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Original Research

Breastfeeding Duration and Exclusivity Among Early-Term and Full-Term Infants: A Cohort Study

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A B S T R A C T

Background: As compared to full-term infants (39–41 weeks of gestation), early-term infants (37–38 wk) are at increased risk of adverse outcomes, including shorter exclusive breastfeeding (EB) duration and continued breastfeeding.
Objectives: To compare early-term with full- and late-term infants regarding the prevalence of EB at 3 mo and any breastfeeding at 12 mo.
Methods: Data sets from two population-based birth cohorts conducted in the city of Pelotas, Brazil, were combined. Only term infants (37 0/7 through 41 6/7 weeks of gestation) were included in the analyses. Early-term infants (37 0/7 through 38 6/7 wk) were compared to the remaining term infants (39 0/7 through 41 6/7 wk). Information on breastfeeding was gathered through maternal interviews at the 3-mo and 12-mo follow-ups. The prevalence of EB at 3 mo and any breastfeeding at 12 mo with 95% CIs were calculated. Crude and adjusted prevalence ratios (PRs) were obtained through Poisson regression.
Results: A total of 6395 infants with information on gestational age and EB at 3 mo and 6401 infants with information on gestational age and any breastfeeding at 12 mo were analyzed. There was no difference between early-term infants and the remaining term infants regarding the prevalence of EB at 3 mo (29.2% and 27.9%, respectively) ($P = 0.248$). Prevalence of any breastfeeding at 12 mo was lower in early-term infants than among those born between 39 0/7 and 41 6/7 weeks of gestation (38.2% compared with 42.4%) ($P = 0.001$). In the adjusted analysis, the PR for any breastfeeding at 12 mo was 15% lower in the early-term group than in the remaining term infants (PR = 0.85; 95% CI: 0.76–0.95) ($P = 0.004$).
Conclusions: The prevalence of EB at 3 mo was similar among term infants. Nonetheless, in comparison with the remaining infants born at term, early-term infants were at increased risk of having been weaned before reaching 12 mo of age. *Curr Dev Nutr* 2023;xx:xx.

Keywords: breastfeeding, gestational age, risk factors, Infant, Premature, Cohort studies

Introduction

Epidemiological evidence indicates that breastfeeding protects against respiratory and gastrointestinal infections [1], reduces mortality, and increases intellectual capacity in children and adolescents [2,3]. Breastfeeding for ≥12 mo enhances protection against mortality and morbidity from infectious diseases until 2 y of age [3]. However, global breastfeeding rates are below the levels proposed by the World Health Organization, which set a goal for 2025 to increase the rate of exclusive breastfeeding (EB) in the first 6 mo of life to ≥50% [4]. In low- and middle-income countries, only 37% of infants are exclusively

Abbreviations: EB, exclusive breastfeeding; PR, prevalence ratio; SGA, small for gestational age.

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breastfed until 6 mo of age, and this rate is even lower in high-income countries, mostly not reaching 20% [3].

A range of historical, socioeconomic, cultural, and individual factors may affect breastfeeding practices [2,5]. An important factor associated with nonexclusive breastfeeding is prematurity. One possible explanation for this is that a considerable number of preterm infants require intensive care, which compromises breastfeeding on demand. Preterm infants are a vulnerable population with specific nutritional needs that require timely attention and proper management [5]. Prematurity affects a great number of live births worldwide and is recognized as an important cause of mortality and morbidity during childhood and even later in life [5].

Recent studies suggest that early-term birth (37 0/6 weeks of gestation through 38 6/7 weeks of gestation) can affect breastfeeding, indicating that incomplete maturation of the newborn is an important factor in this process [6,7]. Therefore, this study aimed to compare early-term infants with the remaining term infant groups regarding the prevalence of EB at 3 mo and any breastfeeding at 12 mo.

Methods

This study included newborns from the 2004 and 2015 Pelotas Birth Cohorts, two population-based studies conducted in the city of Pelotas in Southern Brazil. The first population-based birth cohort in the city of Pelotas was initiated in 1982 and a new cohort was initiated at every 11-y interval. Four population-based birth cohorts (1982, 1993, 2004, and 2015) are currently underway in the city to allow for the assessment of changes in social, maternal, and child health indicators over the decades in the same setting.

All live births occurring in the city between January 1 and December 31 of 2004 and 2015 were eligible for the 2004 and 2015 cohorts, respectively. A total of 4231 newborns from the 2004 cohort and 4275 newborns from the 2015 cohort were enrolled, accounting for 99.2% and 98.7%, respectively, of the eligible sample in each year. For the current study, only term-born infants (37 0/7 weeks through 41 6/7 weeks of gestation) were included. The detailed methodologies of both cohorts can be found in previous publications [8–11]. The current study used data from the perinatal period (during the maternal hospital stay after childbirth) as well as data from the 3- and 12-mo follow-ups of both cohorts combined.

Early-term birth (exposed group) was defined as births occurring at 37 0/7 weeks through 38 6/7 weeks of gestation. The comparison group comprised both full-term (39 0/7 weeks through 40 6/7 weeks of gestation) and late-term infants (41 0/7 weeks through 41 6/7 weeks of gestation) [12]. In both cohorts, the best obstetric estimate based primarily on obstetric ultrasonography performed before 20 weeks of gestation, if available, was used to determine gestational age. If not available, the date of the last menstrual period extracted from prenatal medical records or reported by the mother was used to calculate the gestational age.

The outcomes studied in both cohorts were the prevalence of EB at 3 mo and the prevalence of any breastfeeding at 12 mo of age. EB was investigated at the 3-mo follow-up and was defined as breastfeeding with no other type of liquid, semi-solid, or solid food, including water or tea [13]. The mother or guardian was asked "Is the child being breastfed?" at the 12-mo follow-up to obtain information on any breastfeeding at 12 mo.

Potential confounding variables included family monthly income, maternal characteristics, and infant characteristics at birth. All variables were collected at cohort inception during the hospital stay. Family monthly income was defined as the perceived total income of all household residents in the previous month and subsequently grouped into quintiles. Maternal characteristics included years of education (subsequently categorized as 0–4, 5–9, or >9 y); age at the time of delivery (subsequently categorized as ≤20, 21–30, or >30 y); self-reported skin color (White, mixed, or Black); parity, defined as the number of deliveries including live births and stillbirths (1, 2, or ≥3); medical diagnosis of gestational diabetes as reported by the mother (yes or no); medical diagnosis of high blood pressure during pregnancy as reported by the mother (yes or no); smoking during pregnancy (yes or no); alcohol consumption during pregnancy (yes or no); gestational trimester at the beginning of antenatal care (first, second, or third); number of antenatal consultations (<6 or ≥6); type of delivery (vaginal or cesarean section); provision of breastfeeding counseling to the mother by a medical doctor or nurse during antenatal care (yes or no); and maternal intention to breastfeed (yes or no). These variables were selected on the basis of evidence of factors associated with breastfeeding patterns and durations [6].

Infant characteristics at birth included: sex (male or female), 5-min Apgar score (≤7 or >7), and intrauterine growth, which was assessed by the combination of gestational age and weight at birth and classified into two categories: "term birth with adequate weight for gestational age" and "term birth small for gestational age (SGA)." Children were classified as SGA when their weight for the gestational age and sex was below the 10th percentile of the standard curve, as defined by the INTERGROWTH 21st Project [14].

Analyses consisted of describing the original sample from each cohort and then comparing the samples evaluated at the 3- and 12-mo follow-up visits with the original sample from each cohort. To assess whether the associations between gestational age and outcomes varied according to the year of birth, interaction terms were tested. The results of interaction tests were not statistically significant ($P = 0.767$ for EB and $P = 0.685$ for any breastfeeding at 12 mo). With no evidence of interaction, the 2004 and 2015 samples were combined. Subsequently, the combined sample was described and the prevalence of early-term births, EB at 3 mo, and any breastfeeding at 12 mo, with the respective 95% CI, were calculated. Pearson's chi-squared test was used to assess the statistical significance of the association between early-term births and the outcomes.

The prevalence of study outcomes in the sample was high (>10%). Therefore, the strength of the association was assessed using Poisson regression with robust variance, obtaining crude and adjusted prevalence ratios (PRs) with 95% CIs [15]. Initially, all potential confounding factors were entered into the multivariable model, and after the backward removal of variables associated with the outcome at $P > 0.20$ one by one, all other variables were maintained in the final model for adjustment purposes. Each outcome was analyzed separately. Analyses were performed using Stata 17.0 software (StataCorp).

The perinatal study as well as the 3- and 12-mo follow-ups of the 2004 cohort were approved by the Research Ethics Committee of the Medical School of the Federal University of Pelotas (registration no. 4.06.00.006, approved on June 20, 2003, and registration No. 4.06.01.113, approved on March 9, 2005). The perinatal study and follow-ups of the 2015 cohort were approved by the Research Ethics Committee of the Physical Education School of the Federal University of Pelotas (Certificate of Presentation for Ethical Appreciation No. 26746414.5.0000.5313). Written informed consent was obtained from all participants before the interviews.

Results

From the original sample of the 2004 cohort, 98.6% and 97.2% of infants were assessed at 3 and 12 mo, respectively. From the 2015 cohort, 96.8% and 97.9% of the infants were assessed at 3 and 12 mo, respectively (Figure 1). A total of 3306 (78.1%) and 3256 (76.2%) infants from the 2004 and 2015 cohorts, respectively, were born at term (37 0/7 weeks of gestation through 41 6/7 weeks of gestation).

Supplemental Tables 1 and 2 compare the distribution of infants born at term in the 2004 and 2015 cohorts at birth, 3-mo follow-up, and 12-mo follow-up, according to independent variables. In both cohorts, no statistical differences were observed in either maternal or infant characteristics at 3- and 12-mo follow-ups when compared with the cohort distribution at birth.

In both follow-up periods, almost half (48.8%) of the mothers were aged between 21 and 30 y; most had self-declared White skin and ≥9 y of schooling. Approximately 44.0% of the mothers were primiparous. Regarding morbidity during pregnancy, around 6% had received a medical diagnosis of gestational diabetes and almost one-quarter reported high blood pressure during pregnancy. Almost one-fifth of the mothers smoked and 5% reported alcohol consumption during pregnancy. Most mothers initiated antenatal care in the first trimester, had ≥6 antenatal care consultations, reported having received counseling on breastfeeding during antenatal care, and had a cesarean section (Table 1)

Table 2 shows the distribution of the study sample at 3- and 12-mo follow-ups, according to infant characteristics. Nearly half of the analyzed sample was from both cohorts. More than 7.0% of the infants were SGA, and ~2.0% had a 5-min Apgar score of ≤7. Early-term births corresponded to 42.8% (95% CI: 41.6%–44.0%) of all term births. The prevalence of EB at 3 mo among term infants (37 0/7 weeks of gestation through 41 6/7 weeks of gestation) was 28.4% (95% CI: 27.3%–29.5%) and that of any breastfeeding at 12 mo was 40.6% (95% CI: 40.2%–41.0%). Infants who were exclusively breastfed at 3 mo were twice as likely to receive any breastfeeding at 12 mo than those who were not (66.2% compared with 30.7%, respectively; $P < 0.001$) (data not shown).

Crude and adjusted PRs for EB at 3 mo and for any breastfeeding at 12 mo are presented in Table 3. Neither the crude nor the adjusted analysis showed association between early-term births and EB at 3 mo. Conversely, the adjusted analysis indicated that early-term infants were 15% less likely to be breastfed at 12 mo when compared with those born at 39 0/7 through 41 6/7 wk (PR = 0.85; 95% CI: 0.76–0.95).

Discussion

This study showed that the prevalence of EB at 3 mo of age was similar in early-term and full- or late-term infants, whereas the prevalence of any breastfeeding at 12 mo was lower in early-term infants when compared with the remaining term group. The probability of an early-term infant being breastfed at 12 mo of age was 15% lower than that in the remaining term group, indicating that early-term birth is negatively associated with breastfeeding duration.

The rate of EB at 3 mo in term infants (28.4%) was very close to the global mean (32.0%) and the American mean (30.4%) [16]. To date, few studies have investigated the association between the gestational age of term infants and breastfeeding. Among the nine studies included in a systematic review that evaluated the association between early-term births and duration of EB or any

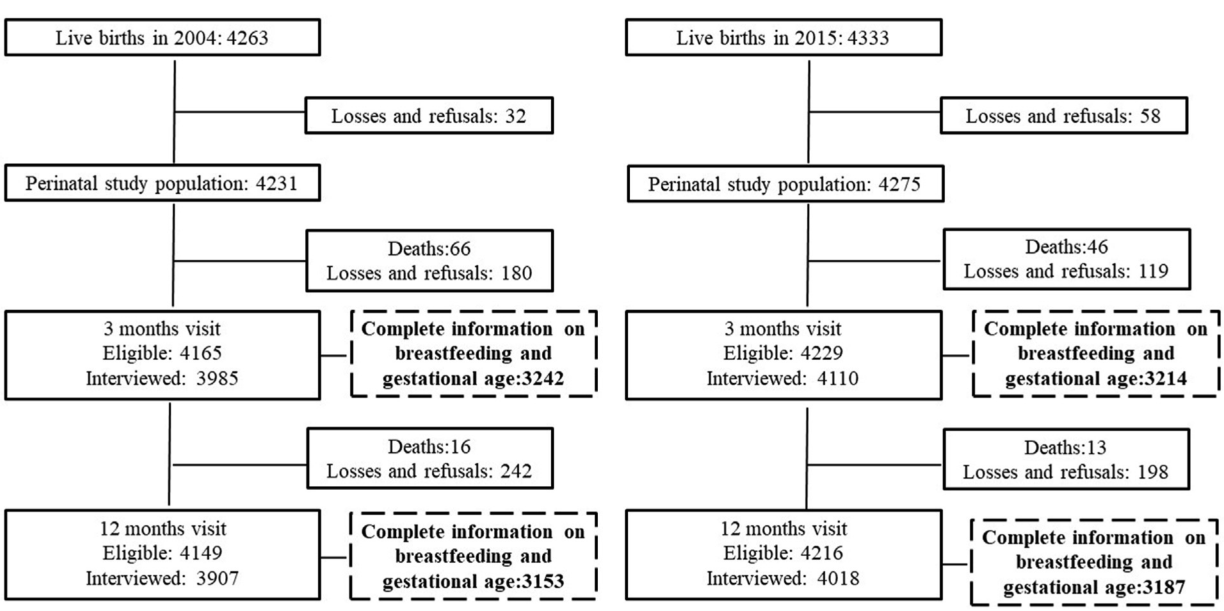

Figure 1. Birth Cohort flow chart.

TABLE 1
The sample distribution at 3-mo and 12-mo follow-ups, according to maternal characteristics

Maternal characteristics	3-mo follow-up *N* (%)	12-mo follow-up *N* (%)
Family income (quintiles)	6393 (100)	6399 (100)
1st (poorest)	1191 (18.6)	1192 (18.6)
2nd	1260 (19.7)	1252 (19.7)
3rd	1266 (19.8)	1272 (18.9)
4th	1340 (21.0)	1343 (21.0)
5th (wealthiest)	1336 (20.9)	1333 (20.8)
Age (y)	6394 (100)	6400 (100)
≤20	1331 (20.8)	1333 (20.8)
21–30	3119 (48.8)	3123 (48.8)
>30	1944 (30.4)	1944 (30.4)
Self-reported skin color	6392 (100)	6398 (100)
White	4718 (73.8)	4725 (73.9)
Mixed	1053 (16.5)	1052 (16.4)
Black	621 (9.7)	621 (9.7)
Schooling (y)	6360 (100)	6366 (100)
0–4	712 (11.2)	713 (11.2)
5–8	2077 (32.7)	2078 (32.6)
≥9	3571 (56.1)	3575 (56.2)
Parity	6392 (100)	6398 (100)
1	2831 (44.3)	2839 (44.4)
2	1875 (29.3)	1875 (29.3)
≥3	1686 (26.4)	1684 (26.3)
Gestational diabetes	6393 (100)	6398 (100)
Yes	377 (5.9)	379 (5.9)
High blood pressure during pregnancy	6387 (100)	6392 (100)
Yes	1481 (23.2)	1491 (23.3)
Alcohol consumption during pregnancy	6392 (100)	6398 (100)
Yes	337 (5.3)	339 (5.3)
Smoking during pregnancy	6392 (100)	6398 (100)
Yes	1333 (20.8)	1332 (20.8)
Beginning of antenatal care (trimester)	6022 (100)	6025 (100)
1st	3961 (65.8)	3964 (65.8)
2nd	1876 (30.5)	1827 (30.3)
3rd	241 (3.9)	234 (3.9)
Number of antenatal care consultations	6214 (100)	6220 (100)
<6	809 (13.0)	808 (13.0)
≥6	5405 (87.0)	5412 (87.0)
Type of delivery	6394 (100)	6400 (100)
Vaginal	2873 (44.9)	2871 (44.9)
Cesarean	3521 (55.1)	3529 (55.1)
Counseling on breastfeeding during antenatal care	6291 (100)	6296 (100)
No	2556 (40.6)	2562 (40.7)
Yes	3735 (59.4)	3734 (59.3)
Intention to breastfeed	6375 (100)	6381 (100)
No	30 (0.5)	31 (0.5)
Yes	6345 (99.5)	6350 (99.5)

breastfeeding, five reported associations with early weaning and one reported associations with shorter EB duration [6].

A study of 2519 children in China found EB rates of 35.7% and 38.2% in the first month postpartum among early-term infants and those born at 39–40 wk, respectively ($P = 0.22$) [17]. A Brazilian study with 608 children showed that gestational age did not interfere with EB duration [18]. In Denmark, children who received EB and partial breastfeeding at 2, 4, and 6 mo of life had greater gestational ages than those who were not breastfed [19].

TABLE 2
The sample distribution at 3-mo and 12-mo follow-ups, according to infant characteristics

Infant characteristics	3-mo follow-up *N* (%)	12-mo follow-up *N* (%)
Sex	6395 (100)	6401 (100)
Female	3285 (51.4)	3288 (51.4)
Male	3110 (48.6)	3113 (48.6)
Gestational age (wk)	6395 (100)	6401 (100)
37 0/7 through 38 6/7	2722 (42.6)	2730 (42.6)
39 0/7 through 41 6/7	3673 (57.4)	3671 (57.4)
Intrauterine growth (birth weight for gestational age)	4754 (100)	4742 (100)
Adequate	4397 (92.5)	4384 (92.4)
Small	357 (7.5)	358 (7.6)
Apgar score at 5-min	6382 (100)	6389 (100)
≤7	132 (2.1)	131 (2.0)
>7	6250 (97.9)	6258 (98.0)
EB at 3 mo	6395 (100)	6397 (100)
Yes	1817 (28.4)	1817 (28.5)
Any breastfeeding at 12 mo		(N= 6401)
Yes	—	2600 (40.6)
Year of birth	6395 (100)	6401 (100)
2004	3242 (50.7)	3214 (50.2)
2015	3153 (49.3)	3187 (49.8)

EB, exclusive breastfeeding

Different maternal factors that vary according to the social context, such as knowledge of the benefits of breastfeeding, intention to breastfeed, previous experience with breastfeeding, smoking habits, profession, socioeconomic status, and age, may affect the success of breastfeeding [3,20,21]. In our sample, ~40% of mothers reported not having received any prenatal counseling on breastfeeding, thus exposing flaws in breastfeeding promotion programs. Methodological aspects of the studies, such as the definition of the comparison group and the method for collecting information, may also influence the results.

Traditionally, delivery between 37 0/7 and 41 6/7 weeks of gestation is considered a term delivery. However, given the higher incidence of adverse outcomes among early-term infants born at 37 0/7 weeks through 38 6/7 weeks of gestation when compared with those born at 39 0/7 weeks through 41 6/7 weeks of gestation, new categories of gestational age consisting of early-term (37 0/6 weeks through 38 6/7 weeks), full-term (39 0/7 weeks through 39 6/7), and late-term (41 0/7 weeks through 41 6/7 weeks) have been recommended [12].

Although historically considered a homogeneous group, early-term infants, when compared with full- and late-term infants, show an increased risk of neonatal adverse events [12], such as respiratory problems, the need for admission to a neonatal intensive care unit, prolonged hospitalization, and readmissions [22,23], all of which may hamper the establishment and consolidation of breastfeeding. Early-term infants also have an increased risk of respiratory and neurological problems throughout childhood, in addition to higher mortality, compared with those born at 39 0/7 through 41 6/7 weeks. Each additional week of pregnancy was shown to be associated with a reduction in the occurrence of these morbidities [24].

A hypothesis for explaining the difference in EB rates among term infants is based on the greater neurological immaturity of children born in early-term than those born in full- or late-term [25]. This immaturity could reflect greater difficulty in

TABLE 3
Outcome prevalence and crude and adjusted PRs with 95% CI for exclusive breastfeeding at 3 mo and any breastfeeding at 12 mo according to gestational age at birth among term infants

	Prevalence (95% CI)	*P* value	PR_{crude} (95% CI)	*P* value	$PR_{adjusted}$ (95% CI)	*P* value
EB at 3 mo		0.248		0.328		0.615
Early-term (37 0/7 through 38 6/7 wk)	29.2 (27.5–30.9)		1.05 (0.95–1.15)		1.03 (0.91–1.17)[1]	
Full-term (39 0/7 through 41 6/7 wk)	27.9 (26.4–29.3)		1.0		1.0	
Any breastfeeding at 12 mo		0.001		0.009		0.004
Early-term (37 0/7 through 38 6/7 wk)	38.2 (36.4–40.0)		0.90 (0.83–0.97)		0.85 (0.76–0.95)[2]	
Full-term (39 0/7 through 41 6/7 wk)	42.4 (40.8–44.0)		1.0		1.0	

EB, exclusive breastfeeding; PRs, prevalence ratios.
[1] Adjusted for family income, maternal age, maternal schooling, parity, high blood pressure during pregnancy, alcohol consumption during pregnancy, smoking during pregnancy, and intrauterine growth.
[2] Adjusted for maternal age, maternal skin color, gestational diabetes, smoking during pregnancy, trimester of the beginning of antenatal care, and intrauterine growth.

establishing and consolidating the breastfeeding process [6,26]. Nevertheless, our study found no difference in EB at 3 mo of age between the two groups. It is possible that mothers engaging in EB are different from those who breastfeed in a nonexclusive pattern. Evidence indicates that a mother's intention to breastfeed is a stronger predictor of breastfeeding than her demographic characteristics [20]. In our sample, none of the infants from mothers who reported no breastfeeding intention were exclusively breastfed at 3 mo or breastfed at 12 mo.

Other studies show that maternal work outside the home and low income are among the main barriers to EB globally [3,27], and preliminary analyses of the Pelotas Birth Cohorts indicate that EB was more readily adopted by mothers in the wealthier quintiles than by poor mothers [25]. Moreover, studies that investigated breastfeeding rates (exclusive or partial) among term infants only analyzed short periods after birth, such as during hospital stay [28], at discharge [26], or a month after birth [17], and only in selected samples (for example, only mothers who intended to breastfeed) [17].

Regarding any breastfeeding at 12 mo, we found only one study that assessed any breastfeeding duration according to gestational age at birth in term infants. In China, the mean breastfeeding duration was 9 wk and the prevalence of breastfeeding at 12 mo did not reach 20%, with no differences between early- and full-term infants [17]. A hypothesis proposed by the authors refers to sample selection, as only normal-weight children without severe gestational or neonatal complications and not requiring admission to a neonatal intensive care unit were included in that study, whereas studies that found differences included early-term infants at a higher risk of being admitted to a neonatal intensive care unit or requiring resuscitation maneuvers.

This study has some limitations. Although previous experience with breastfeeding is known to affect current breastfeeding [27], information about the duration of breastfeeding in children from previous pregnancies was not collected in this study population. In addition, because most participants had self-declared White skin, the external validity of our findings to more diverse populations may be compromised. Finally, information bias cannot be discarded because data on breastfeeding patterns and durations were obtained from maternal reports.

Nevertheless, the strengths of this study include the use of data from two prospective population-based birth cohorts, which had a high response rate, employed comparable protocols, and were conducted by the same group of researchers in a standardized manner and the same city approximately a decade apart. Moreover, as highlighted by the authors of a systematic review that evaluated the association between early-term births and duration of EB or any type of breastfeeding [7], the quality of available evidence varies greatly, and more studies with longer follow-up periods should be conducted. Therefore, our study contributes to filling this gap.

In conclusion, this study found that the rate of EB at 3 mo was similar among term infants, whereas the rate of any breastfeeding at 12 mo was lower among early-term infants, when compared with those born at 39 0/7 through 41 6/7 weeks of gestation. Nonetheless, the fact that infants exclusively breastfed at 3 mo were more likely to be breastfed at 12 mo is enough evidence to support investment in efforts to promote EB in the early postpartum period to increase the duration of any breastfeeding.

Author's contributions

The authors' responsibilities were as follows—MGS: conceptualization, methodology, data curation, writing - original draft; RM: writing - review and editing; BDP: data curation; AM: writing - review and editing; MFS: writing - review & editing; ADB: writing - review & editing; MD: writing - review and editing; FB: writing - review & editing; ISS: conceptualization, methodology, resources, supervision, writing - review and editing.

Data Availability

Data described in the manuscript, code book, and analytic code will be made available upon request pending application and approval.

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Author disclosures

MGS, RM, BDP, AM, MFS, ADB, MD, FB, and ISS, no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.cdnut.2023.100050.

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