry, N329 Dental Science Building, Iowa City, IA 52242. E-mail: steven-levy@uiowa.edu

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