

Breastfeeding Patterns in Relation to Thumb Sucking and Pacifier Use

Clara Aarts, MSc; Agneta Hörnell; Elisabeth Kylberg, PhD; Yngve Hofvander, MD, PhD; and Mehari Gebre-Medhin, MD, MPH, PhD

ABSTRACT. *Objectives.* To analyze the influence of thumb sucking and pacifier use on breastfeeding patterns in exclusively breastfed infants, on the duration of exclusive breastfeeding, and on the total breastfeeding duration.

Study Design. Descriptive, longitudinal, prospective study.

Setting. The subjects were recruited from a population of 15 189 infants born in the maternity ward at the University Hospital, Uppsala, Sweden between May 1989 and December 1992.

Study Population. 506 mother–infant pairs.

Methods. Daily recordings by the mothers on infant feeding from the first week after delivery through the duration of the study. Fortnightly home visits with structured interviews by a research assistant.

Results. Pacifier use was associated with fewer feeds and shorter suckling duration per 24 hours, shorter duration of exclusive breastfeeding, and shorter total breastfeeding duration compared with no pacifier use. These associations were not found for thumb sucking. The possible negative effects of pacifiers on breastfeeding seemed to be related to the frequency of their use. Maternal age and education only slightly modified the association between pacifier use and breastfeeding duration.

Conclusions. More frequent use of a pacifier was associated with shorter breastfeeding duration, even among a group of mothers who were highly motivated to breastfeed. *Pediatrics* 1999;104(4). URL: [http://www.pediatrics.org/cgi/content/full/104/4/e50;breastfeeding duration, breastfeeding pattern, exclusive breastfeeding, pacifier use, thumb sucking](http://www.pediatrics.org/cgi/content/full/104/4/e50;breastfeeding%20duration,%20breastfeeding%20pattern,%20exclusive%20breastfeeding,%20pacifier%20use,%20thumb%20sucking).

ABBREVIATIONS. RR, relative risk; CI, confidence interval.

The sucking habits of infants are described in the literature as nutritive and nonnutritive sucking.¹ The present study focuses on nonnutritive sucking, ie, thumb sucking and sucking on a pacifier (dummy, comforter). The sucking reflex is present from an early age, and thumb sucking has been observed in the fetus from as early as 18 weeks

of gestational age.² Pacifiers or other sucking devices are given to infants to comfort and calm them in many societies.^{3–5} In a Swedish prospective longitudinal study of 212 children, born between 1955 and 1958, Klackenberg¹ found that practically all infants had the habit of nonnutritive sucking during their infant year. Great variations in nonnutritive sucking habits are seen in different cultures.^{6,7}

Nonnutritive sucking habits have been studied extensively in both social and medical sciences. Possible positive effects of pacifier use in the prevention of sudden infant death have been discussed, and it could be added that such an effect also has been questioned.^{8–10} Thumb sucking and pacifier use have been claimed by orthodontists to be related to dental malocclusion.¹¹ An increased prevalence of oral candida has been observed in infants using a pacifier.¹² Among 845 children in Finland, pacifier use was found to be associated with an increased risk for recurrent acute otitis media.¹³ It has been shown that the use of a pacifier in the early postpartum period, when the infant is learning to suck from the breast, may interfere with proper sucking and can contribute to so-called nipple confusion.^{14–17} Several studies have shown an association between pacifier use and shorter breastfeeding duration.^{3–5,14} These findings led to recommendations by the World Health Organization/United Nations Children Fund to avoid the use of pacifiers (step 9 of the “Ten Steps to Successful Breastfeeding,” as part of the Baby Friendly Hospitals Initiative).¹⁸

In a study of 650 mother–infant pairs in Brazil, Victora et al¹⁷ found an association between pacifier use and shorter breastfeeding duration but not among mothers who were comfortable with breastfeeding. To the best of our knowledge, this observation has not been verified in other studies or in other cultural settings.

The aim of the present study was to analyze the influence of thumb sucking and pacifier use on the breastfeeding pattern (ie, breastfeeding frequency, suckling duration, and longest interval between two consecutive feeds) in exclusively breastfed infants. We also analyzed the influence of thumb sucking and pacifier use on the duration of exclusive breastfeeding and on the total breastfeeding duration among infants of mothers with breastfeeding experience who were motivated to breastfeed for ≥ 6 months.

METHODS

The present study was part of the comprehensive collaborative World Health Organization project, “a multicentre, longitudinal

From the Department of Women’s and Children’s Health, Section for International Maternal and Child Health, Uppsala University, Uppsala, Sweden.

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Reprint requests to (C.A.) Section for International Maternal and Child Health, IMCH, University Hospital, Entrance 11, S-75185, Uppsala, Sweden. E-mail: clara.aarts@ich.uu.se

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study of the duration of lactational amenorrhoea in relation to breastfeeding practices.⁷¹⁹ The project was conducted between 1989 and 1994 in seven countries (Australia, Chile, China, Guatemala, India, Nigeria, and Sweden). The Swedish part of the project was organized by the former Unit for International Child Health, Department of Pediatrics, Uppsala University, Uppsala, Sweden. In the present study, Swedish data from this primary project were used.

The descriptive study had a longitudinal prospective design. The mother-infant pairs were followed up from the first week after delivery until the mother's second menstruation postpartum or a new pregnancy. The study took place in the city of Uppsala and the surrounding area within a radius of 20 km from the city center. All mother-infant pairs included in the study were recruited from the University Hospital, where all deliveries in the county take place and where 15 189 children were born between May 1989 and December 1992. The inclusion criteria resulted in a study population of 506 infants, 270 male and 236 female (Fig 1). All mothers had one to three children before the index child and had had previous breastfeeding experience of 4 months or longer with at least one child. All were planning to breastfeed the index child for at least 6 months. The mean age (standard deviation) of the mothers in the study was 30.7 (3.7) years. The mean length of the

mothers' formal education was 14.2 (2.9) years; 65.2% of the mothers had university education and all mothers had at least 9 years of formal education. Seven percent of the mothers were smokers. The mean duration of participation in the study was 8.6 (3.4) months.

Data were obtained from daily recordings by the mother and from fortnightly interviews by a research assistant. The mothers completed two charts during each of these follow-up periods. On one chart, the mother made daily records for 13 days of the number of suckling episodes, the number of episodes of breast milk expression, the number and category of supplementary feeds (including expressed breast milk and water), and any vitamins or minerals given. The second chart, which the mother completed every 14th day, consisted of a detailed 24-hour record of the timing of every suckling episode and of the point in time when other food was given. The first 24-hour record with time taking was made in the infant's third week of life (2 but not yet 3 weeks of age). Subsequent time taking was conducted fortnightly after the first 24-hour detailed record. Thus, each follow-up period was 14 days (with the exception of the first one). Every fortnight, structured interviews were conducted and anthropometric measurements were made by a research assistant in the home. During the home visits, the assistant checked the record charts and re-

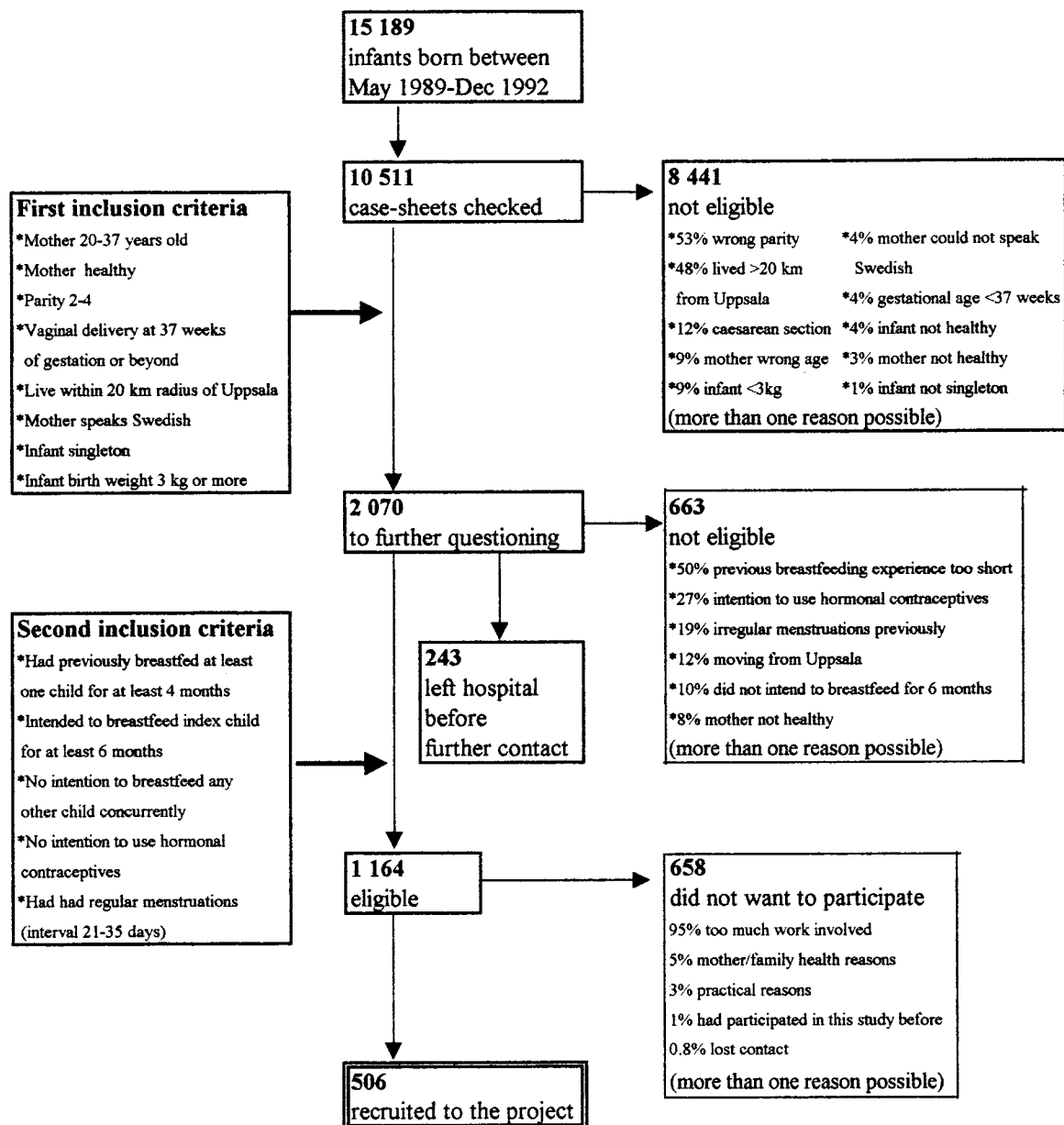


Fig 1. Recruitment details: inclusion criteria, reasons for noneligibility, and reasons for nonparticipation.

corded data for the previous 2 weeks, including, for example, the breastfeeding pattern, any supplementation, thumb sucking, and/or pacifier use. For definitions used in the study, see "Appendix" below. During the first 6 months, 106 mothers (21%) discontinued participation (Table 1). Of these mothers, 78 reached the study endpoint (77 had their second menstruation after delivery and 1 was pregnant) and 28 dropped out of the study for various reasons. Missing data days in the daily records amounted to 0.7%, and those in the 24-hour detailed records amounted to 4%.

Data Analysis

Data were analyzed longitudinally and cross-sectionally using the statistics programs Quest (Quest, Umeå, Sweden)²⁰ and SPSS (SPSS, Cary, NC). Cross-sectional analyses were based either on the 13-day recordings or on the 24-hour detailed records. In each 14-day follow-up period, 10% to 15% of the exclusively breastfed infants were given expressed breast milk (Table 1). They were excluded from the analyses of the breastfeeding patterns during that follow-up period, because the patterns may be affected when anything but suckled breast milk is given. The classification of the infants as exclusively breastfed was based on their feeding history after admission to the study (at 3–7 days postpartum). Any supplements given to the infants before inclusion in the study were disregarded in the classification. Of the 430 infants who were exclusively breastfed during the first follow-up period, 35% were given supplements (6%, the breast milk of another mother; 24%, water; and 5%, formula) before inclusion in the study.

The longitudinal analyses concerned changes over time in individual infants. To analyze differences among groups, the two-sample *t* test, the χ^2 test, and Fisher's exact test were used. The Kaplan-Meier life table and the Cox regression analysis were used to analyze the association among pacifier use, thumb sucking, and duration of breastfeeding. The survival curves were compared using the log-rank test, estimates of relative risk (RR), and median values. A *P* value < .05 was considered statistically significant, and 95% confidence intervals (CI) were used.

RESULTS

Thumb Sucking and Pacifier Use

Thumb sucking started early in the neonatal period. At 2 weeks, the prevalence of thumb sucking was 61%. It increased further to 91% at 16 weeks and then decreased to 64% at 26 weeks (Fig 2, A). During the first 2 months, occasional thumb sucking was more common than was frequent thumb sucking. Frequent thumb sucking increased from 16% at 2 weeks to 73% at 16 weeks and then declined to 41% at 26 weeks. During the first 6 months of life, 2% of the infants never sucked their thumb.

Thumb sucking increased during the first 4 months. Of those 206 infants who did not suck their thumb at 1 month, 16% did not do this at 4 months, 23% sucked their thumb occasionally at 4 months, and 61% sucked their thumb frequently at that age. Of the infants who occasionally sucked their thumb

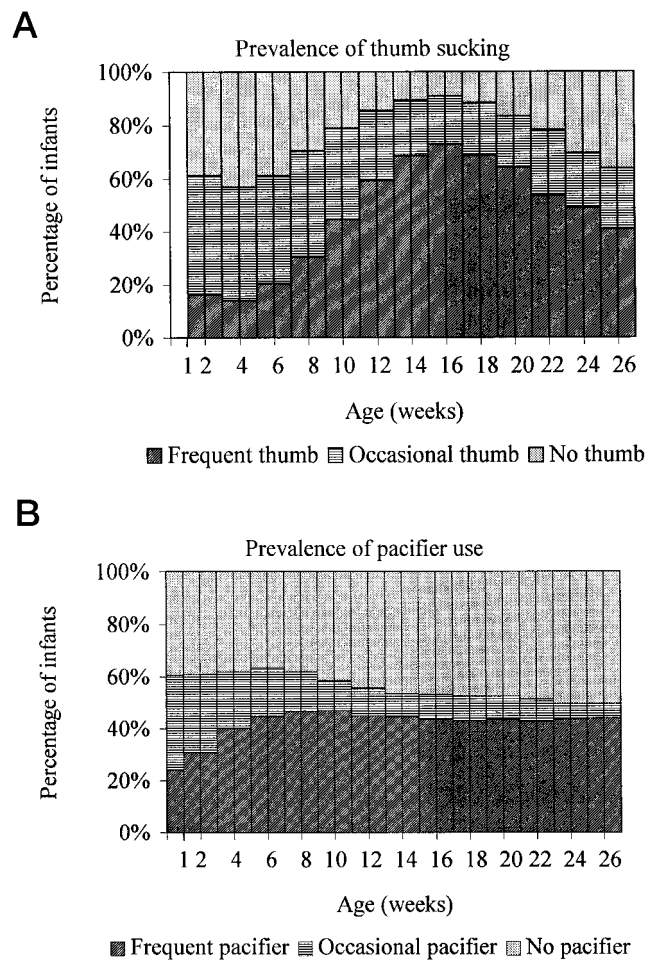


Fig 2. The prevalence of thumb sucking (A) and pacifier use (B) at different ages.

at 1 month of age (*n* = 204), 16% had the habit at 4 months of age, 4% did not suck their thumb at 4 months, and 80% sucked frequently at 4 months. Of the infants who frequently sucked their thumb at 1 month of age (*n* = 62), 89% did so at 4 months of age, 8% did so occasionally at 4 months, and 3% had stopped sucking their thumb by 4 months of age.

Pacifiers were initiated early. Of all of the infants (*n* = 506), 60% were given a pacifier during the first week of life, 12% were introduced to pacifiers during the second to third week of life, 6% were given them during the fourth to fifth week of life, and 7% were introduced to pacifiers later. Of all of the infants, 15% were never given a pacifier.

TABLE 1. Number of Infants in the Study at Different Ages and Number of Infants Exclusively Breastfed at Each Age

Age (Weeks)	Infants Taking Part in the Study (<i>n</i>)	Exclusively Breastfed Infants		Total	
		Only Suckled Breast Milk <i>n</i>	Suckled and Expressed Breast Milk <i>n</i>	<i>n</i>	%
2	506	389	41	430	85.0
4	499	353	42	395	79.2
8	493	287	50	337	68.4
12	486	243	47	290	59.7
16	472	167	22	189	40.0
20	454	65	14	79	17.4
24	423	18	2	20	4.7
26	400	7	0	7	1.8

A slowly declining trend in the introduction of pacifiers during the first week of life was seen during the study period from 67% of those recruited in July through December of 1989 ($n = 76$) to 57% in January through June of 1992 ($n = 77$). A sudden drop to 36% then was seen during the second half of 1992 ($n = 44$). A larger proportion of the infants of mothers recruited during the second half of 1992 never used a pacifier during the first 6 months compared with those recruited during July through December of 1989 (25% vs 13%; $P = .159$; 95% CI: $-26.7-3.0$).

The prevalence of pacifier use (occasional and frequent use combined) remained constant during the first 2 months of life at ~60% (Fig 2, B). It then decreased slightly to 50% at 26 weeks. During the first 2 months, there was an increase in the proportion of infants using a pacifier frequently from 24% at 1 week to 47% at 2 months. Subsequently, it remained at the same level. Changes in pacifier use over the period between the first and the fourth months were not common among nonusers and frequent users. Of the 184 infants who did not use a pacifier at 1 month of age, 83% did not use one at 4 months of age, 5% used one occasionally at 4 months, and 12% frequently at 4 months. Of the occasional pacifier users at 1 month of age ($n = 103$), 19% used a pacifier at 4 months of age, 44% had stopped using a pacifier by 4 months, and 37% used a pacifier frequently at 4 months. Of frequent pacifier users at 1 month of age ($n = 185$), 79% used a pacifier at 4 months of age, 12% had stopped using a pacifier at 4 months, and 9% used a pacifier occasionally at 4 months.

The prevalence of thumb sucking and pacifier use separately and in combination at different ages is shown in Table 2. Data are given for four different groups: 1) no thumb sucking and no pacifier use (nothing group); 2) frequent thumb sucking and no pacifier (thumb group); 3) no thumb sucking and frequent pacifier use (pacifier group); and 4) frequent thumb sucking and frequent pacifier (both group). It should be noted that occasional thumb sucking and occasional pacifier use are not included in Table 2. At 2 weeks of age, 14% of all infants sucked neither their thumb nor a pacifier. This proportion decreased to 5% at 16 weeks but increased to 19% at 26 weeks. Up to 8 weeks of age, frequent pacifier use alone was more common than frequent thumb sucking only.

TABLE 2. Thumb Sucking and Pacifier Use at Different Ages Among All Infants*

Age (Weeks)	<i>n</i>	Nothing (%)	Thumb (%)	Pacifier (%)	Both (%)
2	506	14.4	5.9	10.3	7.9
4	499	17.8	5.6	15.4	7.6
8	493	11.0	10.5	13.4	17.2
12	486	7.2	25.9	5.8	29.0
16	472	5.3	33.3	3.2	34.1
20	454	9.9	28.6	5.9	30.2
26	400	18.8	20.5	15.3	18.0

Nothing indicates no pacifier and no thumb; thumb, frequent thumb and no pacifier; pacifier, no thumb and frequent pacifier; and both, frequent thumb and frequent pacifier.

* Occasional thumb sucking and occasional pacifier use are not included.

Thereafter, frequent thumb sucking alone was more common. The proportion of infants frequently sucking both their thumb and a pacifier increased from 8% at 2 weeks to 34% at 16 weeks and then decreased to 18% at 26 weeks. Thus, thumb sucking alone increased, pacifier use alone decreased, and a combination of frequent thumb sucking and frequent pacifier use increased up to 5 months of age.

Breastfeeding Patterns Among Exclusively Breastfed Infants in Relation to Thumb Sucking and Pacifier Use

The breastfeeding pattern, ie, breastfeeding frequency, suckling duration, and longest interval between two consecutive feeds in exclusively breastfed infants in relation to thumb sucking and the pacifier use was analyzed at 2, 4, 8, and 12 weeks of age in the four different groups (nothing, thumb, pacifier, and both) (Table 3, A). There was no significant difference in the breastfeeding pattern at any age between the nothing and the thumb groups or between the pacifier and the both groups. Significant differences in the breastfeeding pattern were found in the other group comparisons (Table 3, B) indicating that thumb sucking did not seem to be associated with the breastfeeding pattern. Because of this lack of correlation between thumb sucking and breastfeeding patterns, we focused on the relation between pacifier use and breastfeeding pattern. The analyses showed that infants using a pacifier frequently had approximately one breastfeed less and a 15- to 30-minute shorter total suckling duration per 24 hours than did infants not using a pacifier in the different follow-up periods during the first 4 months of life ($P \leq .01$ in each follow-up period). In addition, during the first 2 months of life, the longest interval between two consecutive feeds was 15 to 30 minutes longer per 24 hours in frequent users of a pacifier (P values varied between $<.01$ and $.02$ in the different follow-up periods). Compared with infants using a pacifier occasionally, frequent pacifier users had a mean of 0.5 feeds less per 24 hours in each follow-up period during the first 2 months of life (P values varied between $<.01$ and $.04$ in the different follow-up periods).

Thumb sucking and pacifier use were also analyzed in two special groups of infants exclusively breastfed at 2 weeks, namely 12 infants in the two groups corresponding to the 3rd and 97th percentiles, respectively, regarding frequency of breastfeeds. The infants in the first group (low frequency) were breastfed ≤ 5.5 times per 24 hours and those in the second group (high frequency) > 11 times per 24 hours at 2 weeks of age. In the low frequency group, 10 of the 12 infants used a pacifier at 2 weeks of age (2 occasionally and 8 frequently), whereas 2 infants did not suck on anything. All but one were breastfed on demand. In the high frequency group, 3 of the 12 infants used a pacifier at 2 weeks of age (all occasionally), 7 infants only sucked their thumb (6 occasionally and 1 frequently), and 2 did not suck on anything. All infants in this high frequency group were breastfed on demand. In each follow-up period during the first 3 months of life, between 8 and 10 of the 12 infants in the low frequency group used a

TABLE 3A. Breastfeeding Patterns at Different Ages in Exclusively Breastfed Infants in Relation to Thumb Sucking and Pacifier Use in Four Different Groups

Age (Weeks)	Pacifier Use/Thumb Sucking	<i>n</i>	Number of Breastfeeding Episodes per 24 Hours Mean ± 1 SD	Total Suckling Duration per 24 Hours Mean ± 1 SD	Longest Interval Between Feeds Mean ± 1 SD
2	Nothing	62	8.4 ± 1.5	hours:min 2:14 ± 0:58	4:22 ± 1:16
	Thumb	26	8.0 ± 1.4	2:35 ± 1:01	4:32 ± 1:11
	Pacifier	39	7.5 ± 1.3	2:07 ± 0:56	5:15 ± 1:13
	Both	30	7.4 ± 1.3	2:13 ± 0:46	4:46 ± 1:16
4	Nothing	67	8.5 ± 1.5	2:13 ± 0:49	4:45 ± 1:08
	Thumb	21	8.3 ± 1.6	2:24 ± 1:14	4:34 ± 0:54
	Pacifier	59	7.3 ± 1.3	1:44 ± 0:34	5:20 ± 1:29
	Both	25	7.3 ± 1.6	1:52 ± 0:39	5:38 ± 2:22
8	Nothing	34	7.8 ± 1.3	2:05 ± 0:52	5:56 ± 1:46
	Thumb	34	7.6 ± 1.7	1:59 ± 1:07	6:20 ± 1:56
	Pacifier	34	6.6 ± 1.2	1:37 ± 0:33	7:16 ± 1:49
	Both	49	6.9 ± 1.4	1:40 ± 0:39	6:46 ± 2:06
12	Nothing	24	8.1 ± 1.3	1:38 ± 0:29	6:29 ± 2:01
	Thumb	68	7.4 ± 1.7	1:46 ± 0:45	6:40 ± 1:59
	Pacifier	13	6.2 ± 0.9	1:34 ± 0:33	7:11 ± 2:23
	Both	72	6.8 ± 1.2	1:16 ± 0:39	7:09 ± 2:24

Nothing indicates no pacifier and no thumb; thumb, frequent thumb and no pacifier; pacifier, frequent pacifier and no thumb; and both, frequent thumb and frequent pacifier.
See Table 3B for statistical testing.

TABLE 3B. Differences Among the Different Groups

Age (Weeks)	Groups Compared	Number of Breastfeeding Episodes per 24 Hours <i>P</i> Values	Total Suckling Duration per 24 Hours <i>P</i> Values	Longest Interval Between Feeds <i>P</i> Values
2	Nothing-thumb	.19	.15	.59
	Nothing-pacifier	<.01	.52	<.01
	Thumb-pacifier	.19	.06	.02
	Nothing-both	<.01	>.8	.16
	Thumb-both	.10	.15	.48
	Pacifier-both	.63	.60	.11
4	Nothing-thumb	.56	.15	.54
	Nothing-pacifier	<.01	<.01	.02
	Thumb-pacifier	.01	.02	.01
	Nothing-both	<.01	.06	<.01
	Thumb-both	.04	.08	<.01
	Pacifier-both	>.8	.35	.39
8	Nothing-thumb	.65	.72	.38
	Nothing-pacifier	<.01	.02	<.01
	Thumb-pacifier	.01	.10	.05
	Nothing-both	<.01	.01	.06
	Thumb-both	.03	.13	.34
	Pacifier-both	.36	.79	.30
12	Nothing-thumb	.09	.34	.69
	Nothing-pacifier	<.01	.75	.36
	Thumb-pacifier	<.01	.40	.42
	Nothing-both	<.01	>.8	.24
	Thumb-both	.01	.19	.22
	Pacifier-both	.11	>.8	>.8

pacifier frequently, compared with a maximum of 2 infants in the high frequency group (*P* values varied between .001 and .01). There were no significant differences in the frequency of thumb sucking between the two groups at any age. Life table analysis showed that the expected breastfeeding duration was 8.2 months in the low frequency group and was

12.9 months in the high frequency group (RR: 3.19; *P* = .01).

Feeding Categories in Relation to Thumb Sucking and Pacifier Use

Cross-sectional analyses of the feeding categories at 4 months of age in relation to thumb sucking and

pacifier use at 1 month of age showed no differences for thumb sucking. For pacifier use, significant differences between the frequent users and the never users were seen. Of the infants using a pacifier frequently at 1 month of age, 51% were breastfed exclusively at 4 months of age, and 4% were not breastfed at that age. The corresponding figures for infants not using a pacifier at 1 month of age were 65% and 0%, respectively (Table 4).

Breastfeeding Duration

During the study period, a continuously increasing trend in the total breastfeeding duration was seen. For the 4 years between 1989 and 1992, the median breastfeeding duration figures were 8.3, 8.0, 8.8, and 10.3 months, respectively. No significant difference in total breastfeeding duration was found between infants who used a pacifier during the first week of life and those who did not. Nor was there any difference in total breastfeeding duration between infants who never used a pacifier ($n = 75$) and those who stopped using a pacifier within 2 months ($n = 84$; $RR = 0.91$; $P = .63$; 66 infants stopped within 1 month).

The combined group of children who never used a pacifier or stopped within 2 months ($n = 159$) was used as a reference group in the Cox regression analyses. In these analyses, the breastfeeding duration in relation to the longitudinal use of a pacifier during the first 6 months of life showed differences according to the frequency of pacifier use. An increasing frequency of pacifier use was related to a decline in the total breastfeeding duration. As seen in Fig 3, taken from the crude Cox regression analysis, the median breastfeeding duration was 10 months in infants who did not use a pacifier or stopped within 2 months, and 7.5 months in frequent users of pacifiers ($n = 55$).

Age and education could be potential confounding factors. Both the level of education and the age of the mother were associated with breastfeeding duration, as well as with the use of a pacifier during the first 6 months of follow-up. Older mothers and those with higher levels of education breastfed for a longer period. In an analysis, excluding infants who stopped using a pacifier within 2 months, it was found that pacifier use was less frequent in infants of mothers with university education ($n = 330$) than in infants of mothers without this education ($n = 176$; 62% vs

Breastfeeding duration and pacifier use

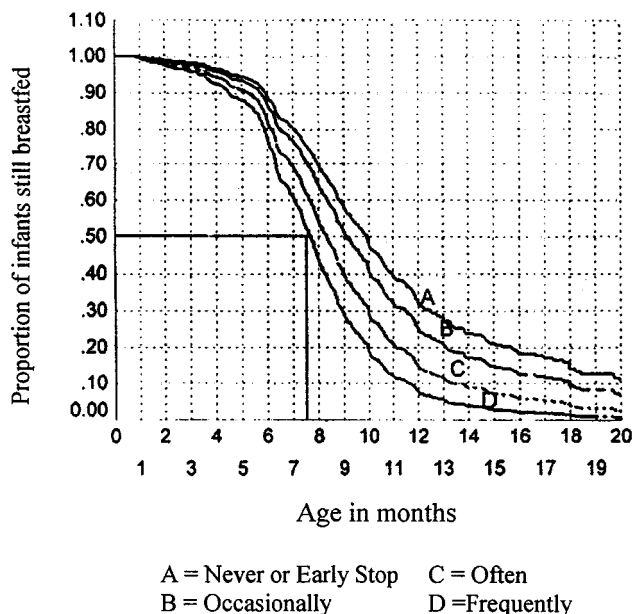


Fig 3. Breastfeeding duration in relation to the longitudinal use of a pacifier during the first 6 months of life. The frequency of pacifier use was categorized into four levels: level 1, never or early stop = infants who never used a pacifier during the first 6 months of life or who stopped at ≤ 2 months of age ($n = 159$); level 2, occasionally = infants who used a pacifier occasionally over a longer period during the first 6 months of life ($n = 86$); level 3, often = infants who used a pacifier sometimes frequently and sometimes occasionally during the first 6 months of life ($n = 206$); and level 4, frequent = infants who used a pacifier frequently during the entire 6-month period ($n = 55$).

81%). Cox regression analysis results showed that maternal age and education slightly modified the association between pacifier use and breastfeeding duration (Table 5). This is exemplified in Table 6, where the median breastfeeding durations are given for both the crude Cox model and the Cox model in which maternal age and education level were introduced as modifying factors.

Gender Differences in Thumb Sucking and Pacifier Use

There were no statistically significant infant gender differences in respect to thumb sucking and pacifier use.

DISCUSSION

This longitudinal prospective study concerns a selected group of mother-infant pairs in a population known to have a high rate of breastfeeding.²¹ All mothers had previous breastfeeding experience of ≥ 4 months and intended to breastfeed the index child for ≥ 6 months. The breastfeeding rate was 95% at 4 months and 85% at 6 months. The selection of motivated mothers together with the study design made it possible to address the question of whether breastfeeding patterns and breastfeeding duration were associated with thumb sucking and pacifier use.

The most important finding in the present study involving infants of motivated mothers was that pac-

TABLE 4. Breastfeeding Categories at 4 Months of Age in Relation to Pacifier Use at 1 Month

Breastfeeding Category at 4 Months	Pacifier Use at 1 Month of Age			CI*
	Never $n = 184$	Frequent $n = 185$	P Values	
	%	%		
Exclusive	65	51	.009	3.9–23.8
Predominant	3	8	.106	–0.1–0.0
Complementary	19	18	<.8	–0.1–0.1
Plus formula	12	20	.089	–0.1–0.0
Not breastfed	0	4	.021	1.0–6.5

Differences tested between never-users and frequent users.

* CI indicates confidence interval.

TABLE 5. Cox Regression Analysis of Variables Associated with Breastfeeding Duration

Variable	Hazard Ratio (95% Confidence Intervals) for Shortening of Breastfeeding Duration			
	Crude	Adjusted for Age*	Adjusted for Education†	Adjusted for Age and education†
Pacifier Use				
Never/early stop	1.00	1.00	1.00	1.00
Occasionally	1.22 (0.90–1.66)	1.17 (0.86–1.58)	1.08 (0.79–1.47)	1.07 (0.79–1.47)
Often	1.69 (1.33–2.14)	1.69 (1.33–2.15)	1.61 (1.27–2.05)	1.62 (1.28–2.07)
Frequent	2.28 (1.61–3.23)	2.33 (1.64–3.30)	2.11 (1.48–2.99)	2.17 (1.53–3.09)
Education†				
≥4 y university	1.00	1.00		
1–3 y university	1.19 (0.93–1.52)	1.12 (0.87–1.44)		
No university	1.62 (1.26–2.08)	1.42 (1.07–1.89)		

* Maternal Age, continuous variable.

† Education, stratified.

TABLE 6. Median Breastfeeding Duration in Months in Relation to the Frequency of Pacifier Use, Calculated From a Crude Regression Model and After Adjustment for Age* and Education† in Some Selected Groups

Pacifier Use	Crude Model	Older Mothers/ Long Education	Older Mothers/ Short Education	Younger Mothers/ Short Education
Never/early stop	10.0	11.0	9.6	8.3
Occasionally	9.0	10.6	9.3	8.0
Often	8.3	9.0	8.2	7.3
Frequent	7.5	8.4	7.6	6.5

* Older mothers, 36 years of age; and younger mothers, 22 years of age.

† Short education, no university; and long education, ≥4 years university.

ifier use showed an association with the breastfeeding pattern and the duration of exclusive breastfeeding as well as with the total breastfeeding duration. No such associations were found with thumb sucking.

Pacifiers were introduced early in the newborn period, as found in other studies.^{16,17} During the course of the study, a secular declining trend occurred in the use of pacifiers during the first week of life with a sudden drop during the second half of 1992. This was most likely attributable to the Baby Friendly Hospitals Initiative launched in Sweden in 1992²² that includes a recommendation for breastfeeding mothers not to use artificial teats or pacifiers in the early postpartum period to avoid nipple confusion.

A continuation of the increase in the total breastfeeding duration that has been observed previously over several decades²¹ was noted during this study period. This increasing trend is probably a consequence of the debate on the benefits of breastfeeding that has been going on in Sweden over a number of years and that now has been intensified with the introduction of the Baby Friendly Hospitals Initiative.

The prevalences of thumb sucking and pacifier use were high by 2 weeks of age (61% and 60%, respectively). Most infants, however, were mostly using the thumb and the pacifier occasionally, ie, less than three times per day. The habit of using a pacifier was established early, and most of the infants who used a pacifier frequently at 1 month continued to do so. Compared with a Swedish study by Klackenber¹ in the 1950s, the prevalences of both pacifier use and the combination of thumb sucking and pacifier use were higher in the present study. A possible expla-

nation for this is the lower availability of pacifiers in the 1950s; now there is an enormous selection of pacifiers, which are marketed widely and accessible everywhere.

Exclusively breastfed infants who used a pacifier frequently were breastfed fewer times per day and had a shorter suckling duration compared with exclusively breastfed infants who did not use a pacifier. Infants using a pacifier also had a shorter total breastfeeding duration, as seen in other studies.^{3,4} This also was confirmed by the low frequency feed and the high frequency feed groups of the 24 infants corresponding to the 3rd and 97th percentiles regarding the frequency of breastfeeds with a 3.7 months shorter expected breastfeeding duration in the low frequency feed group. This group used a pacifier much more frequently than did the high frequency feed group. The pacifier probably is given to calm an infant instead of offering the breast,¹⁷ and less stimulation of the breasts gradually decreases milk production, which in turn, can result in a shorter breastfeeding duration.²³ The use of a pacifier also may interfere with proper sucking.¹⁵ However, we lack information on breast milk intake, and sucking technique was not investigated during the home visits. Data on the growth of the infants will be presented in future reports.

The rate of exclusive breastfeeding at 4 months of age was lower among infants using a pacifier frequently at 1 month of age than among infants not using a pacifier at 1 month. The difference was not as large, however, as in the Brazilian study.³ The rates of exclusive breastfeeding at 4 months of age in the Brazilian study were 17% in frequent pacifier users and 45% in nonusers, compared with 51% and 65%, respectively, in the present study.

Pacifier use that stopped within 2 months did not influence the total breastfeeding duration, probably because most of these infants only sucked the pacifier occasionally. In the group of mothers in our study who were highly motivated to breastfeed, the breastfeeding duration showed a correlation to the frequency of pacifier use and to maternal age and level of education. Older mothers and those with a higher level of education breastfed their infants longer, as shown in other studies.^{4,5} They also gave a pacifier to their infants to a lesser extent. The prevalence of pacifier use differed only moderately between the university group and the nonuniversity group in the present study, whereas the frequency of pacifier use differed markedly between these groups with more occasional pacifier use in the university group.

Our findings showed that even in a selected group of mothers who were motivated to breastfeed and who had previous breastfeeding experience, the use of a pacifier was associated with a shorter breastfeeding duration. This is in contrast to the conclusion drawn by Victora et al¹⁷ that pacifier use did not contribute to a shorter breastfeeding duration among mothers comfortable with breastfeeding. With ethnographic methods, Victora et al showed how different breastfeeding behavioral styles and different ways of responding to the infant's behavior and needs were associated with the pattern of pacifier use. The use of a pacifier is determined by a decision and action by the caregiver. These decisions and actions, in turn, may be influenced by numerous factors, eg, the interplay between the mother and the infant and how the mother responds to the different needs and behaviors of the infant. There are also large cultural differences in pacifier use. A very low prevalence of pacifier use and thumb sucking was found in Zimbabwe compared with that in Sweden.⁶ Pacifier use also was found in one study to be lower among Lapp children in the north of Norway than in other places in Norway or in Sweden, where the use was most common.⁷

We do not know whether the use of a pacifier shortens the breastfeeding duration or whether these mothers would have stopped breastfeeding regardless. This shorter duration of breastfeeding may be a consequence of a decreased frequency of breastfeeds or a change in the intensity of suckling on the breast, resulting in decreased milk production. It is also possible that the mother might have stopped breastfeeding even earlier if she had not had the possibility of giving an unsettled baby a pacifier. For the family, possible advantages of pacifier use include a calming and comforting effect on the child that provides the mother more time to take care of older siblings, attend to other duties, or rest. We still do not know very much about the reasons for introducing and using a pacifier, and no relevant data were obtained during the present study. More explorative qualitative studies in different settings are needed to highlight these issues. Smoking by the mother can shorten the breastfeeding duration.^{4,5} In our material, smoking was not found to have a negative effect on

the total breastfeeding duration but on the duration of exclusive breastfeeding.²⁴

The definitions of pacifier use and thumb sucking used in this study sometimes made it difficult to classify the sucking as occasional (<3 times per 24 hours) or frequent (≥ 3 times per 24 hours) in those infants who had approximately three sucking episodes per day. Therefore, some misclassification between occasional and frequent sucking might have occurred. Furthermore, parents do not observe the infant continuously during the 24 hours of the day, and the thumb sucking frequency is therefore more likely to be underestimated than is the frequency of pacifier use. At every home visit, the interviewers judged whether the information from the detailed 24-hour record was likely to be accurate. Between 5.3% and 9.2% of the 24-hour recordings (mostly regarding duration of feeds) were deemed to be inaccurately made. The most common reasons for inaccuracy were sleepiness of the mother and estimation of data. This usually meant that some night feeding could have occurred while the mother was sleeping or that the mother had given an estimate instead of the exact time of a feed during the 24 hours. However, overall, the mothers were trustworthy and the recordings were in agreement with the interview results. Missing data attributable to missing recordings were few. Based on the above reasoning, the accuracy of the records and the data on thumb sucking and pacifier use were considered to be good.

CONCLUSION

In summary, the present study confirms an association between pacifier use and breastfeeding pattern. We found that pacifier use was related to fewer feeds per 24 hours, shorter suckling duration, shorter duration of exclusive breastfeeding, and shorter total breastfeeding duration among infants of mothers motivated to breastfeed for ≥ 6 months and with previous breastfeeding experience of ≥ 4 months. The study design does not allow any conclusion to be drawn as to the possible causality of this association. No such associations were found for thumb sucking. Thumb sucking was clearly not related to negative effects on the pattern and duration of breastfeeding. The possible negative effects of pacifier use on breastfeeding pattern and duration were related to the frequency of use; occasional pacifier use was not found to have any negative effect on breastfeeding duration.

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Definitions Used in the Study

One breastfeeding episode. Duration of suckling 2 minutes or longer and separated from previous breastfeed by at least 30 minutes. Suckling for less than 2 minutes was not recorded.

Expressed breast milk. Mother's own breast milk given to the infant by other means than suckling (i.e. with spoon, bottle, cup, or other).

Feeding on demand. The mother feeds her baby whenever it cries or indicates by some other means that it is hungry.

Use of a pacifier.

Thumb sucking (finger, toe).



Occasionally <3 times/24 hours

Frequently ≥3 times/24 hours

*Infant feeding categories**

Exclusive breastfeeding. The infant receives breast milk (including expressed milk) and is allowed to receive drops and syrups (vitamins, minerals, medicines). The infant may not receive anything else.

Predominant breastfeeding. The infant receives breast milk and is allowed liquids (water and water-based drinks, fruit-juice, ORS¹), ritual fluids, and drops or syrups (vitamins, minerals, medicines). The infant is not allowed to receive anything else (in particular, non-human milk or food-based fluids).

Breastfeeding plus formula. The infant receives breast milk, formula and/or follow-on formula, but no solid or semi-solid foods.

Complementary feeding. The infant receives breast milk and solid or semi-solid foods. It is allowed to receive any food or liquid, including non-human milk.

*The WHO criteria for assignment to infant feeding categories were used (25). The criteria were originally intended for cross-sectional surveys using 24-hour recall. In the present study, an extra feeding category 'breastfeeding plus formula' was added, since these infants are not covered by the WHO categories.

¹ ORS= oral rehydration salt

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