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Risk Factors for Discontinuing Breastfeeding in Southern Brazil: A Survival Analysis

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Abstract To identify risk factors for discontinuing breastfeeding during an infant's first year of life. A cohort study recruited mothers in a hospital in São Leopoldo, Brazil, which mainly serves the low-income population. In order to obtain socioeconomic, environmental, and behavioral information, face-to-face interviews with mothers were conducted after birth, and when their infants were 6 and 12 months old. The duration of breastfeeding was investigated at 6 and 12 months, and recorded separately for each month. Depressive symptoms were assessed using the Beck Depression Inventory. The multivariate model for predicting the discontinuation of breastfeeding, adjusted Kaplan–Meier survival curves and Cox regression were used. Of the 360 participants, 201 (55.8%) discontinued breastfeeding within the first 12 months. A multivariate Cox regression model revealed that symptoms of maternal depression (low levels: RR = 1.59, 95% CI 1.02–2.47; moderate to severe: RR = 2.03, 95% CI 1.35–3.01), bottle feeding (RR = 2.07, 95% CI 1.31–3.28) and pacifier use in the first month of life (RR = 3.12, 95% CI 2.13–4.57) were independently associated with the outcomes after adjusting for confounders. Breastfeeding cessation rates were lower for children who did not use bottle feeding or a pacifier in the first month of life and for the children whose mothers presented with minimal depression. Early pacifier use and bottle feeding must be strongly discouraged to support long-term breastfeeding. In addition, screening maternal depression at a primary care service can be a step forward in promoting a longer duration of breastfeeding.

Keywords Breast feeding · Behavior · Infant · Depression

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Introduction

International guidelines recommend that women breastfeed their infants exclusively for the first 6 months and continue breastfeeding into the second year of the child's life or even longer [1]. The Brazilian Ministry of Health, supported by the Pan American Health Organization, has established breastfeeding and healthy weaning as a public health priority [2]. In 2008, a national survey was conducted in Brazil to investigate the prevalence of breastfeeding during the first year of life, based on a sample of 34,366 infants. The results showed that 58.7% of 9–12-month-old children had been breastfed the day before the interview [3]. Epidemiological evidence shows that breastfeeding is associated with a lower frequency of infant mortality and infectious disease, besides also having an effect on the vascular system [4–7]. In addition, there is a significant association between shorter breastfeeding duration and developmental delays [8]. Therefore, the

knowledge of risk factors associated with cessation of breastfeeding during the first year of life is necessary to promote prolonged breastfeeding.

Successful breastfeeding depends on multiple factors related to the mother and the infant and on a supportive environment [9–11]. Among the variables related to the mother, depressive symptomatology in the early postpartum period has been hypothesized as a factor associated with decreased breastfeeding duration and increased breastfeeding difficulties [12]. Additionally, worldwide recommendations discourage introducing breastfed infants to artificial nipples, such as pacifiers or bottles. However, the effects of such exposure have only recently been rigorously and scientifically evaluated [13]. In fact, most studies were cross-sectional in nature, or did not continue to the end of the child's first year of life. The identification and quantification of risk factors for breastfeeding cessation in different populations is essential for designing strategies that effectively promote breastfeeding.

This cohort study was part of a larger study, which was conducted to assess the impact of home visits for advising mothers about breastfeeding and weaning on children's feeding practices and general health in the early years of life. The present study aimed to identify risk factors associated with discontinued breastfeeding in the first year of life and included some variables that have received little attention, such as the child's age at the eruption of the first primary tooth and maternal depressive symptoms.

Materials and Methods

Subjects and Study Design

This cohort study was carried out within a randomized trial that investigated the effectiveness of nutritional advice about breastfeeding and healthy weaning, based on WHO [14] recommendations, in the city of São Leopoldo, located in the state of Rio Grande do Sul, in the south of Brazil, which has a population of about 200,000. Mother-and-child pairs were recruited in the maternity wards of the town's hospital, which mainly serves a low-income population. The sample size was calculated considering the main objective of the major project—improvement in the duration of exclusive breastfeeding. A sample of 353 infants was estimated to detect a 65% increase in the frequency of exclusive breastfeeding in the intervention group (80% power and α of 0.05), and a 21.6% frequency of exclusive breastfeeding up to 4 months in the control group [15]. To allow for losses of 25% during follow up, 500 mothers were recruited at the outset of the trial. The results of the main study have been previously published and demonstrated the effectiveness of the intervention in increasing the duration of breastfeeding [16]. The present study investigated risk factors for discontinuing breastfeeding.

From October 2001 to June 2002, all mothers who gave birth to a single and apparently normal baby, full-term (>37 weeks) and with a normal birth-weight (≥2,500 g), and who did not have an impediment to breastfeeding (i.e., HIV/AIDS), were invited to participate in the larger study. After being informed of the research procedures, 90% of them agreed to participate.

Research Assessment Questionnaires

Sixteen fieldworkers conducted face-to-face structured interviews with the mothers after birth (at the hospital) and 6 and 12 months later (at the mothers' homes). After birth, the following variables were collected: maternal age, child sex, birth order, birth height, and weight.

At the six-month interviews, the following socioeconomic, environmental and behavioral variables were investigated: mother's education (number of years at school), mother's work status, family income per capita, family structure, number of people living in the home, smokers in the house, bottle feeding and pacifier use in the first month of life. The mother was then asked about the child's age (in months) at the eruption of the first primary tooth. Family structure was considered either nuclear (child living with mother and father) or non-nuclear (child not living with both parents). The family income per capita was calculated by dividing the family's per capita monthly wage by the current Brazilian minimum wage (BMW: about US $100.00/month).

During the 12-month evaluation, depressive symptoms were assessed using the Beck Depression Inventory (BDI) [17], and only a sub-sample of mothers was investigated due to financial costs. The BDI is a self-assessment of depression over the preceding 2 weeks. It was not designed to generate a diagnosis but to screen for depressive symptoms in non-diagnosed populations or to identify the intensity of diagnosed depressive episodes. This variable was collected 12 months after birth to detect possible underlying maternal pathology rather than mental illness directly related to postpartum. The intensity of depressive symptoms was classified according to the obtained score: 0–11, minimal depression; 12–19, mild depression; 20–35, moderate depression; and 36–63, severe depression. The instrument has been translated into Portuguese, and the translated version has been validated [18]. In this study, the final score was categorized as minimal (<12), low (12–19) and moderate to severe (>19).

Assessment of Total Breastfeeding Duration

Between 6 and 12 months, the structured face-to-face interviews investigated the duration of breastfeeding on a

month-by-month basis. The outcome of the present study was the time (in months) until breastfeeding ceased. Mothers who breastfed their children after 12 months were considered censored cases.

The questionnaire on socioeconomic variables and dietary practices was tested in a pilot study of 16 mothers with children aged 12 months who received primary care services, and it was modified as needed. To eliminate the possibility of a selection bias, the mothers who completed the BDI were compared with those mothers who did not, in terms of socioeconomic and demographic characteristics and breastfeeding outcomes.

Ethical Aspects

The Ethical Committee of the Federal University of Rio Grande do Sul approved the study. Parents gave written consent for the various research procedures. All children received routine assistance from their pediatricians. At the 12-month assessment, all children received nutritional evaluations (anthropometric measurements and blood hemoglobin measurement), child development and dental examinations, and their dwellings were assessed for risk factors for childhood injuries.

After the 12-month assessment, all mothers received advice on diet, hygiene and the prevention of childhood injuries. Children with dental caries were referred for pediatric dental treatment, and children presenting anemia, overweight, malnourishment, poor growth or developmental problems were referred to their primary care doctors for further assessment and treatment. Mothers who reported depressive symptoms were referred for psychological assistance.

Statistical Analysis

The main characteristics of children who were breastfed versus those children whose breastfeeding had stopped over the follow-up period are reported as percentages. Cox proportional hazards analysis was used to evaluate univariate and multivariate associations between the characteristics at the study entry and at the time that breastfeeding stopped. The duration of breastfeeding was based on the month during which breastfeeding ceased. Data were analyzed using SPSS 13.0 statistical software (SPSS Inc, Chicago, IL).

To minimize the reverse causality bias between pacifier use and the outcome (i.e., pacifier use could be a consequence of breastfeeding cessation), only mothers who were still breastfeeding their child at the end of the first month were analyzed ($n = 360$). All variables associated with the discontinuation of breastfeeding that had P values ≤ 0.10 were considered potential confounders, and were included in the multivariate model predicting breastfeeding cessation. Variables that did not contribute to the model fit ($P \geq 0.10$) were removed from the final model with a backward selection algorithm. A two-tailed P value of less than 0.05 was considered statistically significant. Because the duration of breastfeeding may increase with dietary counseling, the variable "group" (intervention vs. control) was included in the final model independent of its statistical significance. Adjusted survival curves for the duration of breastfeeding, stratified by different risk factors, were also presented.

Comparisons between mothers who completed the BDI and those who did not in terms of per capita income, age in years, years of education, and the duration they breastfed their children, were also performed using Chi-squared and t tests for independent samples.

Results

Of the 360 participants, 201 (55.8%) discontinued breastfeeding before 12 months. The rate of breastfeeding in 6-month-olds was 56.4%. The average and median times estimated for breastfeeding were 7.9 and 10.0 months, respectively.

Socio-demographic and behavior characteristics of the total sample ($n = 360$) and of children for whom breastfeeding was discontinued (event, $n = 201$) are shown in Table 1. In the univariate Cox regression model, maternal depressive symptoms (moderate to severe symptoms: RR = 2.47, 95% CI 1.64–3.70), bottle feeding in the first month (RR = 2.46, 95% CI 1.72–3.52) and pacifier use in the first month (RR = 3.48, 95% CI 2.56–4.72) were significantly associated with breastfeeding cessation. The age at the eruption of the first primary tooth was not associated with the outcome ($P = 0.506$), as hypothesized.

In the multivariate Cox regression model, maternal depressive symptomatology (low levels of depressive symptoms: RR = 1.59, 95% CI 1.02–2.47; moderate to severe depressive symptoms: RR = 2.03, 95% CI 1.35–3.01), bottle feeding in the first month (RR = 2.07, 95% CI 1.31–3.28) and pacifier use in the first month (RR = 3.12, 95% CI 2.13–4.57) were independently associated with the outcome, even after adjusting for potential confounders (Table 2).

Survival curves (Figs. 1, 2, 3) showed significant differences in breastfeeding cessation rates for pacifier and bottle use and maternal depressive symptoms. Breastfeeding cessation rates were lower for children who did not use a bottle or pacifier in the first month and for children whose mothers presented minimal depression levels.

A sensitivity analysis was performed to investigate the effect of re-including mothers who had interrupted breastfeeding before the end of the first month. The

Table 1 Characteristics of the studied sample ($N = 360$) and of the children whose breastfeeding was discontinued in the first year of life (event) ($N = 201$)

Variables	Whole sample		Event		*P**	RR** (95% CI)
	n	%	*n*	%		
Group					0.066	
Intervention	152	42.2	77	50.7		1.00
Control	208	57.8	124	59.6		1.30 (0.98–1.73)
Gender					0.437	
Male	207	57.5	114	55.1		1.00
Female	153	42.5	87	56.9		1.12 (0.84–1.48)
Maternal schooling (years)					0.286	
<4	36	10.1	16	44.4		1.00
4–8	223	62.3	130	58.3		1.48 (0.88–2.50)
>8	99	27.7	55	55.6		1.37 (0.78–2.39)
Maternal work status at children aged 6 months					0.986	
Yes	121	34.2	69	57.0		1.00 (0.75–1.34)
No	233	65.8	128	54.9		1.00
Per capita income (minimum wage)					0.841	
<0.5	117	33.7	66	56.4		1.00
0.5–1.0	164	47.3	87	53.0		0.91 (0.66–1.26)
>1.0	66	19.0	37	56.1		0.99 (0.66–1.48)
Family structure					0.238	
Nuclear	259	73.0	139	53.7		1.21 (0.89–1.64)
Non-nuclear	96	27.0	58	60.4		1.00
Number of people at the house					0.603	
<4	92	25.8	50	54.3		1.00
4–5	191	53.7	103	53.9		1.01 (0.72–1.42)
>5	73	20.5	45	61.6		1.20 (0.80–1.80)
Only child					0.222	
Yes	128	35.7	77	60.2		1.20 (0.90–1.59)
No	231	64.3	124	53.7		1.00
Maternal age at birth (years)					0.448	
<18	294	81.9	162	55.1		1.00
>18	65	18.1	39	60.0		1.15 (0.81–1.63)
Maternal depression					<0.001	
Minimal	149	62.1	73	49.0		1.00
Low	47	19.6	29	61.7		1.45 (0.94–2.23)
Moderate to severe	44	18.3	35	79.5		2.47 (1.64–3.70)
Birth height (cm)					0.924	
<49	172	48.6	93	54.1		1.01 (0.77–1.34)
≥49	182	51.4	103	56.6		1.00
Birth weight (g)					0.781	
<2,800	36	10.2	20	55.6		1.07 (0.67–1.70)
≥2,800	318	89.8	176	55.3		1.00
Smokers at the house					0.166	
Yes	145	40.6	87	60.0		1.22 (0.92–1.61)
No	212	59.4	112	52.8		1.00
Bottle-feed user at 1 month					<0.001	
No	309	86.8	164	53.1		1.00
Yes	47	13.2	37	78.7		2.46 (1.72–3.52)

Table 1 continued

Variables	Whole sample		Event		*P**	RR** (95% CI)
	n	%	*n*	%		
Pacifier user at 1 month					<0.001	
No	173	38.4	61	35.3		1.00
Yes	185	61.6	138	74.6		3.48 (2.56–4.72)
Age of eruption of the first primary tooth (months)					0.506	
<4	11	3.1	7	63.6		1.31 (0.61–2.78)
≥4	348	96.9	193	55.5		1.00

* Long-rank test to compare Kaplan–Meier survival curves

** Unadjusted relative risks; univariate Cox proportional hazards analysis

Table 2 Adjusted relative risks (and 95% confidence interval) for interruption of breastfeeding at 1 year

	RR* (95% CI)	*P* value
Maternal depression symptoms		
Minimal	1.00	
Low	1.59 (1.02–2.47)	0.039
Moderate to severe	2.03 (1.35–3.01)	0.001
Bottle feed user at 1 month		
No	1.00	
Yes	2.07 (1.31–3.28)	0.002
Pacifier user at 1 month		
No	1.00	
Yes	3.12 (2.13–4.57)	<0.001

* Final model; relative risks adjusted for the other variables in the model and for group of the child

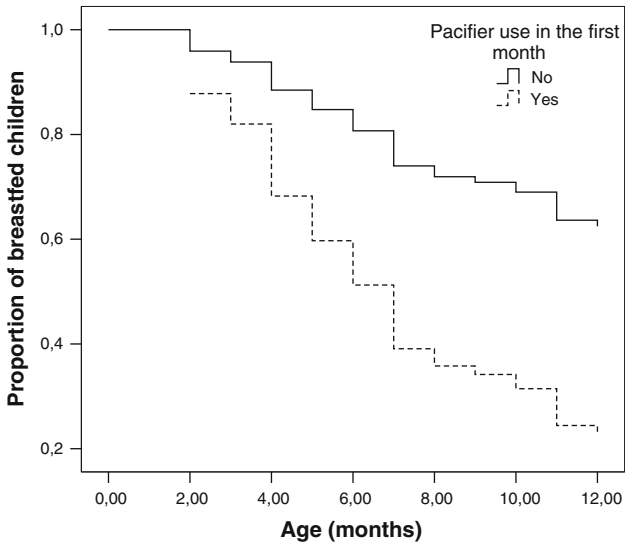

Fig. 1 Adjusted survival curve of the time of cessation of breastfeeding stratified by pacifier use in the first month of life

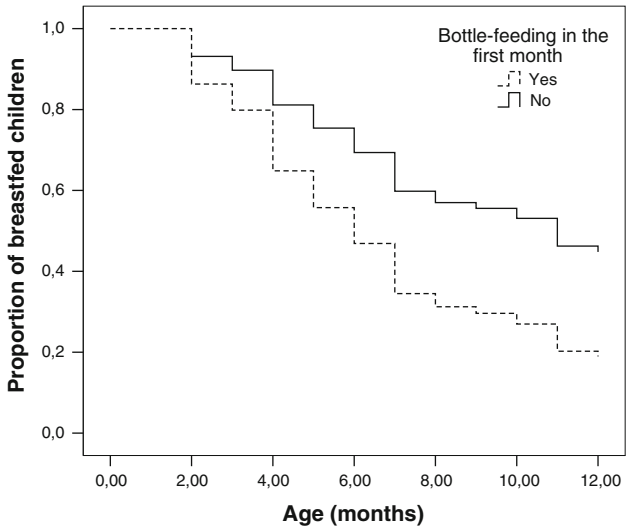

Fig. 2 Adjusted survival curve of the time of cessation of breastfeeding stratified by bottle feeding use in the first month of life

variables significantly associated with interruption of breastfeeding (final model) were unchanged. The relative risks for moderate to severe and for low maternal depressive symptoms were 1.87 (95% CI, 1.25–2.79; $P = 0.002$) and 1.64 (95% CI, 1.08–2.49; $P = 0.020$), respectively; the relative risks for bottle-feeding and pacifier use at 1 month were 2.70 (95% CI, 1.79–4.06; $P < 0.001$) and 2.97 (95% CI, 2.06–4.30; $P < 0.001$), respectively.

No difference was found between mothers whose depressive symptoms were assessed and those mothers without depression data regarding per capita income in US dollars (assessed for depression: 61.1 ± 43; others: 57.0 ± 45; $P = 0.212$); age in years (assessed for depression: 25.8 ± 6.5; others: 26.5 ± 6.8; $P = 0.433$); ≤8 years of education (assessed for depression: 70.1%; others: 77.5%; $P = 0.139$), and the length of time in months they breastfed their children (assessed for depression: 7.9 ± 4.2; others: 8.0 ± 4.4; $P = 0.789$).

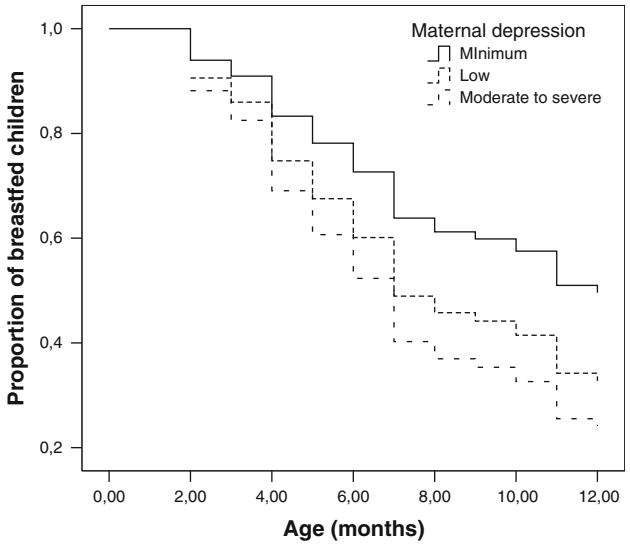

Fig. 3 Adjusted survival curve of the time of cessation of breastfeeding stratified by maternal depression

Discussion

The findings of this cohort study suggest that pacifier and bottle use in the first month and the severity of maternal depressive symptoms are significant risk factors for the cessation of breastfeeding in the first year of age in Brazil. To our knowledge, this is one of few studies to provide such evidence in a representative sample from southern Brazil, which features a 12-month follow up and the inclusion of maternal depressive symptoms as a variable.

Some studies have shown that pacifier use is associated with a reduced duration of exclusive breastfeeding [19–23]. In this sense, our findings are not surprising. However, those studies did not take into account other important variables, such as bottle feeding and/or maternal depression. Our study results demonstrated the independent effect of pacifier use, after adjustment for confounding factors. Furthermore, a number of studies that assessed breastfeeding in infants up to 12 months were cross-sectional in nature and did not allow for causal inference [22, 24–27]. The longitudinal design of the present study, in relation to pacifier and bottle use in the first month and the interruption of breastfeeding in subsequent months, has allowed us to establish a cause-effect relationship. The main mechanisms suggested to explain the impact of pacifier use on breastfeeding are (a) the suction confusion babies experience due to differences between the pacifier and breast suction [25] and (b) a decrease in the mothers' milk production caused by less-frequent breast suction in babies who use pacifiers [25, 28]. Also, we should not disregard the possibility that pacifier use may, at least in part, be a marker of maternal difficulties with breastfeeding [29].

Another important finding of this study was the significant negative association between the duration of breastfeeding and maternal depressive symptoms. These data contribute to the body of evidence regarding the relationship between maternal depression and breastfeeding, an issue that remains controversial. Some authors have reported no association between breastfeeding and depression [30], while other researchers have shown a higher risk of breastfeeding cessation in mothers with postpartum depression [31, 32] or mothers presenting depressive symptoms [33–35]. A case–control study of Brazilian families showed that parental mental health was not associated with breastfeeding at 4 months. Mental disorders during puerperium, however, were negatively associated with the duration of breastfeeding [36]. A recent cohort study with 429 families evaluated the association between postpartum depression and interruption of exclusive breastfeeding. It found that children of mothers with postpartum depressive symptoms had 1.81- and 1.21-times greater risk of early interruption of exclusive breastfeeding, respectively, in the first days of life and in the following 2 months, even after controlling for potential confounders [34]. Although we did not establish the onset of depressive symptomatology in our study, it is important to emphasize that depressive symptoms detected 12 months after birth may not represent a mental illness directly related to postpartum but may instead represent an underlying maternal pathology that was not previously diagnosed. The increased risk of breastfeeding cessation in mothers with higher BDI scores highlights the need for the early recognition and treatment of depressive episodes. Mothers presenting with more severe mental disorders would probably have an increased risk of interrupting breastfeeding, as demonstrated by the proportional increase of relative risk and BDI scores in our results.

In addition, other variables that were not assessed in our study could cause both depressive symptoms and earlier breastfeeding cessation. These variables include a lack of support from a social network and problems that reduce women's confidence in breastfeeding and in their ability to be effective mothers [11]. Adjustment for these factors could reduce the relative risk ratio.

The mechanisms underlying the impact of depressive symptoms on breastfeeding duration are likely to be multifactorial. They may include the adverse effects of depression on maternal self-esteem and cognition and on the relationship among the mother, her baby and the social environment [37]. Women with depressive symptomatology report increased breastfeeding difficulties [38], express decreased satisfaction related to their infant-feeding method [39], and report a lack of confidence in their ability to produce enough milk [40]. These are important points considering that such factors may influence the interruption

of breastfeeding. Income, maternal age and education level, number of children and family structure were not associated with the discontinuation of breastfeeding. These results may be, at least in part, due to the homogenous socioeconomic condition of the group.

In low income groups, discontinuation of breastfeeding may be a risk of micronutrients deficiency, especially if the complementary foods offered to the babies are not adequate, as breast milk is a relevant source of vitamins A, C, E, K, B12 and folate [41].

Some clinical implications of the present study must be highlighted. Studies suggest the first 2-6 weeks are the most difficult time for breastfeeding [42, 43]. The confirmation of the hypothesis that pacifier and bottle use in the first month of the child's life negatively impacts the continuity of breastfeeding in the first year indicates the need for specific education. Moreover, bottle feeding is considered a risk factor for fatter infants by the age of 12 months [44, 45]. Recommendations regarding exclusive breastfeeding must be accompanied by the active discouragement of pacifier and bottle use during the first 6 months of infancy. Modifying these behaviors is a challenging task [21, 46, 47], and interventions should be tested in randomized controlled trials. Our findings also indicated that prenatal care must include special attention to the future mother's mental health, given the potential impact of maternal depressive symptoms on not only breastfeeding but also on other areas of child development.

It is important to draw attention to the association between low socioeconomic status and the prevalence of depression. The nature of this association is not clear, because the relationship could be bidirectional, i.e., low socioeconomic status increases the risk of depression (social causation), but depression could result in difficult social mobility (social selection) [48]. Ritsher et al. [49], in an intergenerational longitudinal study of social class and depression, showed that low parental education was associated with higher risk of depression in offspring, but neither parental nor offspring depression was associated with later levels of offspring occupation, education or income. On the other hand, alternative data demonstrated that psychiatric disorders can lead to a truncated educational attainment, preventing individuals from developing in their education [50]. Considering the characteristics of our study, population comprised mainly of young mothers with low income and levels of education, it is possible that sociodemographic status has an important role in the prevalence of depressive symptoms.

Some methodological aspects of this investigation merit comment. One important independent predictor of early breastfeeding discontinuation is the development of breastfeeding problems within the first 2–3 days [11]. Mothers who expressed difficulties with breastfeeding in the first month were identified and excluded from this analysis, mainly because the pacifier use was already associated with breastfeeding problems, and their inclusion would have biased the results [51]. Several other confounding variables may not have been identified through standard questionnaires, and the interview process may have been impacted by cultural issues. Furthermore, the present study lacks data about the timing of the mother's return to work and about the presence of nipple fissures, both of which influence the decision to discontinue breastfeeding [10]. The possibility of recall bias has to be considered, since the investigators had to rely on the memory of the participants. However, the effect of this bias is not expected to be significant, since the period between bottle feeding or pacifier use and the interview was never longer than 6 months. Furthermore, the effects of variables are more likely to be attenuated than increased by this phenomenon [52].

In conclusion, this study has reinforced that active discouragement of pacifier and bottle use in the first month of life is necessary to increase the prevalence of breastfeeding. In addition, screening maternal depression at a primary care service can be a step forward in promoting longer duration of breastfeeding.

Key Messages

This longitudinal study demonstrated the independent effect of pacifier use and bottle feeding in the first month on cessation of breastfeeding during the first year of life, even after adjustment for important confounding factors.

Screening maternal depression at a primary care service can be a step forward in promoting longer duration of breastfeeding. Women diagnosed with depression during pregnancy or during primary care should be treated for their depression.

There is an imperative need for encouraging mothers to breastfeed exclusively and to avoid pacifier use and bottle feeding in early life.

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