Effect of pacifier use on exclusive and any breastfeeding: a meta-analysis

Erdem Karabulut[1], S. Songül Yalçın[2], Pınar Özdemir-Geyik[1], Ergun Karaağaoğlu[1]

[1]Department of Biostatistics, and [2]Unit of Social Pediatrics, Department of Pediatrics, Hacettepe University Faculty of Medicine, Ankara, Turkey

SUMMARY: Karabulut E, Yalçın SS, Özdemir-Geyik P, Karaağaoğlu E. Effect of pacifier use on exclusive and any breastfeeding: a meta-analysis. Turk J Pediatr 2009; 51: 35-43.

The objective of this meta-analysis was to determine with cross-sectional and cohort trails whether the use of pacifier increases the risk of early weaning from exclusive breastfeeding before six months of age or cessation of breastfeeding from any breastfeeding before 24 months of age. Additionally, the effect of the age for starting pacifier use on breastfeeding duration was analyzed in the cohort trails. The Medline database was searched (1980 to 2006) with "breastfeed, breastfeeding, or breast feed" and "pacifier, dummy, or soother" as individual keywords. Only human studies published in English were included. Unpublished data were not sought. Twelve trials with weaning from exclusive breastfeeding and 19 trials with cessation of any breastfeeding were included in the meta-analysis. The meta-analysis was performed with Stata 6.0 statistical package. Summary risk ratio for early weaning before six months of age in exclusive breastfeeding trails was 2.016 (95% CI: 1.619-2.511) for pacifier users compared with nonusers in studies with univariate analysis and 1.792 (95% CI: 1.452-2.212) in studies with multivariate analysis. Similarly, pacifier usage compared with nonusers reduced the duration of any breastfeeding in both univariate (2.760, 95% CI: 2.083-3.657) and multivariate trials (1.952, 95% CI: 1.662-2.293). The use of pacifiers was associated with shortened duration of exclusive and of any breastfeeding. Given the increase in the benefits with duration of breastfeeding, parents should be informed of the link between pacifier use and shortened breastfeeding duration in order to help them make informed decisions about their children's care.

Key words: breastfeeding, pacifier, duration, meta-analysis.

The UNICEF Baby Friendly Initiative statement recommends that pacifiers should not be given to breastfeeding infants[1]. However, in October 2005, the American Academy of Pediatrics recommended the use of a pacifier throughout the first year of life to decrease the risk of sudden infant death syndrome[2]. Concerns about recommending the use of pacifiers on a population-wide basis have focused primarily on otitis media[3], dental malocclusion[4-5] and dental caries[6]. In addition to these effects, pacifier use has been associated with shorter breastfeeding duration by a number of authors[7-12]. However, breastfeeding duration has been documented to be positively associated with cognitive development in children and later adulthood[13]. Recent systematic reviews have also shown a dose-dependent association between longer duration of breastfeeding and decrease in the risk of overweight in later life[14,15]. Furthermore, breastfeeding has been associated with lower blood pressure, lower risks of urinary tract and middle ear infections, and reduced infant morbidity[3,16,17]. The benefits to infants appear to increase with longer duration of breastfeeding.

Although there are a number of studies indicating the association of pacifier use with significant declines in breastfeeding, there has been no systematic review about this subject. The objective of this study was to determine whether the use of pacifier increases the risk of early weaning from exclusive breastfeeding before six months of age or cessation of

breastfeeding from any breastfeeding before 24 months of age. We also aimed to analyze the effect of age of starting pacifier use on breastfeeding duration.

Material and Methods

The Medline database was searched (1980 to 2006) to obtain data about pacifier use and its association with early weaning from exclusive breastfeeding and cessation of any breastfeeding. The last electronic search was conducted on December 23, 2006. Individual keywords used in the study search included: "breastfeed, breastfeeding, or breast feed" and "pacifier, dummy, or soother". Only human studies published in English were included. Unpublished data were not sought. Prospective cohorts and case control studies that analyzed the risk of early weaning in infants with exclusive breastfeeding or any breastfeeding in pacifier users were included in the meta-analysis. Three independent reviewers read and evaluated all abstracts for inclusion. All data were abstracted by using a standardized protocol and computerized report form. Authors were contacted for any missing information via e-mail. The obtained full text articles were evaluated independently by three reviewers to determine whether or not the articles met the inclusion criteria. In some studies in which the published data did not fulfill the requirements, the corresponding author was contacted by e-mail for additional information. Disagreements were resolved by consensus.

Breastfeeding Definitions: Where appropriate, the breastfeeding terms that were used in this study were those recommended by the World Health Organization (WHO)[18]. An infant was considered to be exclusively breastfed when he or she had received only breast milk with no other liquids or solids. Any breastfeeding was defined as an infant's being fully breastfed or receiving both breast milk and a formula, with or without solids.

Our review identified 42 confounding factors that were taken into consideration when evaluating the relation between breastfeeding duration and pacifier use: infant gender, birth weight and length, type of delivery, multiple birth, parity, planned pregnancy, maternal age, maternal education, paternal age, paternal education, employment status of the parents, factors related to socioeconomic status, marital status, nationality, infant exposure to tobacco smoke (prenatal or postpartum), presence of breastfeeding problems, parents' attitude towards breastfeeding, mothers having been breastfed, prenatal care quality, medical problems before, during, and after delivery, infant discharged home from hospital same time as mother, time at initiation of breastfeeding, pacifier use in hospital ward, formula supplements in the maternity ward, formula promotion at discharge, breastfeeding at hospital discharge, mother sharing bed with infant, whether infant sleeps in parental room at night, use of oral contraceptive, home visit post-birth, use of regular child care, plans to return to work and age of infant when mother returned to work, age at initiation of bottle-feeding, age at initiation of formula or solid foods, breastfeeding on demand or schedule, type of breastfeeding at 1 month of age, body weight at 1 month and at 4 months, child sleeps 6 h at night, body mass index (BMI), knowledge about the lactation centers, and current pregnancy status at the first and at 6 months. Studies were considered covariate-adjusted if they were controlled statistically for a minimum of one characteristic in models to estimate effects of breastfeeding compared with those of pacifier on breastfeeding duration. Outcome measures were unadjusted and adjusted risks of early weaning before six months of age and stopping any breastfeeding before 24 months of age in children who used pacifier. Pooled estimates of effect were separately calculated for unadjusted and adjusted results. We conducted the meta-analysis calculations separately for studies including exclusive breastfed cases and any breastfed cases.

Meta-analysis of studies with binary outcomes (relative risk, odds ratio) were performed. Meta-analysis was performed with Stata 6.0 statistical package. To perform meta-analysis in Stata, user-written meta command was used. The effect estimate (relative risk or odds ratio) and its corresponding standard error for each study were required in meta command. Q test for homogeneity of risk estimates was used. Significant heterogeneity was detected between studies, so pooled estimates of the risk for early weaning were generated using random effects models. Forest plots were drawn to

show the results graphically. In a forest plot, the contribution of each study to the meta-analysis (its weight) is represented by the area of a box, the center of which represents the risk ratios estimated from that study (point estimate). The confidence intervals (CIs) for the risk ratios from each study were also shown. The risk ratio is shown by the middle of a diamond, the left and right extremes of which represent the corresponding CI. Publication bias was assessed using the funnel plot method and the Egger and Begg tests[19].

Results

Searches with selected keywords resulted in 386 abstracts. Only 34 abstracts were identified as appropriate for further assessment when inclusion criteria were considered. After the assessment of the 34 articles, 11 trials were excluded from the study. Studies were excluded for the following reasons: there were some interventions in three studies[20-22]; two studies were review[7,23]; only preterm infants were included[24]; the same subjects were included in two studies[25,26], so one[25] was excluded; there were no information about nonuser[27]; relation between pacifier use and breastfeeding problems were examined[28]; two groups (standard and WHO groups) were compared[29]; and outcome variable (duration of breastfeeding) was measured in continuous scale[30]. Of the remaining 23 eligible reports, 12 trials[9,10,31-40] reported weaning from exclusive breastfeeding and 19 trials[8-12,26,31,33-35,37,38,40-46] analyzed cessation of any breastfeeding status. The summary characteristics of trials meeting the criteria for inclusion are listed in Tables Ia and Ib.

No publication bias was detected in cases with exclusive breastfeeding. However, for any breastfeeding cases, publication bias was detected in univariate analysis with both the funnel plot and the Egger test ($p<0.001$), although the Begg test was non-significant ($p=0.064$). The funnel plot method and the Egger ($p<0.001$) and Begg ($p=0.008$) tests were statistically significant in multivariate analysis for any breastfeeding cases.

Summary risk ratio (SRR) for early weaning before six months of age in exclusive breastfeeding trails was 2.016 (95% CI: 1.619-2.511) for pacifier users compared with nonusers in studies with univariate analysis (Fig. 1a),

Table Ia. Characteristics of Included Trials with Exclusive Breastfed Infants for Meta-Analysis

Author	Publication Year	Location	Study type	No. of infants	Pacifier	Univariate Risk Ratio (95% CI)	Multivariate Risk Ratio (95% CI)	Confounders adjusted for in multivariate analysis*
Barros et al.[31]	1995	Brazil	Prospective	605	<1 mo	1.96 (1.50-2.54)		
Kelmanson et al.[34]	1999	Russia	Cross-sectional	192		1.81 (1.00-3.26)		9
Howard et al.[10]	1999	USA	Prospective	265	<6 wks		1.53 (1.15-2.05)	4, 8, 17, 18, 33
Riva et al.[38]	1999	Italy	Prospective	1365	<1 mo	1.42 (1.24-1.62)	1.35 (1.18-1.55)	9, 25
Aarts et al.[9]	1999	Sweden	Prospective	506	<1 mo	1.41 (1.11-1.81)	2.17 (1.53-3.09)	8, 9
Santiago et al.[39]	2003	Brazil	Prospective	101		4.76 (2.00-11.11)	4.35 (1.67-12.50)	2, 6, 7, 9, 30, 34, 39
Giovannini et al.[33]	2004	Italy	Prospective	2450	<1 mo		1.28 (1.13-1.45)	1, 2, 3, 4, 6, 8, 9, 13, 16, 19, 23, 24, 26, 35, 38, 40
Butler et al.[32]	2004	New Zealand	Prospective	1017	<6 wks	2.58 (1.92-3.46)	2.48 (1.79-3.44)	6, 12, 16, 22, 29, 31, 32
Scott et al.[40]	2005	Australia	Prospective	382	<1 mo		1.92 (1.39-2.64)	7, 8, 16, 17, 18, 33

Table Ia. (Cont'd)

Author	Publication Year	Location	Study type	No. of infants	Pacifier	Univariate risk ratio (95% CI)	Multivariate risk ratio (95% CI)	Confounders adjusted for in multivariate analysis*
Nelson et al.[37]	2005	Multicenter, 17 countries	Prospective	2884		2.16 (1.85-2.52)	1.85 (1.01-3.38)	5, 8, 9, 16, 18, 28
Mikiel-Kostyra et al.[36]	2005	Poland	Cross-sectional	898		2.49 (2.28-2.71)	2.38 (2.17-2.61)	8, 9, 11, 12, 16, 18
Merten et al.[35]	2005	Switzerland	Cross-sectional	2861			1.38 (1.25-1.52)	4, 8, 9, 12, 13, 15, 16, 21

Table Ib. Characteristics of Included Trials with Any Breastfed Infants for Meta-analysis

Author	Publication Year	Location	Study type	No. of infants	Pacifier	Univariate risk ratio (95% CI)	Multivariate risk ratio (95% CI)	Confounders adjusted for in multivariate analysis*
Victora et al.[8]	1993	Brazil	Cross-sectional	249	1 mo		3.00 (1.90-4.60)	1, 2, 9, 13, 34
Barros et al.[31]	1995	Brazil	Prospective	605	1 mo	3.84 (2.65-5.50)	2.87 (1.97-4.19)	9, 17, 41
Clements et al.[41]	1997	United Kingdom	Cross-sectional	511	last 2 wks	3.25 (2.29-4.33)	2.64 (1.81-3.84)	8, 9, 12, 14, 16, 28
Victora et al.[46]	1997	Brazil	Prospective	655	1 mo	4.02 (2.46-3.12)	2.37 (1.40-4.01)	1, 2, 8, 27, 36
Kelmanson et al.[34]	1999	Russia	Cross-sectional	192		3.09 (1.50-6.37)		
Howard et al.[10]	1999	USA	Prospective	265	6 wks		1.61 (1.19-2.19)	4, 8, 18, 21,33
Riva et al.[38]	1999	Italy	Prospective	1365	1 mo	1.30 (1.18-1.50)	1.18 (1.04-1.34)	9, 25
Aarts et al.[9]	1999	Sweden	Prospective	506	1 mo	2.28 (1.61-3.23)		
Kloeblen-Tarver[43]	2001	USA	Prospective	129		8.70 (3.10-25.00)		
Vogel et al.[26]	2001	New Zealand	Prospective	350	1 mo	1.71 (1.29-2.28)	1.91 (1.45-2.51)	12, 13, 8, 14, 16, 17, 18
Görbe et al.[12]	2002	Hungary	Prospective	356		10.32 (4.79-22.24)		
Binns et al.[11]	2002	Australia	Prospective	556	2 wks		2.50 (1.59-4.00)	1, 8, 9, 17
Levy et al.[44]	2002	USA	Prospective	1069	6 wks		1.67 (1.27-2.21)	1, 8, 9, 10, 11, 13, 16, 18, 21
Soares et al.[45]	2003	Brazil	Prospective	219		2.80 (1.60-4.70)	2.20 (1.30-3.80)	37

Table Ib. (Cont'd)

Author	Publication Year	Location	Study type	No. of infants	Pacifier	Univariate risk ratio (95% CI)	Multivariate risk ratio (95% CI)	Confounders adjusted for in multivariate analysis*
Giovannini et al.[33]	2004	Italy	Prospective	2450	1 mo		1.30 (1.15-1.46)	1, 2, 3, 4, 6, 8, 9, 13, 16, 19, 23, 24, 26, 35, 38, 40
Cunha et al.[42]	2005	Brazil	Prospective	500		1.80 (1.40-2.20)	1.90 (1.50-2.40)	8, 12, 20, 21, 42
Nelson et al.[37]	2005	Multicenter, 17 countries	Prospective	2884		2.14 (1.83-2.49)	4.41 (2.47-7.78)	5, 8, 9, 16, 18, 28
Scott et al.[40]	2005	Australia	Prospective	382	1 mo		1.92 (1.40-2.64)	7, 8, 16, 18, 17, 33
Merten et al.[35]	2005	Switzerland	Cross-sectional	2861			1.61 (1.41-1.85)	4, 8, 9, 12, 13, 15, 16, 21

*Multivariate adjustments: 1, infant gender; 2, birth weight; 3, birth length; 4, type of delivery; 5, multiple birth; 6, parity; 7, planned pregnancy; 8, maternal age; 9 maternal education; 10, paternal age; 11, paternal education; 12, employment status of the parents; 13, factors related to socioeconomic status; 14, marital status; 15, nationality; 16, infant exposure to tobacco smoke (prenatal or postpartum); 17, presence of breastfeeding problems; 18, parents' attitude towards breastfeeding; 19, mothers having been breastfed; 20, prenatal care quality; 21, medical problems before, during, and after delivery; 22, infant discharged from hospital same time as mother; 23, time at initiation of breastfeeding; 24, pacifier use at hospital ward; 25, formula supplements in the maternity ward; 26, formula promotion at discharge; 27, breastfeeding at hospital discharge; 28, mother sharing bed with infant; 29, infant sleeps in parental room at night; 30, use of oral contraceptive; 31, home visit post-birth; 32, use regular child care; 33, plans to return work and age of infant when mother returned to work; 34, age at introduction of bottle-feeding; 35, time at introduction of formula or solid foods; 36, breastfeeding on demand or schedule; 37, type of breastfeeding at 1 month of age; 38, weight at age 1 month; 39, weight at 4 months; 40, child sleeps 6 h at night; 41, BMI; 42, knowledge about the lactation centers; 43, current pregnancy status at the first and at 6 months.

and 1.792 (95% CI: 1.452-2.212) in studies with multivariate analysis (Fig. 1b, Table II). Similar to exclusive breastfeeding trails, pacifier usage compared with nonusers increased the risk of cessation of any breastfeeding in both univariate (SRR: 2.760, 95% CI: 2.083-3.657) and multivariate (SRR: 1.952, 95% CI: 1.662-2.293) trials (Fig. 1c, Fig. 1d, Table II).

We wished to determine if cross-sectional studies gave larger estimates of change in the duration of breastfeeding with pacifier use than cohort trails. When meta-analysis was repeated with cohort studies, similar results were obtained (Table III).

Table III presents the pooled effect estimates for studies that compared outcomes for pacifier use before four or six weeks vs. never pacifier use or after four or six weeks. Interestingly, with postponing age for pacifier initiation to four or six weeks of age, the risk of early weaning or cessation of breastfeeding declined.

Discussion

This meta-analysis indicates that pacifier use is associated with a two times increased risk of early weaning and cessation of breastfeeding. The estimated effect for any breastfeeding infants was of the same magnitude and statistically significant for exclusive breastfeeding infants. This difference between pacifier users and nonusers was observed in both cross-sectional and cohort trials. The proposed mechanism for the relationship between reduced breastfeeding and pacifier use is that when infants are using pacifiers they tend to suck on the breast less, and as a result this reduces the milk supply, subsequently ending breastfeeding[9,28].

This meta-analysis should be interpreted within the context of some limitations. First, any meta-analysis is subject to publication bias. Although we used an extensive search strategy for finding published trials, we did not attempt to identify unpublished trials. Second, a meta-analysis is limited by the quantity and quality of existing data. The methodologies of the included studies were different. We do not have the ability to make thorough cross-study checks that can be done using the raw data. Further, there was no unique definition of breastfeeding types in trails. Finally, all meta-analyses contain heterogeneity. The statistically significant heterogeneity among the studies

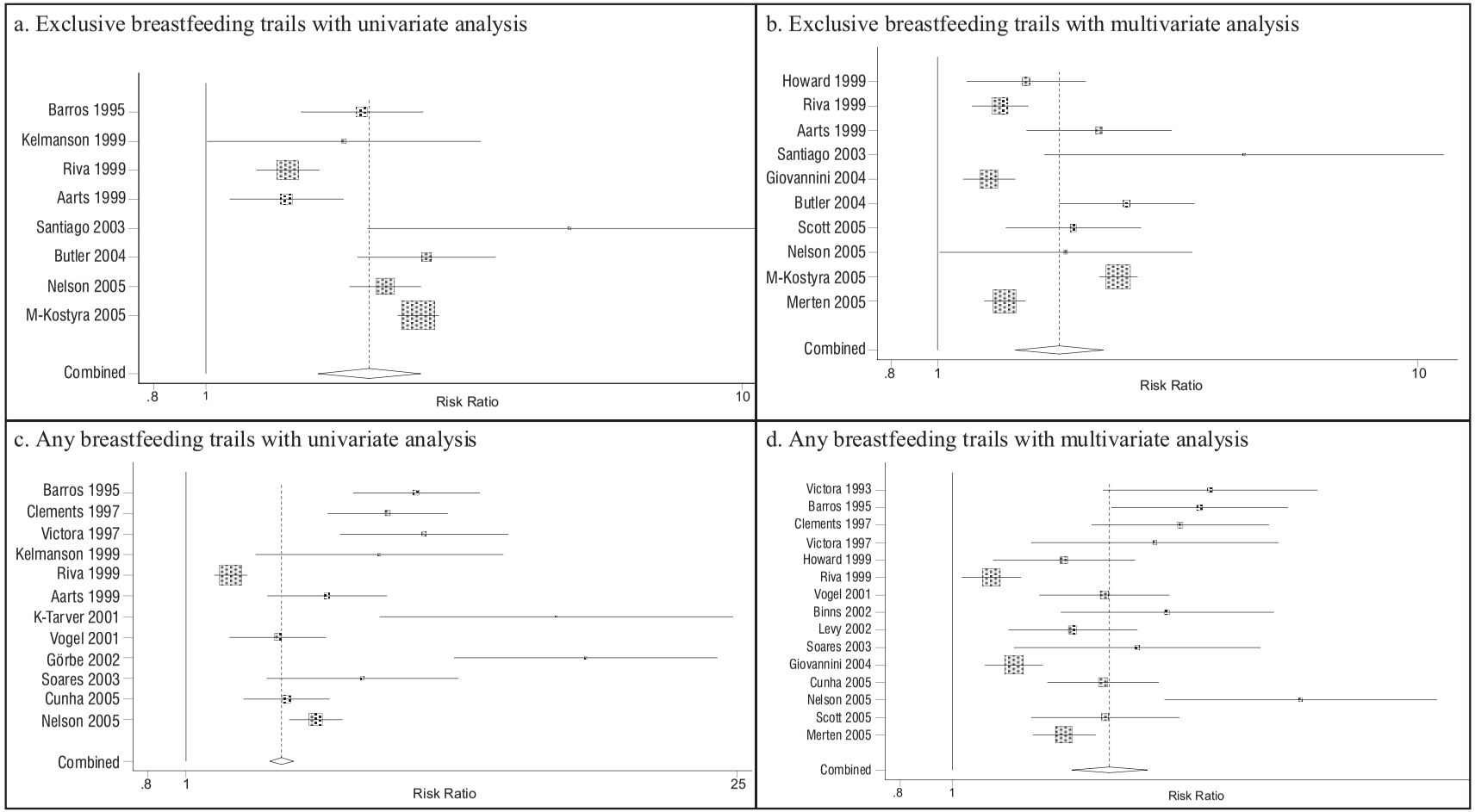

Fig. 1. Forest plot of the studies for risk of early weaning with pacifier use [Odds ratios and 95% confidence intervals (CI) for early weaning from exclusive (a,b) and any (c,d) breastfeeding comparing ever-pacifier-used with never-pacifier-used infants in univariate (a,c) and multivariate (b,d) studies. The study authors and year of publication are indicated on the y-axis. The box for each study is proportional to the inverse of the variance; horizontal lines show 95% CIs of the odds ratios. The pooled estimate is based on a random-effects model shown by a dashed vertical line and diamond (95% CI).

Table II. Pacifier Use and Risk of Early Weaning in Cases with Exclusive Breastfeeding or Cessation of Breastfeeding in Cases with Any Breastfeeding in Trails with Univariate and Multivariate Analysis

Breastfeeding status	Type of estimate	No. of studies	Test for heterogeneity Q	Summary risk ratio (95% CI)	z
Exclusive	Univariate	8	62.245*	2.016 (1.619-2.511)	6.263*
	Multivariate	10	110.961*	1.792 (1.452-2.212)	5.430*
Any	Univariate	12	120.556*	2.760 (2.083-3.657)	7.073*
	Multivariate	15	80.138*	1.952 (1.662-2.293)	8.144*

*p<0.001.

Table III. Results of Meta-Analysis for Only Prospective Cohort Studies According to Pacifier Introduction Time

	Pacifier introduction time	Type of estimate	No. of studies	Test for heterogeneity Q	Summary risk ratio (95% CI)	z
Exclusive Breastfeeding	≤1 month	Univariate	3	4.776	1.546 (1.282-1.865)	4.560*
		Multivariate	4	11.928*	1.539 (1.261-1.879)	4.240*
	≤6 weeks	Univariate	4	16.228*	1.751 (1.347-2.277)	4.179*
		Multivariate	6	23.466*	1.664 (1.366-2.027)	5.061*
	All	Univariate	6	31.765*	1.941 (1.524-2.471)	5.380*
		Multivariate	8	29.060*	1.740 (1.430-2.118)	5.526*
Any Breastfeeding	≤1 month	Univariate	5	55.046*	2.322 (1.471-3.665)	3.617*
		Multivariate	7	41.183*	1.814 (1.427-2.307)	4.857*
	≤6 weeks	Univariate	5	55.046*	2.322 (1.471-3.665)	3.617*
		Multivariate	9	43.099*	1.758 (1.449-2.133)	5.723*
	All	Univariate	10	105.410*	2.681 (1.983-3.623)	6.413*
		Multivariate	12	63.536*	1.900 (1.576-2.291)	6.727*

*p<0.001.

forced us to use random effects model. To minimize bias during trial selection, we used predetermined inclusion criteria and we took all studies with any breastfed infants and repeated meta-analysis in cohort studies.

Several factors might affect breastfeeding duration; however, limited trails were controlled for these confounding factors. Maternal age, education, social status, unrestricted mother–infant contact and frequent feeding are associated with the duration of breastfeeding, as well as psychosocial factors such as intention to breastfeed, self-efficacy and confidence concerning breastfeeding, and earlier experiences with breastfeeding[28,47-50]. The Baby-Friendly Hospital Initiative is a useful guide to increase rates of exclusive breastfeeding, but continuing support is needed to prevent a decline in an initially high breastfeeding rate[35]. Breastfeeding duration was negatively associated with breastfeeding difficulties in the first four weeks, maternal smoking, introduction of a pacifier, and early return to work[40]. In this study with further meta-analyses, there was no evidence that effects estimates differed according to study design (adjusted or unadjusted for some confounding factors). Similarly, Aarts et al.[9] found that adjusting for mothers' age and education level had no impact on findings, while Howard et al.'s[10] analysis was based on a model that had considered many possible predictors of breastfeeding (including maternal age, parental education, social class and breastfeeding preferences), but found use of pacifiers to be a significant factor independent of these.

Pacifiers provide some beneficial effects including management of discomfort during painful procedures as determined by reductions in crying and other validated measures. Two recent meta-analyses have shown that pacifier use in the last sleep is associated with a reduced risk of sudden infant death syndrome (SIDS)[51,52]. However, breastfeeding is also associated with a reduced risk of SIDS[53-55]. Breastfed infants have more arousals than bottle-fed infants, which may explain a possible protective effect[56]. In addition, breastfeeding reduces infection, which could also be the protective mechanism[16].

Even if the recommendation to breastfeed is not included in the specific SIDS-prevention advice, it should be included in the general advice, as it reduces morbidity and mortality in infants even in developed countries. Furthermore, links have been made between pacifier sucking and the risks of suffering from otitis media[3] and gastrointestinal problems[57], increased reporting of wheezing, earache, possetting and diarrhea[58]. Adults who had used a pacifier in infancy were found to have a significantly lower intelligence score than those who had not[59].

One randomized, controlled trial found that early pacifier users (2-5 days at introduction) were slightly less likely to be exclusively breastfed at one month compared with nonusers[10]. It was suggested that pacifier introduction after one month of age was not detrimental to breastfeeding duration. Similarly, this meta-analysis suggests that pacifier use may have a significant effect on breastfeeding duration in term infants, and initiation of pacifier use after 4-6 weeks is associated with greater reductions in risk of early weaning or cessation of breastfeeding.

The benefits of breastfeeding in infants tend to increase with longer duration of breastfeeding. However, the use of pacifiers (dummies) has been associated with shortened duration of breastfeeding. Parents should be informed of the link between pacifier use and shortened breastfeeding duration in order to help them make informed decisions about their children's care.

REFERENCES

1. World Health Organization, Division of Child Health and Development. Evidence for the Ten Steps to Successful Breastfeeding. Geneva, Switzerland: World Health Organization; 1998.
2. American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome. The changing concept of sudden infant death syndrome: diagnostic coding shifts, controversies regarding the sleeping environment, and new variables to consider in reducing risk. Pediatrics 2005; 116: 1245-1255.
3. Niemela M, Uhari M, Mottonen M. A pacifier increases the risk of recurrent otitis media in children in daycare centres. Pediatrics 1995; 96: 884-888.
4. Viggiano D, Fasano D, Monaco G, Strohmenger L. Breast feeding, bottle feeding, and non-nutritive sucking: effects on occlusion in deciduous dentition. Arch Dis Child 2004; 89: 1121-1123.
5. Peres KG, Barros AJ, Peres MA, Victora CG. Effects of breastfeeding and sucking habits on malocclusion in a birth cohort study. Rev Saude Publica 2007; 41: 343-350.
6. Stone KN, Fleming P, Golding J, The ALSPAC Study Team. Socio-demographic associations with digit and pacifier sucking at 15 months of age and possible associations with infant infection. Early Hum Dev 2000; 60: 137-148.
7. Ullah S, Griffiths P. Does the use of pacifiers shorten breastfeeding duration in infants? Br J Community Nurs 2003; 8: 458-463.
8. Victora CG, Behague DP, Barros FC, Olinto MT, Weiderpass E. Pacifier use and short breastfeeding duration: cause, consequence, or coincidence? Pediatrics 1997; 99: 445-453.
9. Aarts C, Hornell A, Kylberg E, Hofvander Y, Gebre-Medhin M. Breastfeeding patterns in relation to thumb sucking and pacifier use. Pediatrics 1999; 104: E50.
10. Howard CR, Howard FM, Lanphear B, deBlieck EA, Eberly S, Lawrence RA. The effects of early pacifier use on breastfeeding duration. Pediatrics 1999; 103: E33.
11. Binns CW, Scott JA. Using pacifiers: what are breastfeeding mothers doing? Breastfeed Rev 2002; 10: 21-25.
12. Gorbe E, Kohalmi B, Gaal G, et al. The relationship between pacifier use, bottle feeding and breast feeding. J Matern Fetal Neonatal Med 2002; 12: 127-131.
13. Oddy WH, Kendall GE, Blair E, et al. Breast feeding and cognitive development in childhood: a prospective birth cohort study. Paediatr Perinat Epidemiol 2003; 17: 81-90.
14. Harder T, Bergmann R, Kallischnigg G, Plagemann A. Duration of breastfeeding and risk of overweight: a meta-analysis. Am J Epidemiol 2005; 162: 397-403.
15. Owen CG, Martin RM, Whincup PH, Davey Smith G, Cook DG. Effect of infant feeding on the risk of obesity across the life course: a quantitative review of published evidence. Pediatrics 2005; 115: 1367-1377.
16. Howie PW. Protective effect of breastfeeding against infection in the first and second six months of life. Adv Exp Med Biol 2002; 503: 141-147.
17. Schack-Nielsen L, Larnkjaer A, Michaelsen KF. Long term effects of breastfeeding on the infant and mother. Adv Exp Med Biol 2005; 569: 16-23.
18. World Health Organization. Indicators for Assessing Breastfeeding Practices. Geneva, Switzerland: WHO/CDD/SER91; 1991.
19. Egger M, Smith GD, Altman DG. Systematic Reviews in Health Care: Meta-Analysis in Context (2nd ed). London: BMJ Publishing Group; 2001.
20. Kramer MS, Barr RG, Dagenais S, et al. Pacifier use, early weaning, and cry/fuss behavior: a randomized controlled trial. JAMA 2001; 286: 322-326.
21. Howard CR, Howard FM, Lanphear B, et al. Randomized clinical trial of pacifier use and bottle-feeding or cupfeeding and their effect on breastfeeding. Pediatrics 2003; 111: 511-518.
22. Benis MM. Are pacifiers associated with early weaning from breastfeeding? Adv Neonatal Care 2002; 2: 259-266.
23. Lamounier JA. The influence of nipples and pacifiers on breastfeeding duration. J Pediatr (Rio J) 2003; 79: 284-286.

24. Collins CT, Ryan P, Crowther CA, McPhee AJ, Paterson S, Hiller JE. Effect of bottles, cups, and dummies on breast feeding in preterm infants: a randomised controlled trial. BMJ 2004; 329: 193-198.
25. Vogel A, Hutchison BL, Mitchell EA. Factors associated with the duration of breastfeeding. Acta Paediatr 1999; 88: 1320-1326.
26. Vogel AM, Hutchison BL, Mitchell EA. The impact of pacifier use on breastfeeding: a prospective cohort study. J Paediatr Child Health 2001; 37: 58-63.
27. Marques NM, Lira PI, Lima MC, et al. Breastfeeding and early weaning practices in northeast Brazil: a longitudinal study. Pediatrics 2001; 108: E66.
28. Righard L. Are breastfeeding problems related to incorrect breastfeeding technique and the use of pacifiers and bottles? Birth 1998; 25: 40-44.
29. Schubiger G, Schwarz U, Tonz O. UNICEF/WHO baby-friendly hospital initiative: does the use of bottles and pacifiers in the neonatal nursery prevent successful breastfeeding? Neonatal Study Group. Eur J Pediatr 1997; 156: 874-877.
30. Hornell A, Aarts C, Kylberg E, Hofvander Y, Gebre-Medhin M. Breastfeeding patterns in exclusively breastfed infants: a longitudinal prospective study in Uppsala, Sweden. Acta Paediatr 1999; 88: 203-211.
31. Barros FC, Victora CG, Semer TC, Tonioli Filho S, Tomasi E, Weiderpass E. Use of pacifiers is associated with decreased breast-feeding duration. Pediatrics 1995; 95: 497-499.
32. Butler S, Williams M, Tukuitonga C, Paterson J. Factors associated with not breastfeeding exclusively among mothers of a cohort of Pacific infants in New Zealand. N Z Med J 2004; 117: U908.
33. Giovannini M, Riva E, Banderali G, et al. Feeding practices of infants through the first year of life in Italy. Acta Paediatr 2004; 93: 492-497.
34. Kelmanson IA. Use of a pacifier and behavioural features in 2-4-month-old infants. Acta Paediatr 1999; 88: 1258-1261.
35. Merten S, Dratva J, Ackermann-Liebrich U. Do baby-friendly hospitals influence breastfeeding duration on a national level? Pediatrics 2005; 116: E702-708.
36. Mikiel-Kostyra K, Mazur J, Wojdan-Godek E. Factors affecting exclusive breastfeeding in Poland: cross-sectional survey of population-based samples. Soz Praventivmed 2005; 50: 52-59.
37. Nelson EA, Yu LM, Williams S; International Child Care Practices Study Group Members. International Child Care Practices study: breastfeeding and pacifier use. J Hum Lact 2005; 21: 289-295.
38. Riva E, Banderali G, Agostoni C, Silano M, Radaelli G, Giovannini M. Factors associated with initiation and duration of breastfeeding in Italy. Acta Paediatr 1999; 88: 411-415.
39. Santiago LB, Bettiol H, Barbieri MA, Guttierrez MR, Del Ciampo LA. Promotion of breastfeeding: the importance of pediatricians with specific training. J Pediatr (Rio J) 2003; 79: 504-512.
40. Scott JA, Binns CW, Oddy WH, Graham KI. Predictors of breastfeeding duration: evidence from a cohort study. Pediatrics 2006; 117: 646-655.
41. Clements MS, Mitchell EA, Wright SP, Esmail A, Jones DR, Ford RP. Influences on breastfeeding in southeast England. Acta Paediatr 1997; 86: 51-56.
42. Cunha AJ, Leite AM, Machado MM. Breastfeeding and pacifier use in Brazil. Indian J Pediatr 2005; 72: 209-212.
43. Kloeblen-Tarver AS. Pacifier use is associated with shorter breastfeeding duration among low-income women. Pediatrics 2001; 108: 526.
44. Levy SM, Slager SL, Warren JJ, Levy BT, Nowak AJ. Associations of pacifier use, digit sucking, and child care attendance with cessation of breastfeeding. J Fam Pract 2002; 51: 465.
45. Soares ME, Giugliani ER, Braun ML, Salgado AC, de Oliveira AP, de Aguiar PR. Pacifier use and its relationship with early weaning in infants born at a Child-Friendly Hospital. J Pediatr (Rio J) 2003; 79: 309-316.
46. Victora CG, Tomasi E, Olinto MT, Barros FC. Use of pacifiers and breastfeeding duration. Lancet 1993; 341: 404-406.
47. Anderson GC, Moore E, Hepworth J, Bergman N. Early skin-to-skin contact for mothers and their healthy newborn infants. Cochrane Database Syst Rev 2003; CD003519.
48. Kronborg H, Vaeth M. The influence of psychosocial factors on the duration of breastfeeding. Scand J Public Health 2004; 32: 210-216.
49. Renfrew MJ, Lang S, Martin L, Woolridge MW. Feeding schedules in hospitals for newborn infants. Cochrane Database Syst Rev 2000; CD000090.
50. Scott JA, Binns CW. Factors associated with the initiation and duration of breastfeeding: a review of the literature. Breastfeed Rev 1999; 7: 5-16.
51. Hauck FR, Omojokun OO, Siadaty MS. Do pacifiers reduce the risk of sudden infant death syndrome? A meta-analysis. Pediatrics 2005; 116: 716-723.
52. Mitchell EA, Blair PS, L'Hoir MP. Should pacifiers be recommended to prevent SIDS? Pediatrics 2006; 117: 1755-1758.
53. Alm B, Wennergren G, Norvenius SG, et al. Breast feeding and the sudden infant death syndrome in Scandinavia, 1992-95. Arch Dis Child 2002; 86: 400-402.
54. Hoffman HJ, Damus K, Hillman L, et al. Risk factors for SIDS. Results of the National Institute of Child Health and Human Development SIDS Cooperative Epidemiological Study. Ann N Y Acad Sci 1988; 533: 13-30.
55. McVea KL, Turner PD, Peppler DK. The role of breastfeeding in sudden infant death syndrome. J Hum Lact 2000; 16: 13-20.
56. Horne RS, Parslow PM, Ferens D, et al. Comparison of evoked arousability in breast and formula fed infants. Arch Dis Child 2004; 89: 22-25.
57. Orenstein SR. Effect of non-nutritive sucking on infant gastroesophageal reflux. Pediatr Res 1988; 24: 38-40.
58. The ALSPAC Study Team, North K, Fleming P, Golding J. Pacifier use and morbidity in the first 6 months of life. Pediatrics 1999; 103: E34.
59. Gale C, Martin CN. Breastfeeding, pacifier use and adult intelligence. Lancet 1996; 347: 1072-1075.