BJOS
Brazilian Journal of Oral Sciences

Volume 23
2024
e244708

Original Research

Exclusive breastfeeding and its association with pre- and postnatal factors: a cohort prospective study

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Editor: Dr. Altair A. Del Bel Cury

Received: October 10, 2023
Accepted: June 18, 2024

Aim: This cohort study aimed to investigate the exclusive breastfeeding (EBF) prevalence and its association with maternal EBF intention and other variables. **Method:** Pregnant women (n=653) in the third trimester of pregnancy filled out a questionnaire on EBF intention using the Infant Feeding Intentions scale and other variables. After delivery, mothers were contacted by phone at the first (T1; n=467), third (T3; n=333), and sixth (T6; n=217) month of the baby's life or until breastfeeding was terminated, to collect data on breastfeeding, delivery, the newborn, oral habits, and family variables. The associations between independent variables and the outcomes (EBF prevalence at T1, T3, and T6) were analyzed by simple and multiple logistic regression models (α =0.05). **Results:** EBF prevalence was 81.2% at T1, 64.0% at T3, and 35.9% at T6. Nott use baby bottle (OR=612.59; OR=139.08; OR=15.05) and no pacifier use (OR=2.94; OR=2.78; OR=2.93) were associated with the outcome at T1, T3, and T6, respectively. Other associated variables were strong EBF intention (OR=1.71) at T1; higher birth weight (OR=1.62), childcare support (OR=2.59), maternal age (OR=0.54), being married or having a partner (OR=1.82) at T3; and not returning to work (OR=2.39) at T6. **Conclusion:** The EBF prevalence was high at the first month of the baby's life and decreased over six months. The EBF intention affected EBF initiation. Variables related to the mother´s demographic characteristics, the baby´s birth weight, the childcare support or the baby bottle/pacifier use were associated with EBF.

Keywords: Behavior. Breast feeding. Infant food. Intention. Milk, human.

Introduction

Acknowledging the importance of breastfeeding (BF) for the health and development of infants has become a public policy priority in several countries[1]. World organizations such as the United Nations Children's Fund (UNICEF), the World Health Organization (WHO), and the Brazilian Ministry of Health recommend BF in the first two years of the child's life and exclusive breastfeeding (EBF) in the first six months[2,3].

Breast milk (BM) contains essential nutrients with immunological and anti-inflammatory properties that protect infants from various infections and diseases[4]. Due to these characteristics, BM can prevent deaths in children under 5 years old[3], especially those of lower socioeconomic status[3], reduce the likelihood of developing chronic diseases and obesity throughout life, and promote better nutrition and adequate cognitive development. Children who did not receive BF have deficient immune system compared to those who receive BM, putting them at a significantly higher risk of developing respiratory, gastrointestinal, and other diseases[5]. Finally, BF also contributes to the proper development of the oral cavity[3].

Additionally, BF can reduce the risk of a new pregnancy in the first six months after delivery, as long as there is EBF and the woman has not menstruated[3]. In the long term, BF may help to reduce the risk of developing breast cancer[6] and ovarian cancer[3]. Finally, the process favors a deep interaction between mother and child[3], promoting positive effects on this relationship[1].

Despite all the benefits provided by EBF and the global efforts to encourage BF[3], EBF rates are far from the ideal of 70%[7]. Worldwide, it is estimated that only 41% of infants under six months old are on EBF[7]. In Brazil, the prevalence of EBF in 2009 was 41% in the first six months of the baby's life[8] and, in 2019-2020, the rate increased to 45.7%. Despite the improvement, an increase of 24.3% is still required to reach the level recommended by the WHO.

Some characteristics have favored EBF in the first six months of the baby's life. One of them is EBF intention, which has been highlighted as a strong predictor of golden hour BF practice and longer BF[9].

Most Brazilian studies on BF are either cross-sectional assessing BF duration[10,11] and EBF prevalence[12,13], or literature reviews[14]. A Brazilian cohort study followed mother-baby dyads in the postnatal period to assess maternal BF intention, BF duration, and reasons for weaning at 12 months of the baby's life[15]. The researchers found that 74.3% of mothers showed EBF intention but only 58% of infants were breastfed until six months[15]. Therefore, there is a scarcity of Brazilian longitudinal studies on EBF and its determinants since pregnancy[12], as well as studies using the Infant Feeding Intentions (IFI) scale for determining EBF intention.

This study investigated EBF prevalence up to six months of the baby's life and its association with EBF intention and other variables.

Methodology

This prospective cohort study included a non-random sample of pregnant women at the third trimester of pregnancy followed until the baby is six months old or until breastfeed-

ing was terminated. The study was approved by a Research Ethics Committee (CAAE 96978518.6.0000.5416) and all the participants signed an informed consent form before data collection. The study was reported according to the STROBE guidelines.

Baseline data were collected from December/2018 to November/2019 in a major public maternity hospital under private rules. This is a reference hospital in humanized birth located in a medium-sized city located in the center of the state of São Paulo, Brazil. Women in the third trimester of pregnancy, Brazilian, without prior contraindication to breastfeeding, literate, and who signed the informed consent form participated in this study (n=653).

After delivery, mothers were contacted by phone at the first (n=467), third (n=333), and sixth (n=217) months of the baby's life or until breastfeeding was terminated. Among baseline participants, the data from 186 participants were excluded (four due to the death of the mother or baby and one due to twin birth). It was not possible to contact 181 mothers by phone in the first month after delivery in Fig. 1.

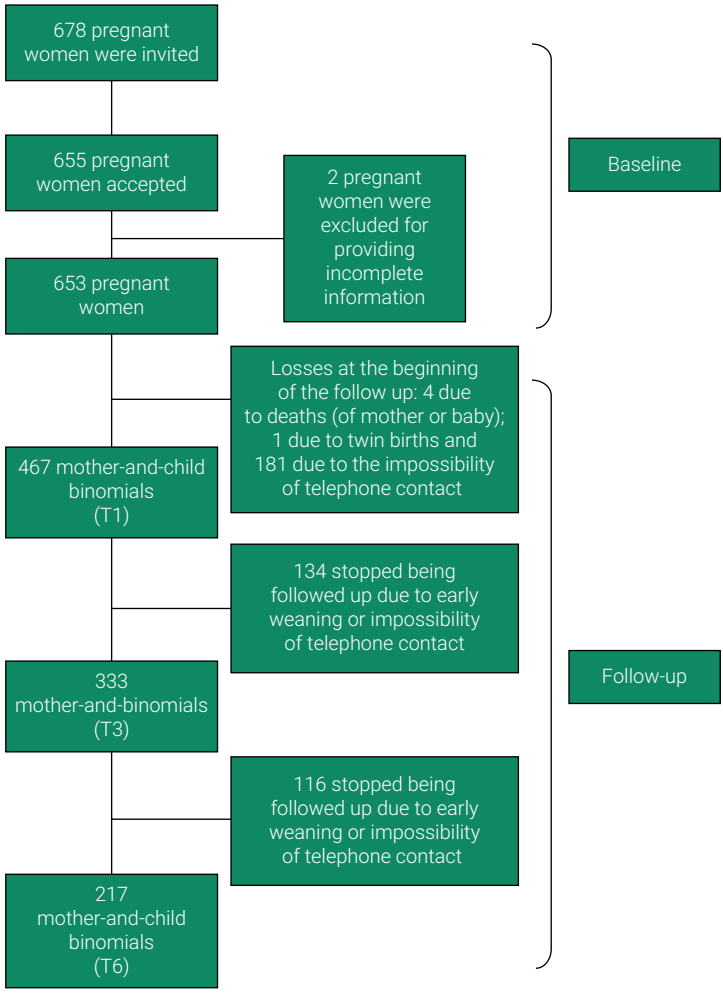

Figure 1. Flowchart reporting the reason for the losses in the course of the study

The sample size of 467 mother-baby dyads provided a test power of 0.80 (β=0.20), a significance level of 5% (α=0.05), for a minimum detectable odds ratio of 2.0. This sample size also agrees with the minimum number of events per variable required in logistic regression analyses. Calculations were performed using the EpiInfo software for the main independent variable of "baby botlle use", considering the prevalence found in previous studies[16].

The data were collected with a semi-structured questionnaire on EBF intention, demographic, socioeconomic, pregnancy, BF, family, health care, and biological and habits variables. For EBF intention, the Infant Feeding Intention (IFI) scale[17] was used. Such scale was translated and adapted to Brazilian Portuguese[18] and assessed the intention to initiate BF and continue EBF during the first six months of the baby's life. For other variables, a semi-structured pre-tested questionnaire was built based on previous studies.

The IFI scale consists of five sentences and categorized responses scored from zero to four, according to the level of agreement in a 5-point Likert Scale. The first two sentences measured the intention to initiate EBF. The other three items assessed the intention of EBF duration of one, three, and six months. The total score of the IFI scale was calculated by averaging the scores of the first two items, added to items three through five. Thus, the score ranged from 0 (very strong intention to not breastfeed at all) to 16 (very strong intention to provide breast milk as the sole source of milk up to six months of age)[17].

The variables collected at follow-up were the type of delivery, golden hour breastfeeding practice, infant feeding practices, oral habits (pacifier use and baby bottle use), baby care support available in the home environment, and return to work. The information was entered in an Excel spreadsheet.

For infant feeding practices, the following classification was used:

- Exclusive Breastfeeding (EBF): the baby receives only breast milk, from the breast or expressed in a baby bottle, up to the sixth month, allowing the use of vitamins, minerals, and medicine[2,3].
- Predominant Breastfeeding (PBF): the baby receives breast milk as the predominant source of nutrition, allowing water or water-based drinks, fruit juices, and ritual fluids[2,3].
- Complementary Feeding (CF): the baby receives breast milk, non-human milk and formula[2].
- Breastfeeding (BF): the baby receives breast milk, allowing any food or beverage including non-human milk and formula[3].
- Artificial feeding: the baby receives any type of milk other than human milk[3].

The data were analyzed descriptively with absolute and relative frequencies for categorical variables and mean, standard deviation, median, minimum, and maximum values for quantitative variables. The associations between independent variables and EBF prevalence in the first, third, and sixth months after delivery (outcomes) were analyzed by simple and multiple hierarchical logistic regression models, following the conceptual model by Boccolini et al.[19] (2015). Such conceptual model considers the determinants of EBF in the first six months of the baby's life operating at multiple levels: family or household characteristics, maternal, pregnancy, prenatal care, childbirth care, maternal characteristics during hospitalization, the newborn, nursing mothers/family, infants, and health services.

- Distal model: maternal age (dichotomized between ≤27 and >27 years), color/race (dichotomized between white and non-white), marital status (dichotomized between single/divorced and married/stable union), maternal education (dichotomized between complete and incomplete elementary school and other levels of study), family income (dichotomized between ≤2000 and >2000 Brazilian Reais), type of residence (dichotomized between owned and not owned), first pregnancy, and previous breastfeeding experience.
- Distal intermediate model: pregnancy planning.
- Proximal intermediate model: EBF intention score (score obtained using the IFI scale, dichotomized as <16 or =16), type of delivery, golden hour BF practice, newborn weight (dichotomized as ≤3.28 Kg or >3.28 Kg), newborn length (dichotomized as ≤49.5 cm or >49.5 cm).
- Proximal model: baby care support available in the home environment, pacifier use, baby bottle use, and return to work.

Simple logistic regression analyses were performed for each independent variable with the three outcomes. Variables with p<0.20 in the simple analyses were tested in multiple logistic regression models. The variables were inserted in the multiple models from the first to the last level, with variable adjustments at the same and previous levels. The fit of the models was evaluated by Akaike's Information Criterion (AIC). From the regression models, the raw and adjusted odds ratios were estimated with their respective 95% confidence intervals. The analyses were performed in the R software at a significance level of 5%.

Results

Table 1 shows the descriptive analyses of the study variables considering the three different follow-up times. The baseline data showed that 41.8% of mothers were married, 64.5% had completed high school, and 63.2% were multiparous. A total of 56.1% of mothers had previous BF experience and 43.0% had a planned pregnancy. The mean score of the IFI scale was 14.4.

Table 1. Descriptive analysis of the sample.

Variable	Category	Frequency (%)
Maternal marital status	Single	148 (31.7%)
	Married	195 (41.8%)
	Common-law marriage	115 (24.6%)
	Separated	9 (1.9%)
Color / Race	Black	57 (12.2%)
	White	209 (44.8%)
	Yellow	6 (1.3%)
	Brown	193 (41.3%)
	Indigenous	2 (0.4%)

Continue

Continuação

Maternal education	Incomplete primary education	46 (9.8%)
	Complete elementary school	42 (9.0%)
	Incomplete high school	77 (16.5%)
	Complete high school	225 (48.2%)
	Incomplete higher education	25 (5.4%)
	Complete higher education	51 (10.9%)
	Not informed	1 (0.2%)
Type of residence	Owned - paid off	88 (18.8%)
	Owned - financed	126 (27.0%)
	Rented	179 (38.3%)
	Given by parents	64 (13.7%)
	Ceded by work	4 (0.9%)
	Given up for having nowhere to live	1 (0.2%)
	Others	4 (0.9%)
	Not informed	1 (0.2%)
Parity	Primiparous	172 (36.8%)
	Multiparous	295 (63.2%)
Planned pregnancy	Yes	201 (43.0%)
	No	266 (57.0%)
Previous breastfeeding experience	Yes	262 (56.1%)
	No	205 (43.9%)
Type of delivery	Vaginal	210 (45.0%)
	Cesarean	257 (55.0%)
Baby care support available in the home environment	Yes	335 (71.7%)
	No	124 (26.6%)
	Not informed	8 (1.7%)
Golden hour breastfeeding practice (N=467)	Yes	172 (36.8%)
	No	290 (62.1%)
	Not informed	5 (1.1%)
Pacifier use at the first month (N=467)	Yes	184 (39.4%)
	No	276 (59.1%)
	Not informed	7 (1.5%)
Baby bottle use at first month (N=467)	Yes	109 (23.3%)
	No	348 (74.5%)
	Not informed	10 (2.1%)
Pacifier use at the third month (N=333)	Yes	153 (46.0%)
	No	177 (53.2%)
	Not informed	3 (0.9%)
Baby bottle use at the third month (N=333)	Yes	128 (38.4%)
	No	203 (61.0%)
	Not informed	2 (0.6%)

Continue

Continuação

Pacifier use at the sixth month (N=217)	Yes	84 (38.7%)
	No	131 (60.4%)
	Not informed	2 (0.9%)
Baby bottle use at the sixth month (N=217)	Yes	121 (55.8%)
	No	95 (43.8%)
	Not informed	1 (0.5%)
Returned to work in the first month (N=467)	Yes	30 (6.4%)
	No	430 (92.1%)
	Not informed	7 (1.5%)
Returned to work in the third month (N=333)	Yes	37 (11.1%)
	No	293 (88.0%)
	Not informed	3 (0.9%)
Returned to work in the sixth month (N=217)	Yes	77 (35.5%)
	No	139 (64.1%)
	Not informed	1 (0.5%)
Infant feeding practices at the first month (N=467)	Exclusive breastfeeding (EBF)	379 (81.2%)
	Complementary feeding (CF)	45 (9.6%)
	Predominant breastfeeding (PBF)	3 (0.6%)
	Artificial feeding	40 (8.6%)
Infant feeding practices at the third month (N=333)	Exclusive breastfeeding (EBF)	213 (64.0%)
	Complementary feeding (CF)	72 (21.6%)
	Predominant breastfeeding (PBF)	15 (4.5%)
	Artificial feeding	30 (9.0%)
	Breastfeeding (BF)	3 (0.9%)
Infant feeding practices at the sixth month (N=217)	Exclusive breastfeeding (EBF)	78 (35.9%)
	Complementary feeding (CF)	58 (26.7%)
	Predominant breastfeeding (PBF)	4 (1.8%)
	Artificial feeding	36 (16.6%)
	Breastfeeding (BF)	41 (19.8%)
	Mean (standard deviation)	**Median (min. and max.)**
Maternal age (years)	27.2 (6.4)	27.0 (15.0-44.0)
Family income (Brazilian Reais)	2159.0 (1138.1)	2000.0 (190.0-7000.0)
Infant Feeding Intentions (IFI) scale score	14.4 (2.6)	16.0 (1.0-16.0)
Baby weight at birth (Kg) (N=467)	3.3 (0.5)	3.9 (1.7-6.3)
Baby length at birth (cm) (N=467)	49.2 (2.5)	(38.0-59.0)

The follow-up data showed that 45.0% of mothers had a vaginal delivery, 36.8% practiced golden hour BF, and 71.7% had baby care support available in the home environment. About 81.2%, 64.0%, and 35.9% of mothers reported EBF at one, three, and six months of the baby's life, respectively. Concerning pacifier use, 39.4%, 46.0%, and 38.7% of mothers reported their babies were using it at one, three, and six months of

age, respectively. Also, 23.3%, 38.4%, and 55.8% of babies were using a baby bottle at one, three, and six months of age, respectively. About 6.4%, 11.1%, and 35.5% of mothers returned to work at one, three, and six months of the baby's life, respectively.

Table 2 presents the association analyses of EBF at the first month, considering the variable of baby bottle use at the first month in the model. Individual analyses showed that the EBF intention score, pacifier use, and baby bottle use were significantly associated with EBF ($p<0.05$), but only the variable of baby bottle use remained in the final model ($p<0.05$). A higher probability of being on EBF at the first month was observed for infants who were not bottle-fed at one month old. Because there was a strong association between EBF and baby bottle use, the outcome was also studied without considering this variable (Table 2). In this case, mothers with higher EBF intention score (OR=1.71; 95%CI: 1.05-2.78) and babies who did not use a pacifier at this time (OR=2.94; 95%CI: 1.81-4.78) ($p<0.05$) were more likely to be on EBF at the first month. Among mothers with IFI score of 16, 85.9% of babies were on EBF at the first month, while for those with lower scores, this percentage was 76.1% ($p<0.05$). Among babies who did not use a pacifier, the percentage of EBF was 88.0%, while for those who did, this percentage was 70.6% ($p<0.05$).

Table 3 presents the results for EBF at the third month. The variables of baby weight at birth, pacifier use, and baby bottle use ($p<0.05$) were significantly associated with the outcome in the individual analyses. In the final model, the variables of baby care support available in the home environment and baby bottle use remained significant ($p<0.05$). There was a higher chance of EBF at the third month among women with care support available in the home environment and infants who are not using a baby bottle at the third month ($p<0.05$). Among mothers who had support, the percentage of EBF was 66.3%, while for those who did not, this percentage was 55.8% ($p<0.05$). The outcome at the third month was also studied, excluding the variable of baby-bottle use, which had a strong association with the outcome (Table 3). Maternal age (OR=0.54; 95%CI: 0.33-0.88), maternal marital status (OR=1.82; 95%CI: 1.08-3.07), newborn weight (OR=1.62; 95%CI: 1.01-2.62), and pacifier use (OR=2.78; 95%CI: 1.73-4.48), $p<0.05$) remained in the final model. Babies of younger mothers, whose mother was married or in a common-law marriage, with higher birth weight, and who did not use a pacifier were more likely to be on EBF at the third month ($p<0.05$). Among mothers aged up to 27 years, 67.8% were on EBF at the third month and, for older mothers, this percentage was 59.8% ($p<0.05$). Among mothers who were married or in a common-law marriage, the percentage of EBF was 67.0%, while for the others, it was 57.3% ($p<0.05$). Among the babies born weighing over 3.28 kg, the percentage of EBF was 69.5%, while for the others, it was 58.3% ($p<0.05$). Among babies who did not use a pacifier, the percentage of EBF was 74.0%, while for those who did, it was 51.6% ($p<0.05$).

Table 4 shows the analyses for EBF in the sixth month of the baby's life. The variables of pacifier use, baby bottle use, and return to work were significantly associated with the outcome in the individual analyses ($p<0.05$). In the final model, only the variable of pacifier use remained ($p<0.05$). There was a greater chance of EBF among infants who were not use baby bottle ($p<0.05$). This outcome was also studied without considering the variable of baby bottle (Table 4). In this case, the variables of pacifier use and return to work remained in the final model ($p<0.05$). Babies who did not use a pac-

Table 2. Analyses (crude and adjusted) of associations with EBF at the first month, with and without the variable of baby bottle use at the first month in the multiple analysis (N=467).

Variable	Category	N(%)	EBF at the first month		Crude OR (95%CI)	p-value	OR final model including baby bottle use at the first month (CI95%)	p-value	OR final model without the variable of baby bottle use at the first month (95%CI)	p-value
			Yes	No						
			N (%)	N (%)						
Distal level										
Maternal age (years)	≤ 27	250 (53.5%)	201 (80.4%)	49 (19.6%)	Ref		-	-	-	-
	> 27	217 (46.5%)	178 (82.0%)	39 (18.0%)	1.11 (0.70-1.77)	0.6538				
Color / Race	White	209 (44.8%)	166 (79.4%)	43 (20.6%)	Ref		-	-	-	-
	Not white	258 (55.2%)	213 (82.6%)	45 (17.4%)	1.23 (0.77-1.95)	0.3899				
Maternal marital status	Single or separated	157 (33.6%)	125 (79.6%)	32 (20.4%)	Ref		-	-	-	-
	Married or common-law marriage	310 (66.4%)	254 (81.9%)	56 (18.1%)	1.16 (0.72-1.88)	0.5454				
Maternal education	Elementary school (complete and incomplete)	88 (18.8%)	65 (73.9%)	23 (26.1%)	Ref		-	-	-	-
	Others	379 (81.2%)	314 (82.8%)	65 (17.2%)	1.71 (0.99-2.95)	0.0540				
Family income (Brazilian Reais)	≤ 2000	249 (61.0%)	197 (79.1%)	52 (20.9%)	Ref		-	-	-	-
	> 2000	159 (39.0%)	135 (84.9%)	24 (15.1%)	1.48 (0.87-2.52)	0.1446				
Homeownership	Yes	214 (45.9%)	174 (81.3%)	40 (18.7%)	1.00 (0.62-1.59)	0.9910	-	-	-	-
	No	252 (54.1%)	205 (81.4%)	47 (18.6%)	Ref					

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Continuation

Parity	Primiparous	172 (36.8%)	139 (80.8%)	33 (19.2%)	Ref		-	-	-	-
	Multiparous	295 (63.2%)	240 (81.4%)	55 (18.6%)	1.04 (0.64-1.67)	0.8848				
Previous breastfeeding experience	Yes	262 (56.1%)	218 (83.2%)	44 (16.8%)	1.35 (0.85-2.16)	0.2013	-	-	-	-
	No	205 (43.9%)	161 (78.5%)	44 (21.5%)	Ref					
Distal intermediate level										
Planned pregnancy	Yes	201 (43.0%)	162 (80.6%)	39 (19.4%)	0.94 (0.59-1.50)	0.7882	-	-	-	-
	No	266 (57.0%)	217 (81.6%)	49 (18.4%)	Ref					
Proximal intermediate level										
EBF intention (IFI scale score)	< 16	226 (48.4%)	172 (76.1%)	54 (23.9%)	Ref		-	-	Ref	
	16	241 (51.6%)	207 (85.9%)	34 (14.1%)	1.91 (1.19-3.07)	0.0074			1.71 (1.05-2.78)	0.0316
Type of delivery	Vaginal	210 (45.0%)	175 (83.3%)	35 (16.7%)	1.30 (0.81-2.08)	0.2776	-	-	-	-
	Cesarean	257 (55.0%)	204 (79.4%)	53 (20.6%)	Ref					
Golden hour breastfeeding practice	Yes	172 (37.2%)	146 (84.9%)	26 (15.1%)	1.50 (0.90-2.48)	0.1173	-	-	-	-
	No	290 (62.8%)	229 (79.0%)	61 (21.0%)	Ref					
Baby weight at birth (Kg)	≤ 3.28	232 (50.5%)	486 (80.2%)	46 (19.8%)	Ref		-	-	-	-
	> 3.28	227 (49.5%)	186 (81.9%)	41 (18.1%)	1.12 (0.70-1.79)	0.6295				

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Baby length at birth (cm)	≤ 49.5	230 (50.4%)	181 (78.7%)	49 (21.3%)	Ref		-	-	-	-
	> 49.5	226 (49.6%)	189 (83.6%)	37 (16.4%)	1.38 (0.86-2.22)	0.1793				
Proximal level										
Baby care support available in the home environment	Yes	335 (73.0%)	259 (80.3%)	66 (19.7%)	0.83 (0.48-1.43)	0.5024	-	-	-	-
	No	124 (27.0%)	103 (83.1%)	21 (16.9%)	Ref					
Pacifier use at the first month	Yes	184 (40.0%)	130 (70.6%)	54 (29.4%)	Ref		-	-	Ref	
	No	276 (60.0%)	243 (88.0%)	33 (12.0%)	3.06 (1.89-4.96)	<0.0001			2.94 (1.81-4.78)	<0.0001
Baby bottle use at the first month	Yes	109 (23.8%)	24 (22.0%)	85 (78.0%)	Ref		Ref		-	-
	No	348 (76.2%)	346 (99.4%)	2 (0.6%)	612.59 (142.02->999.99)	<0.0001	612.59 (142.02->999.99)	<0.0001		
Returned to work in the first month	Yes	30 (6.5%)	26 (86.7%)	4 (13.3%)	Ref		-	-	-	-
	No	430 (93.5%)	346 (80.5%)	84 (19.5%)	0.63 (0.22-1.86)	0.4075				
AIC							143.54		426.10	

*Outcome event. Ref: Reference category for independent variables. OR: Odds Ratio. CI: Confidence Interval. AIC (empty model) = 448.16. IFI: Infant Feeding Intentions.

Table 3. Analyses (crude and adjusted) of the associations with EBF at the third month, with or without the variable of baby bottle use at the third month in the multiple analysis (N=333).

Variable	Category	N(%)	EBF at the third month		Crude OR (95%CI)	p-value	OR final model including baby bottle use at the third month (CI95%)	p-value	OR final model without baby bottle use at the third month (CI95%)	p-value
			*Yes	No						
			N (%)	N (%)						
Distal level										
Maternal age (years)	≤ 27	174 (52.2%)	118 (67.8%)	56 (32.2%)	Ref		-	-	Ref	
	> 27	159 (47.8%)	95 (59.8%)	64 (40.2%)	0.70 (0.45-1.10)	0.1262			0.54 (0.33-0.88)	0.0132
Color / Race	White	145 (43.5%)	90 (62.1%)	55 (37.9%)	Ref		-	-	-	-
	Not white	188 (56.5%)	123 (65.4%)	65 (34.6%)	1.16 (0.74-1.81)	0.5271				
Maternal marital status	Single or separated	103 (30.9%)	59 (57.3%)	44 (42.7%)	Ref		-	-	Ref	
	Married or common-law marriage	230 (69.1%)	154 (67.0%)	76 (33.0%)	1.51 (0.94-2.44)	0.0901			1.82 (1.08-3.07)	0.0253
Maternal education	Elementary school (complete and incomplete)	64 (19.2%)	36 (56.2%)	28 (43.8%)	Ref		-	-	-	-
	Others	269 (80.8%)	177 (65.8%)	92 (34.2%)	1.50 (0.86-2.60)	0.1542				
Family income (Brazilian Reais)	≤ 2000	178 (61.0%)	110 (61.8%)	68 (38.2%)	Ref		-	-	-	-
	> 2000	114 (39.0%)	74 (64.9%)	40 (35.1%)	1.14 (0.70-1.86)	0.5908				
Homeownership	Yes	159 (47.8%)	99 (62.3%)	60 (37.7%)	0.87 (0.56-1.36)	0.5369	-	-	-	-
	No	174 (52-2%)	114 (65.5%)	60 (34.5%)	Ref					

Continue

Continuation

Parity	Primiparous	124 (37.2%)	80 (64.5%)	44 (35.5%)	Ref		-	-	-	-
	Multiparous	209 (62.8%)	133 (63.6%)	76 (36.4%)	0.96 (0.61-1.53)	0.8718				
Previous breastfeeding experience	Yes	189 (56.8%)	123 (65.1%)	66 (34.9%)	1.04 (0.65-1.65)	0.8718	-	-	-	-
	No	144 (43.2%)	90 (62.5%)	54 (37.5%)	Ref					
Distal intermediate level										
Planned pregnancy	Yes	148 (44.4%)	96 (64.9%)	52 (35.1%)	1.07 (0.68-1.68)	0.7594	-	-	-	-
	No	185 (55.6%)	117 (63.2%)	68 (36.8%)	Ref				-	-
Proximal intermediate level										
EBF intention (IFI scale score)	≤ 16	156 (46.8%)	94 (60.3%)	62 (39.7%)	Ref		-	-	-	-
	> 16	177 (53.2%)	119 (67.2%)	58 (32.8%)	1.35 (0.86-2.12)	0.1864				
Type of delivery	Vaginal	149 (44.7%)	96 (64.4%)	53 (35.6%)	1.04 (0.66-1.63)	0.8736	-	-	-	-
	Cesarean	184 (55.3%)	117 (63.6%)	67 (36.4%)	Ref					
Golden hour breastfeeding practice	Yes	123 (37.4%)	79 (64.2%)	44 (35.8%)	1.03 (0.64-1.64)	0.9077	-	-	-	-
	No	206 (62.6%)	131 (63.6%)	75 (36.4%)	Ref					
Baby weight at birth (Kg)	≤ 3.28	175 (53.2%)	102 (58.3%)	73 (41.7%)	Ref		-	-	Ref	
	> 3.28	154 (46.8%)	107 (69.5%)	47 (30.5%)	1.63 (1.03-2.57)	0.0359			1.62 (1.01-2.62)	0.0473

Continue

Continuation										
Baby length at birth (cm)	≤ 49.5	170 (52.0%)	102 (60.0%)	68 (40.0%)	Ref		-	-	-	-
	> 49.5	157 (48.0%)	107 (68.2%)	50 (31.8%)	1.43 (0.90-2.25)	0.1257				
Proximal level										
Baby care support available in the home environment	Yes	243 (73.9%)	161 (66.3%)	82 (33.7%)	1.55 (0.94-2.57)	0.0849	2.59 (1.00-6.71)	0.0500	-	-
	No	86 (26.1%)	48 (55.8%)	38 (44.2%)	Ref		Ref			
Pacifier use at three months	Yes	153 (46.4%)	79 (51.6%)	74 (48.4%)	Ref		-	-	Ref	
	No	177 (53.6%)	131 (74.0%)	46 (26.0%)	2.67 (1.68-4.23)	<0.0001			2.78 (1.73-4.48)	<0.0001
Baby bottle use at three months	Yes	128 (38.7%)	18 (14.1%)	110 (85.9%)	Ref		Ref		-	-
	No	203 (61.3%)	193 (95.1%)	10 (4.9%)	117.94 (52.59-264.52)	<0.0001	139.08 (58.78-329.04)	<0.0001		
Returned to work at three months	Yes	37 (11.2%)	21 (56.8%)	16 (43.2%)	Ref		-	-	-	-
	No	293 (88.8%)	190 (64.8%)	103 (35.2%)	1.40 (0.70-2.81)	0.3359				
AIC							181.54		408.85	

*Outcome event. Ref: Reference category for independent variables. OR: Odds Ratio. CI: Confidence Interval. AIC (empty model) = 431.89. IFI: Infant Feeding Intentions.

Table 4. Analyses (crude and adjusted) of the associations with EBF at sixth months, with or without the variable of baby bottle use at the sixth month in the multiple analysis (N=217).

Variable	Category	N(%)	EBF at the sixth month		Crude OR (CI95%)	p-value	OR final model including baby bottle use at the sixth month (95%CI)	p-value	OR final model without baby bottle use at the sixth month (95%CI)	p-value
			*Yes	No						
			N (%)	N (%)						
Distal level										
Maternal age (years)	≤ 27	111 (51.2%)	45 (40.5%)	66 (59.5%)	Ref		-	-	-	-
	> 27	106 (48.8%)	33 (31.1%)	73 (68.9%)	0.66 (0.38-1.16)	0.1497				
Color / Race	White	91 (41.9%)	30 (33.0%)	61 (67.0%)	Ref		-	-	-	-
	Not white	126 (58.1%)	48 (38.1%)	78 (61.9%)	1.25 (0.71-2.20)	0.4376				
Maternal marital status	Single or separated	63 (29.0%)	20 (31.8%)	43 (68.2%)	Ref		-	-	-	-
	Married or common-law marriage	154 (71.0%)	58 (37.7%)	96 (62.3%)	1.30 (0.70-2.42)	0.4103				
Maternal education	Elementary school (complete and incomplete)	37 (17.0%)	12 (32.4%)	25 (67.6%)	Ref		-	-	-	-
	Others	180 (83.0%)	66 (36.7%)	114 (63.3%)	1.21 (0.57-2.56)	0.6253				
Family income (Brazilian Reais)	≤ 2000	116 (60.7%)	43 (37.1%)	73 (62.9%)	Ref		-	-	-	-
	> 2000	75 (39.3%)	27 (36.0%)	48 (64.0%)	0.96 (0.52-1.75)	0.8811				
Homeownership	Yes	109 (50.2%)	34 (31.2%)	75 (68.8%)	0.66 (0.38-1.15)	0.1437	-	-	-	-
	No	108 (49.8%)	44 (40.7%)	64 (59.3%)	Ref					

Continue

Continuation

Parity	Primiparous	79 (36.4%)	34 (43.0%)	45 (57.0%)	Ref		-	-	-	-
	Multiparous	138 (63.6%)	44 (31.9%)	94 (68.1%)	0.62 (0.35-1.10)	0.1005				
Previous breastfeeding experience	Yes	122 (56.2%)	41 (33.6%)	81 (66.4%)	0.79 (0.45-1.39)	0.4163	-	-	-	-
	No	95 (43.8%)	37 (39.0%)	58 (61.0%)	Ref					
Distal intermediate level										
Planned pregnancy	Yes	106 (48.8%)	33 (31.1%)	73 (68.9%)	0.66 (0.38-1.16)	0.1497	-	-	-	-
	No	111 (51.2%)	45 (40.5%)	66 (59.5%)	Ref					
Proximal intermediate level										
EBF intention (IFI scale score)	≤ 16	99 (45.6%)	31 (31.3%)	68 (68.7%)	Ref		-	-	-	-
	> 16	118 (54.4%)	47 (39.8%)	71 (60.2%)	1.45 (0.83-2.55)	0.1936				
Type of delivery	Vaginal	100 (46.1%)	42 (42.0%)	58 (58.0%)	1.63 (0.93-2.85)	0.0867	-	-	-	-
	Cesarean	117 (53.9%)	36 (30.8%)	81 (69.2%)	Ref					
Golden hour breastfeeding practice	Yes	85 (39.7%)	35 (41.2%)	50 (58.8%)	1.50 (0.85-2.65)	0.1609	-	-	-	-
	No	129 (60.3%)	41 (31.8%)	88 (68.2%)	Ref					
Baby weight at birth (Kg)	≤ 3.28	108 (50.2%)	36 (33.3%)	72 (66.7%)	Ref		-	-	-	-
	> 3.28	107 (49.8%)	41 (38.3%)	66 (61.7%)	1.24 (0.71-2.17)	0.4462				

Continue

Continuation

Baby length at birth (cm)	≤ 49.5	100 (47.0%)	35 (35.0%)	65 (65.0%)	Ref		-	-	-	-
	> 49.5	113 (53.0%)	42 (37.2%)	71 (62.8%)	1.10 (0.63-1.92)	0.7424				
Proximal level										
Baby care support available in the home environment	Yes	161 (74.9%)	53 (32.9%)	108 (67.1%)	0.66 (0.35-1.24)	0.1996	-	-	-	-
	No	54 (25.1%)	23 (42.6%)	31 (57.4%)	Ref					
Pacifier use at six months	Yes	84 (39.1%)	18 (21.4%)	66 (78.6%)	Ref		-	-	Ref	
	No	131 (60.9%)	58 (44.3%)	73 (55.7%)	2.91 (1.56-5.44)	0.0008			2.93 (1.55-5.52)	0.0009
Baby bottle use at six months	Yes	121 (56.0%)	14 (11.6%)	107 (88.4%)	Ref		Ref			
	No	95 (44.0%)	63 (66.3%)	32 (33.7%)	15.05 (7.46-30.33)	<0.0001	15.05 (7.46-30.33)	<0.0001	-	-
Returned to work at six months	Yes	77 (35.7%)	18 (23.4%)	59 (76.6%)	Ref		-	-	Ref	
	No	139 (64.4%)	59 (42.4%)	80 (57.6%)	2.42 (1.29-4.52)	0.0057			2.39 (1.26-4.55)	0.0078
AIC							212.10		265.69	

*Outcome event. Ref: Reference category for independent variables. OR: Odds Ratio. CI: Confidence Interval. AIC (empty model) = 281.32. IFI: Infant Feeding Intention.

ifier (OR=2.93; 95%CI: 1.55-5.52) and whose mothers did not return to work (OR=2.39; 95%CI: 1.26-4.55) (p<0.05) had a higher chance of EBF at the sixth month. Among the babies who did not use a pacifier, the percentage of EBF at the sixth month was 44.3%, while for the others, it was 21.4% (p<0.05). Among mothers who did not return to work, the percentage of EBF was 42.4%, while for those who did, this percentage was 23.4% (p<0.05).

Discussion

This cohort study assessed EBF prevalence and its predictors during the first six months of the baby's life. The EBF prevalence was 81%, 64.0%, and 36% at the first, third, and sixth months, indicating an EBF rate below the ideal of 70% under six months[7] since babies were three months old. Recent data collected in Brazil revealed that 45.7% of babies under six months were on EBF[16]. Other studies showed higher rates of 58%[15] or lower rates of 29.8% (a Turkish city)[20] of EBF prevalence at six months in comparison to our findings.

Factors such as fewer prenatal visits/higher barriers to prenatal follow-up, no EBF intention, cesarean delivery, late initiation of BF, early offering of other foods, maternal work, belief that BM was not enough, BF problems (mastitis, cracked nipples, breast pain, and others), absent or insufficient BF counseling from healthcare providers, and lack of support[21] have been described as the main barriers for EBF. Therefore, strengthening health actions directly related to encouraging and preparing pregnant women for EBF up to the sixth month of the baby's life is strongly suggested.

Babies who did not use a pacifier were more likely to be on EBF at one (OR=2.94), three (OR=2.78), and six (OR=2.93) months of age. Until the sixth month, there was a reduction from 70.6% (n=130) of infants on EBF who used pacifiers in the first month to 21.4% (n=18) of infants on EBF in the sixth month. Other studies have also found that pacifier use reduced EBF by 33% in infants followed up in the first month[6], meaning a lower prevalence of EBF in infants who used a pacifier[20].

According to a systematic review[22], pacifier use and/or baby bottle use can work as a risk factor for early weaning because it decreases the sucking activity, leading to lower milk production. In Brazil, using pacifiers is not recommended because it can negatively interfere with EBF duration, besides being associated with a higher occurrence of oral candidiasis, otitis media, and changes in the oral cavity[3]. The WHO/UNICEF also contraindicates artificial nipples or pacifiers to breastfed infants[23]. However, the American Academy of Pediatrics recommends pacifier use to full-term babies at nap time or during sleep after breastfeeding is established because its use is associated with a reduction in the incidence of Sudden Infant Death Syndrome[24]. Considering these contradictory recommendations, there should be a consensus about pacifier use among health organizations worldwide.

In the analysis of the first month of the baby's life, mothers who showed very stronger EBF intention at the end of pregnancy (OR=1.71) were more likely to offer exclusive breast milk to the baby, suggesting that maternal EBF intention affected the establishment of EBF. Authors state that EBF intention is a concept constructed throughout life and it may affect the initiation and maintenance of BF[14]. At baseline, 74% of pregnant women strongly or

somewhat agreed with the statement that, at the sixth month of the baby's life, they would breastfeed without any formula or other milk. At follow-up, 35.9% of mothers reported EBF at six months, reinforcing the need for public policies that strengthen EBF practice and strategies to identify and guide pregnant women without strong EBF intention on the potential barriers and ways to overcome them during the EBF process.

Babies of younger mothers (≤27 years) were more likely to be on EBF at the third month, which contrasts with other studies that have found poor BF rates in younger mothers. This is seen in the systematic review by Dalili et al.[25] (2020), which noted that maternal age <36 presents as a risk factor for BF duration, as well as the Brazilian systematic review by Santana et al.[26] (2018), which noted a higher possibility of older women continuing BF for up to 12 months. The findings of the present study may have differed from others due to the mean age of 27 years (ranging from 15 to 44 years), but further studies are suggested to understand the influence of age on EBF rates.

Babies with higher birth weight (OR=1.62) were also associated with EBF at the third month. This finding agrees with the results of a study that looked at underweight babies are more likely to be admitted to neonatal units[19] and separated from their mothers for longer periods[27], so it may be harder for them to initiate or maintain BF, considering that both sucking frequency and pressure increase as gestational age and birth weight increase[28].

Variables directly or indirectly related to the support network of women (married or in a common-law marriage (OR=1.82) and baby care support available in the home environment (OR=2.78) were associated with EBF at the third month of the baby's life. The support given to breastfeeding women and encouragement from surrounding people are determinants for BF adherence and maintenance[29]. In this context, it is important that health professionals are careful to strengthen the knowledge of pregnant women and, if possible, of their support network about the benefits and importance of BF, during prenatal and postnatal periods.

At the sixth month of the baby's life, the mother not returning to work (OR=2.39) was an important predictor of EBF. The literature has shown that returning to work is often indicated as a cause of early weaning[19]. In Brazil, the maternity leave determined by law is 120 days, which is shorter than the 180 days recommended by the WHO for EBF. A short maternity leave (< 6 months) can increase by four the chances of not initiating BF or early weaning[30]. The need to return to work before the baby is six months old may hinder EBF continuity, considering that the workplace often lacks an environment prepared for milking and storing breast milk to offer the baby when returning home.

In summary, the findings of the present study showed not using a pacifier also had a positive influence on EBF. Other variables were important for establishing EBF at the first month of the baby's life, such as EBF intention at the end of pregnancy or, for EBF consolidation at the third month, such as maternal age, birth weight, maternal marital status, and baby care support available in the home environment. Finally, returning to work was a predictor for the absence of EBF at the sixth month of the baby's life. The findings of this study highlight the relevance of investing in public health policies that contribute to eliminate barriers and strengthen measures to favor EBF during prenatal and postnatal periods, such as promoting the empowerment of pregnant and lactat-

ing women concerning the benefits of EBF, the disadvantages of pacifier use and BF support in the workplace.

The limitations of this study include the impossibility of contacting all the baseline participants due to telephone number changes. The strengths of this study are the design, quality of data, and statistical analysis.

In conclusion, the EBF prevalence was high at the first month of the baby's life and decreased over six months. The EBF intention affected EBF initiation. Variables related to the mother´s demographic characteristics, the baby´s birth weight, the childcare support or the baby bottle/pacifier use were associated with EBF. Improvements are suggested for maternal guidance and parental and family counseling by addressing the benefits of EBF and the importance of supporting lactating woman.

Acknowledgments

To the maternity hospital and its employees for welcoming us. To the pregnant women, for their acceptance and participation in the research. To the researchers, Dr. Laurie Nommsen-Rivers and Dr. Fernanda Góes, for providing and translating the Infant Feeding Intentions scale, respectively.

Funding

This study was supported by the Coordination for the Improvement of Higher Education Personnel - Brazil (CAPES) - Funding Code 001 and UNESP's Dean of Graduate Studies – Funding for language review (PROPG 6/2021).

Conflict of Interest

The authors have no conflict of interest to disclose.

Data availability

Datasets related to this article will be available upon request to the corresponding author.

Author contribution

Letícia Santos Alves de Melo: collected the data, interpreted the data, were involved in drafting the manuscript. **Lorena Fonseca Silva:** collected the data. **Elaine Pereira da Silva Tagliaferro:** interpreted the data, were involved in drafting the manuscript. All the authors have made substantial contributions to the conception and design of the study. All the authors revised manuscript critically and have final approval of the version to be submitted.

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