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Determinants of using pacifier and bottle feeding

Determinantes do uso de chupeta e mamadeira

ABSTRACT

OBJECTIVE: To analyze the factors associated with the use of pacifiers and/or bottle feeding in infants aged under one year.

METHODS: This is a cross-sectional study with 34,366 children and using data from the database of the 2nd Nationwide Survey of Breastfeeding Prevalence performed in the Brazilian capitals and Federal District in 2008. Cluster sampling was used. The questionnaire included questions about the use of artificial nipples in the last 24 hours. The analysis considered three outcomes: exclusive use of pacifier, exclusive use of bottle feeding, and use of artificial nipples (pacifier and bottle feeding). Prevalence ratios were obtained using Poisson regression with robust variance following a hierarchical model.

RESULTS: The following factors were associated with exclusive use of the pacifier: mother working outside the home, primiparity, child was not breastfed within the first hour, and child had consumed tea on the first day at home. The following factors were associated with exclusive use of bottle feeding: mother working outside the home, primiparity, low birth weight, child not breastfed within the first hour, and child had consumed milk formula and tea on the first day at home. The following factors were associated with use of artificial nipples (pacifier and bottle feeding): mother working outside the home, primiparity, cesarean delivery, the male gender, low birth weight, born in a hospital not accredited as “baby friendly”, required health baby monitoring in the Primary Health Care Unit (PR = 0.91), and child had consumed milk formula, water, or tea on the first day at home.

CONCLUSIONS: This study identified profiles of exclusive users of pacifiers, bottle feeding, and both. The provided information can guide preventive practices for child health.

DESCRIPTORS: Bottle Feeding, Pacifiers, utilization. Maternal and Child Health. Cross-Sectional Studies.

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RESUMO

OBJETIVO: Analisar os fatores associados ao uso de chupeta e/ou mamadeira em lactentes menores de um ano.

MÉTODOS: Estudo transversal realizado com dados de 34.366 crianças obtidos da II Pesquisa Nacional de Prevalência de Aleitamento Materno, realizada em 2008, nas capitais brasileiras e Distrito Federal. Foi utilizada amostragem por conglomerados e o questionário incluiu perguntas sobre o uso de bicos artificiais nas últimas 24h. Três desfechos foram considerados para a análise: uso exclusivo de chupeta, uso exclusivo de mamadeira e uso de bicos artificiais (chupeta e mamadeira). As razões de prevalência foram obtidas por regressão de Poisson com variância robusta seguindo modelo hierárquico.

RESULTADOS: Associaram-se ao uso exclusivo de chupeta: mãe trabalhar fora, primiparidade, não ter sido amamentado na primeira hora e uso do chá no primeiro dia em casa. Para uso exclusivo da mamadeira, foram identificados: mãe trabalhar fora, primiparidade, baixo peso ao nascer, não amamentado na primeira hora de vida, uso de fórmula e chá no primeiro dia em casa. O uso de bicos artificiais (chupeta e mamadeira) foi associado com trabalho materno fora do lar, primiparidade, parto cesárea, bebês do sexo masculino, baixo peso ao nascer, nascimento em um hospital não credenciado como “Amigo da Criança”, realizar o acompanhamento de saúde da criança em unidade básica de saúde (RP = 0,91), uso de fórmula, água e chá no primeiro dia em casa.

CONCLUSÕES: Este estudo encontrou perfis de usuários exclusivos de chupetas, mamadeiras e de ambos. Essas informações podem orientar as práticas preventivas para a saúde da criança.

DESCRIPTORIOS: Mamadeiras. Chupetas, utilização. Saúde Materno-Infantil. Estudos Transversais.

INTRODUCTION

It is estimated that two-thirds of newborns will receive bottle feeding and pacifiers during the first year of life.²⁴ However, the use of these tools can affect breastfeeding¹⁴ and induce alteration in the children's health.^{9,19,23} In the history of mankind, the use of artificial nipples has assumed different roles and sociocultural representations.^{12,16,23}

Among the pacifier users, those who use it more frequently include firstborn children,^{19,24} males,^{18,23,24} children with low birth weight,²³ children aged under 6 months,¹⁹ children not breastfed in the maternity ward,²³ and children breastfed at prearranged times.²² In addition, mothers who were younger,^{1,6,23} were primiparous,^{6,23} had a low socioeconomic status,⁹ had a smoking history,^{9,24} and were less educated^{1,9,18} were more likely to resort to the use of pacifiers. Qualitative studies have indicated that the use of pacifiers is correlated with cultural issues, maternal uncertainty about her ability to breastfeed, and crying and behavior of baby.^{3,16,23,24} Previous studies have indicated that infant-related factors that favor the use of

bottle feeding include decreased weight gain, excessive crying,¹² the use of pacifiers,⁶ and the consumption of processed milk, tea, and water.⁶ Maternal-related factors that favor the use of bottle feeding include teenage mothers,⁶ maternal uncertainty about her ability to breastfeed and difficulty in breastfeeding,^{6,12,23} nervousness and impatience,¹² convenience,¹² working outside the home,^{12,13} and coexistence with the maternal grandmother.⁶ In addition, parents and health professionals indicate that the use of bottle feeding facilitates feeding and brings confidence during infant feeding.

However, these results cannot be generalized because the aforementioned studies were conducted in distinct periods, with distinct methodologies and population groups. Till date, no study has investigated the determinants of the use of artificial nipples using a representative sample of children in Brazil. Therefore, the present study aimed to identify the factors associated with the use of pacifiers and/or bottle feeding in children aged under one year.

METHODS

This cross-sectional study analyzed data from the Second National Survey on the Prevalence of Breastfeeding (II NSPB), conducted in Brazil in 2008.^a

The II NSPB is a national survey on the status of breastfeeding and complementary feeding involving children aged ≤ 12 months who participated in the second phase of the national campaign of multivaccination.²¹

The survey was conducted with cluster samples, lots were cast in two stages, and the probabilities were proportional to the cluster size. In the first stage, lots were cast on the vaccination sites, and in the second stage, lots were cast on the children vaccinated at each site. The sample size considered the prevalence of exclusive breastfeeding in 1999, in the 26 state capitals and in the Federal District (FD), with an added rate of 2.0%-10.0% to account for the increase in prevalence. To compensate for the potential loss of precision, the design effect was added to the sample by multiplying the initial estimate by 1.5 and incorporating a nonresponse rate, which ranged between 5.0% and 10.0%. The sample size required to estimate the prevalence of breastfeeding in children aged < 6 months was multiplied by two. Therefore, the minimum sample size varied between each capital but was reached in all capitals, ensuring sample representativeness. In total, 34,366 children aged under one year, who participated in the second phase of the multivaccination campaign conducted in all Brazilian capitals and FD in 2008, were analyzed. Detailed data of each sample population by capital have been reported previously.^{21,22}

For proper implementation of the process of casting lots on the children participating in the vaccination program, the interviewers were provided instructions with regard to the importance of randomness in data collection and systematic random sampling.²¹

The data collection instrument was also applied to the child's parents or guardians. The questionnaire included closed questions related to the children and mother profile, infant feeding, health care services used by families, and use of pacifiers and bottle feeding in the last 24 hours.

Three outcomes were defined: the exclusive use of pacifiers (i.e., nonusers of bottle feeding), exclusive use of bottle feeding (i.e., nonusers of pacifiers), and use of artificial nipples (users of both pacifiers and bottle feeding). Each of the three outcomes were classified on the basis of the affirmative responses to the outcome in relation to the lack of use of artificial nipples during the study period, similar to the methodology used in studies on disease-associated factors (sick *versus* healthy patients). The three children subsamples with a positive outcome were compared with the subsample

comprising the nonusers of artificial nipples. We chose this analysis strategy to attenuate potential confounders.

Data entry was performed by team members in each state capital using a web application specially developed for the typing of this information.²¹ The II NSPB database was exported to Stata software version 9.2 for data analysis. Sample complexity in all the study phases was considered.

After descriptive analysis, age-adjusted Poisson regression analysis with robust variance⁴ was used to estimate the prevalence ratio (PR) and confidence intervals (95%CI). A linear trend test was used for the variables having a theoretical assumption of a dose-response relation. To estimate the individual influence of the outcome-associated variables, we used a multiple hierarchical model. For this purpose, the variables were grouped into blocks and ordered according to the influence that they would have on each outcome. The theoretical model that guided the analysis and the variables are presented in Figure. Notably, the variables related to infant feeding during the first day after hospital discharge were only collected for children aged under four months (subsample) to any avoid possible memory bias.

Considering that this study has three different outcomes, the steps for data analysis were separately reproduced for each outcome. Initially, PR was calculated for each variable and outcome (step 1). Variables with $p < 0.20$ were entered into multiple internal analysis of each block (step 2). Following this, variables with $p < 0.20$ in internal analysis of each block were used as control variables in step 3 as follows.

The variables of the more distal block (1), "Socioeconomic profile and maternal lifestyle", were the first variables to be included in the model and served as adjustment factors for the hierarchically inferior variables. Similarly, the variables of the intermediate blocks (2 and 3), "Characteristics related to birth conditions and the health care services used", which met the inclusion criteria of the multivariate model after adjusting for the distal block, became the control variables of the subsequent block. An analogous procedure was adopted for analyzing the proximal blocks (4A and 4B), "Characteristics of infant feeding within the first hour after birth and on the first day after hospital discharge". The selected variables were maintained in the model despite having lost statistical significance after including the inferior blocks. After adjusting for the factors of the same block and superior blocks, the correlation between variables and outcomes was considered significant by adopting a significance level of 5%.

The research protocol was approved by the Research Ethics Committee of the *Faculdade de Saúde Pública* of the *Universidade de São Paulo* (Protocol 2,192, from 3/18/2011).

^a Ministério da Saúde. Prevalência de aleitamento materno nas capitais brasileiras e no Distrito Federal. Brasília (DF); 2001.

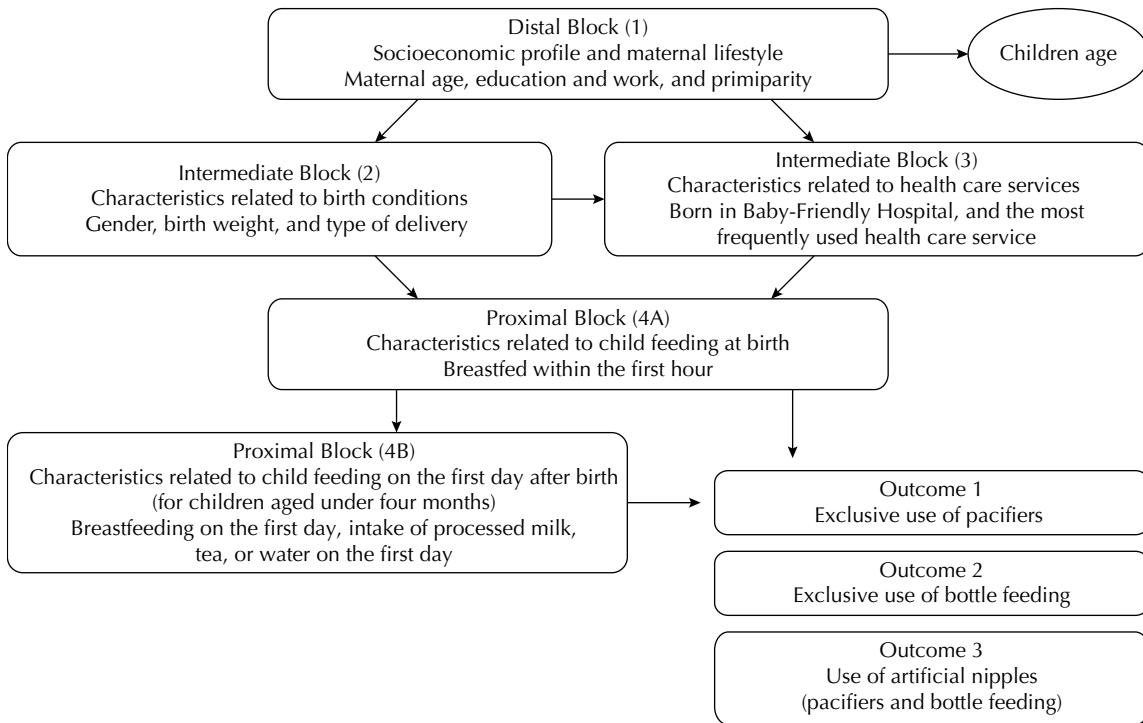


Figure. Hierarchical theoretical model to determine the factors associated with use of artificial nipples. State capitals and Federal District, Brazil, 2008.

RESULTS

The study included 34,366 children aged ≤ 12 months. We observed a predominance of children aged under six months (54.5%) and of the male gender. Low birth weight was observed in 9.0% of the children. Most mothers were aged between 20 and 35 years (72.2%), had < 12 years of education (85.6%), and did not work outside the home (66.2%). Approximately 50.0% of the mothers were primiparous, and approximately 50.0% deliveries were cesarean. One-third of the deliveries occurred in a Baby-Friendly Hospital initiative (BFH), and 58.7% of the children had routine follow-up in public health care units (basic health care units or family health strategy (FHS) units). Approximately 70.0% of the children were breastfed within the first hour after birth. With regard to the outcomes, information on the use of pacifiers and/or bottle feeding was available for 33,776 children (98.3%). Of these, 2,901 (9.1%) exclusively used pacifiers, 8,757 (24.8%) exclusively used bottle feeding, and 10,451 (33.5%) used artificial nipples. Approximately one-third ($n = 11,667$, 32.6%) of the children used no artificial nipples.

In the subsample of children aged under four months ($n = 12,704$), 95.9% were breastfed on the first day after hospital discharge. In contrast, processed milk, tea, and water were consumed on the first day after birth by 12.0%, 8.4%, and 5.0% of the children, respectively.

To determine the similarity between the subsample of children aged under four months and the rest of the population, these two groups were compared in relation to maternal education (considered in this study as a proxy for the socioeconomic status), infant gender, birth weight, and type of delivery. No significant differences were found among these groups.

The sample strata used for analysis of the exclusive use of pacifiers comprised exclusive users of pacifiers ($n = 2,901$) and nonusers of artificial nipples ($n = 11,667$). The frequency of use of pacifiers gradually decreased as infant age increased, indicating a strong inverse correlation ($p < 0.001$) (data not shown).

Table 1 shows the prevalence of children who used exclusively pacifiers among those born from primiparous women, those born by cesarean delivery, and male infants. The use of pacifiers gradually increased among children born from mothers who worked outside the home. It was observed that the consumption of tea on the first day after hospital discharge and the inability to breastfeed within the first hour after birth were associated with the increased use of pacifiers.

Table 2 shows that the factors associated with the exclusive use of pacifiers in multivariate analysis were primiparity, mother working outside the home, inability to breastfeed within the first hour after birth, and consumption of tea on the first day after hospital discharge.

Table 1. Poisson analysis of the exclusive use of pacifiers in children aged under one year and age-adjusted prevalence ratio. State capitals and Federal District, Brazil, 2008.

Variable	Total N ^a	Exclusive use of pacifier (%)	PR _{adjusted}	95%CI	p
Distal block (1)					
Maternal age (years)					0.122 ^b
20 to 35	9,017	21.3	1		
< 20	3,044	23.0	1.09	0.97;1.24	0.119
> 35	1,372	21.9	1.03	0.88;1.21	0.685
Maternal education (years)					0.161 ^b
> 12	1,795	24.8	1		
9 to 12	6,363	21.7	0.90	0.77;1.03	0.139
0 to 8	5,189	20.9	0.90	0.76;1.02	0.093
Maternal work					0.016 ^b
Not working outside the home	9,025	20.6	1		
On maternity leave	1,964	26.9	1.13	0.99;1.29	0.076
Working outside the home	1,678	23.1	1.16	1.00;1.35	0.045
Primiparity					
No	7,079	19.3	1		
Yes	6,114	24.8	1.28	1.16;1.41	< 0.001
Intermediate block (2 to 3)					
Type of delivery					
Normal/Forceps	7,582	20.7	1		
Cesarean	6,862	23.0	1.10	1.00;1.21	0.049
Infant gender					
Female	7,395	20.8	1		
Male	7,173	22.8	1.10	1.00;1.21	0.041
Low birth weight (< 2,500 g)					
No	13,182	22.1	1		
Yes	1,069	20.4	0.90	0.74;1.10	0.297
Born in Baby-Friendly Hospital					
Yes	5,092	21.5	1		
No	8,385	22.1	1.02	0.92;1.13	0.611
Routine health care services					
Family Health Strategy	3,715	23.4	1		
Basic health care unit	4,514	20.7	0.89	0.79;1.01	0.088
Private health care services	4,747	23.4	1.00	0.89;1.13	0.923
Proximal block (4A)					
Breastfed within first hour of birth					
Yes	9,976	20.3	1		
No	3,886	24.8	1.19	1.08;1.32	0.001
Proximal block (4B)					
Breastfed on the first day after hospital discharge					
Yes	7,310	25.6	1		
No	168	23.8	0.94	0.66;1.33	0.744
Consumed processed milk on the first day after hospital discharge					
No	7,021	25.3	1		
Yes	384	28.9	1.16	0.91;1.48	0.219
Consumed water on the first day after hospital discharge					
No	7,219	25.6	1		
Yes	186	23.3	0.96	0.62;1.48	0.873
Consumed tea on the first day after hospital discharge					
No	7,052	25.2	1		
Yes	337	32.0	1.30	1.01;1.67	0.040

^a This analysis included exclusively users of pacifiers and nonusers of artificial nipples.

^b Linear trend test.

The sample strata used for analysis of the exclusive use of bottle feeding comprised exclusive users of bottle feeding ($n = 8,757$) and nonusers of artificial nipples ($n = 11,667$).

It was observed that as the children age progressed, the exclusive use of bottle feeding increased. Trend analysis indicated the existence of a dose-response relationship ($p < 0.001$) (data not shown).

Table 3 shows that the frequency of use of bottle feeding gradually increased among working mothers; however, no significant difference was observed between mothers on maternity leave and those who did not work outside the home. Low birth weight and inability to breastfeed within the first hour after birth were associated with the increased use of bottle feeding. As expected, the consumption of commercial milk, tea, or water on the first day after hospital discharge stimulated the exclusive use of bottle feeding.

Table 4 indicates that the factors associated with the exclusive use of bottle feeding in multivariate analysis were primiparity, mother working outside the home, low birth weight, inability to breastfeed within the first hour after birth, and the consumption of processed milk or tea on the first day after hospital discharge.

The sample strata used for analysis of the use of artificial nipples comprised users of artificial nipples (pacifiers and bottle feeding) ($n = 10,451$) and nonusers of artificial nipples ($n = 11,667$).

Advancing child age was associated with the increased use of artificial nipples. Trend analysis indicated a significant correlation ($p < 0.001$), suggesting the existence of a dose-response relationship (data not shown).

Table 5 shows that younger women offered artificial nipples to their children more frequently than older women. Moreover, primiparous women offered artificial nipples to their children more frequently than nonprimiparous women. Cesarean delivery, low birth weight, and the male gender were factors associated with the increased use of artificial nipples. As expected, mothers who worked outside the home resorted to artificial nipples more frequently than those who did not work outside the home. However, births in BFH and breastfeeding within the first hour after birth favored the decreased use of artificial nipples. Children routinely attending basic health care units tended to use artificial nipples less frequently, whereas those attending private health care facilities tended to use artificial nipples more frequently.

Table 6 presents the factors associated with the use of artificial nipples after adjusting for other variables: mother working outside the home, primiparity, cesarean delivery, the male gender, low birth weight, deliveries in hospitals not accredited by the BFH system,

Table 2. Multiple hierarchical model to identify the factors associated with the exclusive use of pacifiers in children aged under one year. State capitals and Federal District, Brazil, 2008.

Variable	PR _{adjusted}	95%CI	p
Model 1 ^a			
Maternal work			0.017 ^d
Not working outside the home	1		
On maternity leave	1.11	0.96;1.27	0.139
Working outside the home	1.18	1.01;1.37	0.034
Primiparity			
No	1		
Yes	1.28	1.15;1.42	< 0.001
Model 3 ^b			
Breastfed within the first hour after birth			
Yes	1		
No	1.15	1.03;1.29	0.014
Model 4 ^c			
Ingested tea on the first day after birth			
No	1		
Yes	1.37	1.05;1.79	0.020

^a Model 1: work, primiparity, and infant age.

^b Model 2: Model 1 + infant gender and type of delivery.

^c Model 3: Model 2 + breastfeeding within the first hour.

^d Model 4: Model 3 + consumption of tea on the first day after hospital discharge.

^e Linear trend test.

type of health care service (private/health insurance), inability to breastfeed within the first hour after birth, and consumption of processed milk, tea, or water on the first day after hospital discharge. Performing routine follow-up in primary health care units was a protective factor against the use of artificial nipples.

DISCUSSION

This study is the first to investigate the determinants of the use of artificial nipples in a representative sample of children living in state capitals in Brazil. Importantly, the study classified the use of nipples into three outcomes (use of pacifiers, bottle feeding, or both), which allowed us to understand the use of these equipment, which can negatively interfere with breastfeeding and child health.

Maternal-related factors, including mother working outside the home and primiparity, were significantly correlated with the three outcomes, whereas infant-related factors, including low birth weight, cesarean delivery, and the male gender, were significantly correlated with only two outcomes (exclusive use of bottle feeding and use of artificial nipples). Child feeding on the first day after hospital discharge (through the consumption of baby formula, tea, or water) influenced

Table 3. Poisson analysis of the exclusive use of bottle feeding in children aged under one year and age-adjusted prevalence ratio. State capitals and Federal District, Brazil, 2008.

Variable	Total N ^a	Exclusive use of baby bottles (%)	PR _{adjusted}	95%CI	p
Distal block (1)					
Maternal age (years)					0.274 ^b
20 to 35	12,127	40.6	1		
< 20	4,243	42.0	1.02	0.96;1.08	0.433
> 35	1,897	44.5	1.07	0.98;1.15	0.090
Maternal education (years)					0.008 ^b
> 12	2,419	44.7	1		
9 to 12	8,725	41.4	0.93	0.87;1.00	0.073
0 to 8	7,036	40.3	0.90	0.83;0.96	0.006
Maternal work					< 0.001 ^b
Not working outside the home	12,171	39.0	1		
On maternity leave	1,985	26.6	0.99	0.88;1.12	0.953
Working outside the home	3,089	60.3	1.40	1.33;1.48	< 0.001
Primiparity					
No	9,424	38.7	1		
Yes	8,501	44.3	1.13	1.07;1.19	< 0.001
Intermediate block (2 to 3)					
Type of delivery					
Normal/Forceps	10,526	41.6	1		
Cesarean	9,698	45.0	1.08	1.03;1.13	0.001
Child gender					
Female	10,287	42.3	1		
Male	10,137	44.2	1.01	0.97;1.06	0.488
Low birth weight (< 2,500 g)					
No	18,188	42.4	1		
Yes	1,711	49.6	1.18	1.09;1.27	< 0.001
Born in Baby-Friendly Hospital					
Yes	6,993	41.9	1		
No	11,881	44.2	1.05	1.00;1.10	0.050
Routine health care services					
Family Health Strategy	5,129	42.1	1		
Basic health care unit	6,371	41.6	0.96	0.90;1.02	0.252
Private health care services	6,854	47.3	1.08	1.02;1.14	0.008
Proximal block (4A)					
Breastfed within the first hour after birth					
Yes	13,793	24.9	1		
No	5,485	38.7	1.55	1.15;2.09	0.003
Proximal block (4B)					
Breastfed on the first day after hospital discharge					
Yes	7,467	24.9	1		
No	197	38.7	1.50	1.12;2.03	0.007
Consumed processed milk on the first day after hospital discharge					
No	7,007	22.8	1		
Yes	580	51.4	2.20	1.91;2.52	< 0.001
Consumed water on the first day after hospital discharge					
No	7,318	24.6	1		
Yes	266	41.3	1.54	1.21;1.94	< 0.001
Consumed tea on the first day after hospital discharge					
No	7,079	23.3	1		
Yes	493	52.2	2.15	1.86;2.49	< 0.001

^a This analysis included exclusively users of baby bottles and nonusers of artificial nipples.

^b Linear trend test.

the three outcomes but not the same components of each outcome, which suggests the existence of different motivations for the adoption of each feeding equipment. Birth in BFH and child follow-up in basic health care units were factors significantly correlated with the decreased use of artificial nipples.

Child age was significantly correlated with all the three outcomes. Previous studies indicated that child age may influence the use of artificial nipples.^{1,9,18,19,23,24} Victora et al²³ and Aarts et al¹ observed that the use of pacifiers begins in early childhood and is a dynamic process until the age of three and four months. However, with advancing age, the use of this feeding equipment decreases.^{1,9,23} Other authors indicated that bottle use is associated with water and tea intake and with the intake of processed milk, which increases the use of bottle feeding as child age progresses.^{6,23} Considering the potential influence of this variable on the outcomes studied, infant age was considered an adjustment variable.

The male gender was significantly correlated with the use of artificial nipples but not with the isolated use of the two equipment. Previous studies on the use of pacifiers identified a correlation between its increased use and the male gender.^{9,18,23,24} Another study reported a higher probability of interruption of breastfeeding in male infants.²⁰ In this respect, the authors suggest that mothers believe that male infants have higher nutritional requirements than female infants and they are therefore provided food supplements first.¹¹ Scott et al¹⁵ indicated that the cultural construction of gender can influence this decision and can lead to the increased use of bottle feeding by male infants. However, till date, no study has indicated child gender as a determinant of the use of bottle feeding. The higher tendency of male infants to use artificial nipples than female infants warrants an explanation and should be further explored in qualitative studies.^{15,18}

Low birth weight was associated with the exclusive use of bottle feeding and artificial nipples. Weight gain is associated with child survival and is a condition that raises concerns among family members and health professionals.³ This condition stimulates the early indication of food supplements, which are usually provided in bottle feeding,^{6,23} thereby increasing its use among children with low birth weight. The associated use of bottle feeding and pacifiers has not been reported in previous studies. However, it is plausible to assume that these equipment will be used more frequently, considering the stressful conditions that the mother and infant are exposed to in hospital settings and during family adaptation.³

The consumption of processed milk, tea, and water within the first day after hospital discharge was significantly correlated with the three outcomes. Previous studies have indicated that these liquids are usually provided by bottle feeding.^{6,23} França et al⁶ found that 21.3% and 46.9% infants used bottle feeding seven

Table 4. Multiple hierarchical model to identify the factors associated with the exclusive use of bottles in children aged under one year. State capitals and Federal District, Brazil, 2008.

Variable	PR _{adjusted}	95%CI	p
Model 1^a			
Maternal work			< 0.001 ^e
Not working outside the home	1		
On maternity leave	0.97	0.86;1.10	0.708
Working outside the home	1.39	1.32;1.47	< 0.001
Primiparity			
No	1		
Yes		1.06;1.17	< 0.001
Model 2^b			
Low birth weight			
No	1		
Yes	1.21	1.11;1.31	< 0.001
Model 3^c			
Breastfed within the first hour after birth			
Yes	1		
No	1.08	1.02;1.15	0.004
Model 4^d			
Consumed processed milk on the first day after hospital discharge			
No	1		
Yes	1.82	1.52;2.19	< 0.001
Consumed tea on the first day after hospital discharge			
No	1		
Yes	1.96	1.63;2.36	< 0.001

^a Model 1: maternal work, primiparity, infant age.

^b Model 2: Model 1 + low birth weight.

^c Model 3: Model 2 + breastfeeding within the first hour.

^d Model 4: Model 3 + intake of processed milk or tea on the first day.

^e Linear trend test.

days and 30 days after birth, respectively, and tea and processed milk were the main ingredients offered at both instances. Bottle feeding is used as a vehicle for fluid delivery, whereas pacifiers are used to calm the infants,^{16,18} and the latter function is also attributed to tea.⁶ The symbolic and sociocultural role of calming the infant^{16,18,23} corroborates the results of the present study. Although previous studies have indicated that the use of pacifiers increases the likelihood of using bottle feeding,⁶ a causal relationship could not be established.

Primiparity was significantly correlated with the three outcomes, and it has been reported as a risk factor for early weaning and consequently for the use of artificial nipples.^{18,19,24} Silva¹⁷ reported that since child birth, mothers go through a learning process to understand their child's language. Previous studies have found that parents are poorly oriented on how to manage child

Table 5. Poisson analysis of the use of artificial nipples in children aged under one year and age-adjusted prevalence ratio. State capitals and Federal District, Brazil, 2008.

Variable	Total N ^a	Use of artificial nipples (%)	PR _{adjusted}	95%CI	p
Distal block (1)					
Maternal age (years)					0.004 ^b
20 to 35	12,809	46.8	1		
< 20	4,584	50.1	1.07	1.02;1.13	0.008
> 35	2,018	50.6	1.06	0.99;1.14	0.072
Maternal education (years)					< 0.001 ^b
> 12	2,783	55.7	1		
9 to 12	9,056	47.1	0.86	0.81;0.91	< 0.001
0 to 8	7,479	46.6	0.84	0.79;0.89	< 0.001
Maternal work					< 0.001 ^b
Not working outside the home	12,550	43.8	1		
On maternity leave	2,148	34.1	0.97	0.88;1.08	0.644
Working outside the home	3,562	69.1	1.45	1.39;1.52	< 0.001
Primiparity					< 0.001
No	9,680	43.2	1		
Yes	9,349	52.9	1.21	1.16;1.26	< 0.001
Intermediate block (2 to 3)					
Type of delivery					
Normal/Forceps	11,132	48.4	1		
Cesarean	10,718	52.7	1.09	1.04;1.13	< 0.001
Child gender					
Female	11,021	49.4	1		
Male	11,097	52.1	1.04	1.00;1.08	0.016
Low birth weight (< 2,500 g)					
No	19,657	49.9	1		
Yes	1,866	55.2	1.11	1.05;1.19	< 0.001
Born in Baby-Friendly Hospital					
Yes	7,496	45.5	1		
No	12,812	53.0	1.15	1.10;1.20	< 0.001
Routine health care services					
Family Health Strategy	5,521	49.6	1		
Basic health care unit	6,528	46.7	0.93	0.88;0.98	0.011
Private Health Care Service	7,723	56.5	1.09	1.05;1.15	< 0.001
Proximal block (4A)					
Breastfed within the first hour after birth					
Yes	14,669	49.0	1		
No	6,129	52.5	1.09	1.05;1.14	< 0.001
Proximal block (4B)					
Breastfed on the first day after hospital discharge					
Yes	8,082	33.5	1		
No	399	72.4	2.11	1.91;2.33	< 0.001
Consumed processed milk on the first day after hospital discharge					
No	7,493	30.6	1		
Yes	910	70.5	2.25	2.08;2.44	< 0.001
Consumed water on the first day after hospital discharge					
No	7,952	33.6	1		
Yes	438	66.2	1.87	1.67;2.08	< 0.001
Consumed tea on the first day after hospital discharge					
No	7,746	33.1	1		
Yes	639	64.0	1.87	1.70;2.06	< 0.001

^a This analysis included exclusive user of artificial nipples (pacifiers and bottle feeding) and nonusers of artificial nipples.^b Linear trend test.

crying and behavior,^{3,8} and when oriented, they feel more confident in comforting the child without resorting to artificial nipples.⁸ Therefore, one can assume that less experienced mothers become more anxious when managing infant crying and behavior^{16,19} and therefore resort to artificial nipples more frequently.

The factor mother working outside the home was significantly correlated with the three outcomes studied. Maternal work was expressed in categories of increased frequency of the use of nipples. Therefore, maternity leave was considered an intermediate condition with respect to the others.^{10,12,13} Rea & Cukier¹² observed that mother working outside the home has become a primary reason for bottle feeding and weaning. Previous studies have shown that reconciling the roles of a worker and mother is increasingly common and that employee benefits alone are not sufficient for mothers to continue breastfeeding and not resort to artificial nipples.^{12,13} In Brazil, women working in the formal sector are entitled to 120 days of maternity leave. However, their return to work is filled with anxiety and uncertainty related to children feeding and comfort in times of maternal absence.¹² Therefore, maternal work outside the home and the return to work after maternity leave are situations of great vulnerability that favor the interruption of exclusive breastfeeding and the consequent introduction of pacifiers and bottle feeding.¹⁰

A significant correlation was observed between cesarean delivery and the use of artificial nipples. Victora et al²³ found that women who had cesarean delivery breastfed for a shorter period and resorted to pacifiers more frequently. Other authors found that women having cesarean deliveries showed a significant delay in the initiation of breastfeeding, which could lead to decreased frequency of breastfeeding and increased use of artificial nipples.²

Breastfeeding in the first hour after birth was a protective factor and was strongly correlated with the three outcomes. In this sense, no previous studies that correlated the use of artificial nipples with breastfeeding in the first hour were found. However, some studies have correlated breastfeeding in the first hour with the increased prevalence of breastfeeding and the establishment of stronger bonds between the mother and child,² which are important factors involved in the decision to use artificial nipples.

BFH follow the “Ten Steps to Successful Breastfeeding”^{5,18,22} Step 9 establishes the nonuse of pacifiers and bottle feeding in hospitals for breastfed children.⁵ In this study, child birth in hospitals without BFH accreditation was associated with the increased use of artificial nipples. Corroborating these findings, Coutinho et al⁵ observed that the use of pacifiers and bottle feeding decreased after an BFH training program in two maternity wards. Moreover, Venancio et al²² found a correlation between birth in BFH and the decreased use of pacifiers. Therefore, these studies

Table 6. Multiple hierarchical model to identify the factors associated with the use of artificial nipples in children aged under one year. State capitals and Federal District, Brazil, 2008.

Variable	PR _{adjusted}	95%CI	p
Model 1^a			
Maternal work			< 0.001 ^f
Not working outside the home	1		
On maternity leave	0.95	0.86;1.07	0.447
Working outside the home	1.43	1.37;1.51	< 0.001
Primiparity			
No	1		
Yes	1.21	1.15;1.27	< 0.001
Model 2^b			
Type of delivery			
Normal/Forceps	1		
Cesarean	1.06	1.01;1.12	0.008
Child gender			
Female	1		
Male	1.07	1.02;1.12	0.003
Low birth weight			
No	1		
Yes	1.11	1.03;1.19	0.005
Model 3^c			
Born in Baby-Friendly Hospital			
Yes	1		
No	1.12	1.06;1.18	< 0.001
Routine health care services			
Family Health Strategy	1		
Basic Health Care Unit	0.91	0.86;0.97	0.005
Private health care services	1.02	0.96;1.09	0.397
Model 4^d			
Breastfed within the first hour after birth			
Yes	1		
No	1.06	1.00;1.11	0.030
Model 5^e			
Consumed processed milk on the first day after hospital discharge			
No	1		
Yes	2.06	1.83;2.31	< 0.001
Consumed water on the first day after hospital discharge			
No	1		
Yes	1.18	1.01;1.37	< 0.001
Consumed tea on the first day after hospital discharge			
No	1		
Yes	1.38	1.21;1.59	< 0.001

^a Model 1: maternal age, education and work, primiparity, and infant age.

^b Model 2: Model 1 + child gender, low birth weight, and type of delivery.

^c Model 3: Model 2 + BFH and health care services.

^d Model 4: Model 3 + breastfeeding within the first hour.

^e Model 5: Model 4 + intake of processed milk, tea, or water on the first day.

^f Linear trend test.

highlight the need for effective support and guidance interventions during child follow-up in health care units and in the community.^{5,22}

Child follow-up is performed through primary health care services in public health care facilities, which comprise basic health care units and FHS units. In basic health care units, follow-up is performed by a pediatrician, whereas in FHS units, it is performed by a multidisciplinary team. Follow-up in public health care facilities, particularly in basic health care units, was considered a protective factor against the use of artificial nipples. The noninfluence of FHS in the results can be attributed to its low application in the Brazilian capitals (53.1% of the Brazilian territory in 2011).^b

With regard to the surveys conducted during the vaccination campaigns, Venancio et al²² reported that they are widely used in Brazil and can collect data in a short period, at a low cost. The adopted sample design and the high sample coverage (> 80.0%) in the second stage of the vaccination campaign in 2008 ensured sample

representativeness. Furthermore, maternal educational levels were similar to those reported in the Live Births Information System in the same year.²¹

One limitation of the present study is the noninclusion of subjects living in rural areas, and this aspect deserves attention in relation to the generalization of results. The other limitation is that the cross-sectional design of the study did not allow an assessment of the temporality of facts. However, the present study helped to identify situations that may serve as “markers” of the analyzed outcomes and to generate hypotheses for the development of longitudinal studies.⁷

This is the first study to identify the factors associated with the exclusive use of bottle feeding and pacifiers and the use of artificial nipples (bottle feeding and pacifiers) in children aged under one year, in a representative sample of children. These results can be generalized to populations living in middle-income urban areas in countries such as Brazil and contribute to the planning of preventive actions in maternal and child health.

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