Successful breastfeeding among women with intention to breastfeed: From physiology to socio-cultural factors

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ABSTRACT

Background: Even if women have intention to breastfeed, they do not always achieve a successful breastfeeding.
Aim: This study aims to analyse factors affecting breastfeeding prevalence among mothers that intended to breastfeed.
Methods: This is a prospective observational study involving 401 pregnant women that intended to breastfeed (asked at the 20th week). Breastfeeding prevalence was evaluated in reference to health-related, socio-cultural factors and healthcare professionals' interventions at 1 month, 6 months and 12 months after birth. Data were analysed using descriptive statistical methods, bivariate logistic regression and multivariate logistic regression modelling.
Results: Independent factors negatively affecting breastfeeding prevalence related to mothers' and newborns' health parameters and birth characteristics included smoking during pregnancy, anaemia and use of analgesia during labour. Regarding sociocultural parameters, being an immigrant, higher education level, intention to breastfeed before pregnancy, comfort with public breastfeeding and bedsharing were positively linked to breastfeeding, while teat or pacifier use in the first week was negatively linked. Regarding healthcare professionals' practices, mother and father/partner antenatal education course attendance and exclusive breastfeeding at the hospital were positively associated with breastfeeding.
Conclusion: Breastfeeding is a very complex phenomenon affected by multiple and diverse variables. Physiological factors only affect the short term (1st month), while middle and long term BF affecting variables are mainly identical and include mostly socio-cultural factors and also BF related practices, especially in the first days after birth. These data should help to develop more effective breastfeeding promotion strategies.

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1. Introduction

The World Health Organization (WHO) recommends exclusive breastfeeding (BF) for the first 6 months after birth, followed by continued BF with complementary foods until at least two years of age [1]. Despite this recommendation, BF rates in the Basque Country, a region located in the north of Spain —although increasing in recent years—are still far from the recommended level [2]. The WHO classifies BF into exclusive BF (only breast milk and medicines), predominant BF (breast milk and other liquids such as water or juices) and BF (breast milk and anything else, including non-human milk and formula) [3].

Although BF is a physiological process involving a mother and her newborn, society and culture are also relevant to its success. Thus, when evaluating the factors affecting BF prevalence, it should be considered from multiple perspectives.

The BF intentions of pregnant women are very heterogeneous throughout the world [4–7]. However, despite most pregnant women being willing to breastfeed their children, various situations can arise that lead to a mother ceasing BF before planned [8]. Therefore, in order to promote BF in a particular context, it is essential to determine which parameters influence BF prevalence most.

In our region, some research has been done in recent years regarding the factors affecting BF prevalence [9–11]. Notably, Artieta-Pinedo et al. have focused their research on the effect that antenatal education sessions have on the BF rates and identified a positive relationship between attending antenatal education sessions and any BF in the first month——but not onwards. Another study, the INMA project (Infancy and Environment) [10,11], has noted the exclusive and predominant BF prevalence during the first 6 months after birth and related it mainly to social factors and the self-reported reasons affecting BF.

The main objective of the present study was to analyse BF prevalence from a wide and multifactorial perspective that includes health-related, socio-demographic, socio-cultural, affective and healthcare professional intervention-related factors in a cohort of women who already intended to breastfeed, during their first year after birth in Bilbao, the main city of the Basque Country.

Although exclusive BF should be considered the gold standard, since its prevalence is low and often difficult to achieve (mainly due to maternity leaves being shorter than 6 months), we have considered analysing "any BF", which includes any of the aforementioned forms of BF. These findings should help to develop an overall strategy aimed to improve BF outcomes.

2. Methods

2.1. Study design

This is a prospective observational study that involved the recruitment of 401 pregnant women attending midwife offices of the Basque Public Health Service in the city of Bilbao and adheres to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) [12] guidelines for cross-sectional studies.

In the present study BF was evaluated at various times across the first year after birth in relation to numerous variables, such as mother and newborn health parameters, birth characteristics, socio-demographic and cultural variables and variables related to healthcare practices.

2.2. Setting

A cohort of pregnant women whose birth was expected between July 2012 and June 2013 was recruited after their 20th week of pregnancy in the midwife offices in the Basque Public Health Service (Osakidetza) and were followed-up until complete weaning or until the first year after birth. The last participant follow-up was completed in June 2014.

A pre-test with 20 women was conducted in order to adjust the items of the questionnaires, the time required for recording data and other practical aspects. The results of the pre-test were not used for this study. Pregnant women who previously intended to breastfeed their babies were recruited when visiting a midwife consulting room in the 20th week of pregnancy.

2.3. Participants

The participants of this study were 401 pregnant women between 18 and 48 years of age. The eligibility criteria were: *i*) being attended by a midwife in the Basque Public Health Service in the city of Bilbao, *ii*) certain or probable intention to breastfeed, *iii*) having a singleton pregnancy, *iv*) being older than legal age (>18), *v*) speaking Spanish and *vi*) having the availability to follow up during one year.

2.4. Variables

For the results presented in this article, the time points selected were 1st month, 6th month and 12th month, while the definition of BF was any type of BF that includes exclusive BF but also BF along with any food or liquid including non-human milk and formula. BF prevalence was the main outcome and the independent selected variables (based on the bibliography and the previous experience of investigators) included the following:

A) Mothers' and newborns' health parameters and birth characteristics.

A1) Variables of the mother during pregnancy:

- Obesity in the 1st trimester (body mass index (BMI) $\geq$30 kg/m^2). [13]
- Anaemia at 3rd trimester (<11 g Hb/dL) [14] and 24 h after birth (<12 g Hb/dL) (yes or no).
- Smoking habit during pregnancy and BF (yes or no).
- Diet (adequate or not). To assess diet adequacy in the first interview, midwives asked what had the women eaten the previous day and adequacy was stated according to the consumption of nutrients, liquids, and their frequency.
- Physical activity during pregnancy (adequate or not). Adequacy was stated if they performed a minimum of 30 min of moderate aerobic exercise at least three days per week [15].
- Weight gain during pregnancy (adequate or not) [16].
- Perceived breast augmentation during pregnancy (yes or no).

A2) Variables related to birth:

- Spontaneous labour onset (yes or no).
- Use of oxytocin during labour (yes or no).
- Use of epidural analgesia or general anaesthesia during labour (yes or no).
- Eutocic birth (yes or no).

A3) Variables related to the newborn:

- Apgar score after 5 min (0–8 or 9–10).
- Neonatal weight (2500 g–4000 g or different). [17]
- Gestational age.

B) Socio-demographic, cultural and affective variables:

- Maternal age (under or over 30).
- Partnered (yes or no).
- Country of origin (Spain or abroad).
- Years of education (under or over 12 years of education).
- Working status (regularly working or not before pregnancy).
- Intention to BF prior to pregnancy (yes or no).
- Comfortable with public BF (yes or no).
- Previous BF experience (yes or no).

- Use of teats and/or pacifiers in the 1st week (yes or no).
- Bedsharing (yes or no).

C) Variables related to the intervention of healthcare professionals during pregnancy, birth and BF.

- Attendance to maternal education courses by mother and partner (yes or no).
- Time of skin-to-skin contact after birth (≥30 min or no).
- Early BF during the first 2 h after birth (yes or no).
- Infant formula supplements at the hospital (yes or no).

The collected variables were related to the prevalence of BF, its success or its failure.

2.5. Data sources and measurement

A data compilation booklet was designed for selected variable collection and analysis. During pregnancy, demographic data and others related to intention, knowledge and expectations related to BF were also collected using a self-completed questionnaire.

Clinical and analytical data were obtained from regular examinations driven by the midwives and from electronic clinical history. Face-to-face personal interviews were performed during pregnancy as well as one week and one month after birth. Later, telephonic follow up was driven by the midwife at the 6th and 12th month after birth or until weaning. All these data were added to the data compilation booklet.

2.6. Study size

The estimated sample size was based on the number of pregnant women in the city of Bilbao during the 2 years prior to the beginning of the study ($n = 2849$ and $n = 2835$, in 2010 and 2011 respectively). We required 223 participants for a 15% proportion of losses and a confidence level of 95%. For the calculation of the sample, a tool developed by López Calviño et al. of the Clinical Epidemiology and Biostatistics Unit of the Integrated Management Area of A Coruña [18] was used.

2.7. Statistical methods

For the descriptive analysis, the mean and standard deviations (SD) of the quantitative variables were calculated, while the number and percentage of women in each of the analysed subcategories were calculated for the qualitative variables. To obtain an improved understanding of the multivariate analysis, some of the quantitative variables were categorised.

To study how each analysed qualitative parameter influences BF prevalence, univariate logistic regression was performed. The findings are presented as odds ratios (ORs) with 95% confidence intervals (CI) and *p*-values. A p-value less than 0.05 was considered to indicate statistical significance.

Any variables with a p-value <0.1 in the previous univariate analysis were included in the multivariate logistic regression models. One model was constructed for each time point (1 month, 6 months and 12 months after birth) in an attempt to explain the phenomena of BF from its beginning to its continuity and prolongation throughout the first year. Results are shown as ORs with 95% CI and p-values. The Hosmer and Lemeshow goodness-of-fit test was used to determine if there was a satisfactory fit of the model to the data.

IBM SPSS version 24 software was used to perform the statistical analyses.

2.8. Ethical approval

Ethical approval was granted by the University of the Basque Country CEISH/40/2010 SANZ ECHEVARRIA and CEISH /236M/2013/

RUIZ LITAGO Human Research Ethics Committee. The project also obtained the authorisation of the Basque Public Health Service.

All pregnant women who were invited to participate were explained the objectives of the study and what exactly their collaboration involved. They were also offered a fact sheet and signed an informed consent form accepting their participation, which is in accordance with the legislation in force and explicitly mentioned the confidentiality of the data and the possibility to revoke consent and leave the study at any time.

3. Results

3.1. Descriptive analysis of the sample

The participant flow chart is presented in Fig. 1.

Descriptive data of the analysed physiological and socio-cultural parameters of the sample, as well as those related to the intervention of healthcare professionals, are presented in Tables 1A, 1B.

3.2. Weaning

During the first year, 265 babies were weaned. Fig. 2 presents the number of babies weaned each month during their first age of life (A), as well as the accumulated rate of weaning throughout the studied year (B). Overall, 99% of the newborns initiated BF at the hospital, while the BF rate at the end of the first month was 90%, followed by 64% and 34% at the end of the 6th and 12th months, respectively.

3.3. Factors affecting the prevalence of breastfeeding in the 1st month

In the univariate analysis, variables of the three considered groups appeared to be significant. Regarding the health-related variables of mothers, smoking during pregnancy and BF, as well as anaemia in the 3rd trimester and 24 h after birth, were significantly related to lower BF rates, while adequate weight gain during pregnancy was related to significantly higher BF rates. The socio-cultural variables positively associated with BF prevalence included higher academic degree, the pre-pregnancy decision for BF, being comfortable with public BF and bedsharing. On the other hand, being Spanish and the use of a teat or pacifier in the 1st week were negatively associated with BF prevalence. Moreover, mothers attending maternal education courses and absence of infant formula supplements at the hospital were also significant variables that were positively related to BF regarding health intervention.

As shown in the multivariate analysis results presented in Table 2, smoking during pregnancy (OR = 3.65), anaemia 24 h after birth (OR = 4.56), and the use of a teat or pacifier in the 1st week (OR = 8.81) were independent factors significantly linked to lower BF rates. Conversely, being an immigrant (OR = 8.99), pre-pregnancy BF decision (OR = 3.73), bedsharing (OR = 8.41), attending maternal education courses (OR = 3.54) and absence of infant formula supplements at the hospital (OR = 7.37) were independent factors significantly linked to higher BF rates. The model was a good fit based on the Hosmer and Lemeshow test ($p = 0.686$).

3.4. Factors affecting the prevalence of breastfeeding in the 6th month

In the univariate analysis, the physiological variables of mothers that were negatively related to BF included smoking during pregnancy and BMI greater than 25 in the 1st trimester, while adequate physical activity and weight gain during pregnancy, as well as perceived breast enlargement, were positively linked to BF. Regarding birth characteristics, the use of analgesia/anaesthesia was negatively related to BF. Moreover, regarding newborn health, an Apgar score after 5 min of 9 or 10 was positively related to BF. Among socio-cultural factors, the following were found to be positively associated to higher BF rates: higher education level, the pre-pregnancy intention for BF, being
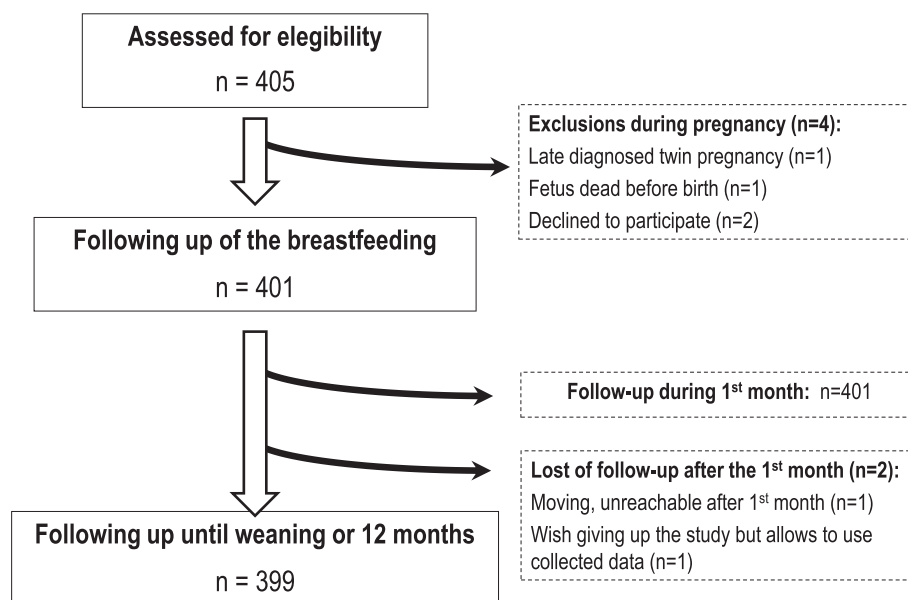
Fig. 1. Flow chart of participant progression in the study.

Table 1A
Descriptive data of the qualitative variables of the sample.

	Yes	No
	n (%)	n (%)
Physiological variables		
Smoking during P	63 (15.7)	338 (84.3)
Smoking during BF	52 (13.1)	346 (86.9)
BMI at 1st trimester <25	280 (69.8)	121 (30.2)
Adequate diet during P	355 (88.5)	46 (11.5)
Adequate physical activity during P	178 (44.4)	223 (55.6)
Adequate weight gain during P	248 (61.8)	153 (38.2)
Perceived breast enlargement	266 (66.3)	135 (33.7)
Anaemia at 3rd trimester	69 (17.2)	332 (82.8)
Anaemia 24 h after birth	186 (46.4)	186 (46.4)
Spontaneous labour onset	255 (63.6)	136 (33.9)
Eutocic birth	259 (64.6)	142 (35.4)
Use of oxytocin in labour	301 (75.1)	100 (24.9)
Use of analgesia in labour	377 (94.0)	24 (6.0)
Apgar score 5 min ≥9	372 (92.8)	29 (7.2)
Neonatal weight (2500–4000 g)	365 (91.0)	36 (9.0)
Socio-cultural variables		
Maternal age ≥30 years	307 (76.6)	94 (23.4)
Partnered	379 (94.5)	22 (5.5)
Country of origin being Spain	331(82.5)	70 (17.5)
Years of education (≥12 years)	333 (83.0)	68 (17.0)
Working regularly	307 (76.6)	94 (23.4)
Pre-pregnancy BF intention	332 (82.8)	69 (17.2)
Comfortable with public BF	212 (52.9)	189 (47.1)
Previous BF experience	140 (34.9)	261 (65.1)
Use of a teat or pacifier (1st week)	172 (42.9)	229 (57.1)
Bedsharing	323 (81.1)	75 (18.8)
Health professionals intervention variables		
Attendance at ME courses	348 (86.8)	53 (13.2)
Attendance at ME courses by partner	83 (21.4)	304 (78.5)
Skin-to-skin contact ≥30 min	80 (21.1)	299 (78.9)
Early breastfeeding (2 h)	353 (88.0)	48 (12.0)
Formula supplements at hospital	204 (50.9)	197 (49.1)

Abbreviations: P, pregnancy; BF, breastfeeding; ME, maternal education.

comfortable with public BF and bedsharing. On the contrary, the use of a teat or pacifier in the first week was negatively associated with BF rates. Maternal education courses attendance by mothers and partners, as well as early and exclusive BF at the hospital, were positively linked variables related to the healthcare professionals' practices.

Table 1B
Descriptive data of the quantitative variables of the sample.

	Mean ± SD
Maternal age (years)	32.9 ± 4.9
BMI at 1st trimester (kg/m^2)	24.1 ± 4.4
Haemoglobin at 3rd trimester (g/dL)	11.7 ± 0.9
Haemoglobin 24 h after birth (g/dL)	10.9 ± 1.3
Apgar score 5 min	9.22 ± 0.58
Neonatal weight (g)	3347 ± 427
Gestational age (weeks)	39.6 ± 1.2
Duration of skin-to-skin contact (min)	17.7 ± 20.8

Abbreviations: SD, standard deviation; BMI, body mass index.

The multivariate analysis showed (Table 3) that higher education level (OR = 2.45), bedsharing (OR = 2.61), being comfortable with public BF (OR = 1.80), maternal education course attendance by partners (OR = 2.10) and absence of infant formula supplements at hospital (OR = 2.48) were factors positively related to higher BF rates. On the other hand, use of analgesia during labour (OR = 4.65) and the use of a teat or pacifier in the first week (OR = 3.06) were factors related to lower BF rates. The Hosmer and Lemeshow test produced a *p*-value of 0.319.

3.5. Factors affecting the prevalence of breastfeeding in the 12th month

In the univariate analysis, none of the analysed physiological variables of the mother or the newborn were found to be significant. However, some of the ones related to the birth appeared such as eutocic birth were positively and significantly linked to BF, while the use of oxytocin and use of analgesia/anaesthesia were negatively and significantly linked to BF. In the opposite, most of the socio-cultural variables analysed were found to be significant at this time point. Positively related factors included higher education level, the pre-pregnancy decision of BF, being comfortable with public BF, previous BF experience, and bedsharing. On the contrary, being Spanish and the use of teat and pacifier in the first week were negatively related factors for BF. Regarding health professionals' practices, only absence of infant formula supplements at the hospital was significantly related to higher BF rates.

Following the multivariate analysis (Table 4), factors positively linked to BF prevalence included higher education level (OR = 1.97), being comfortable with public BF (OR = 1.59), absence of infant formula
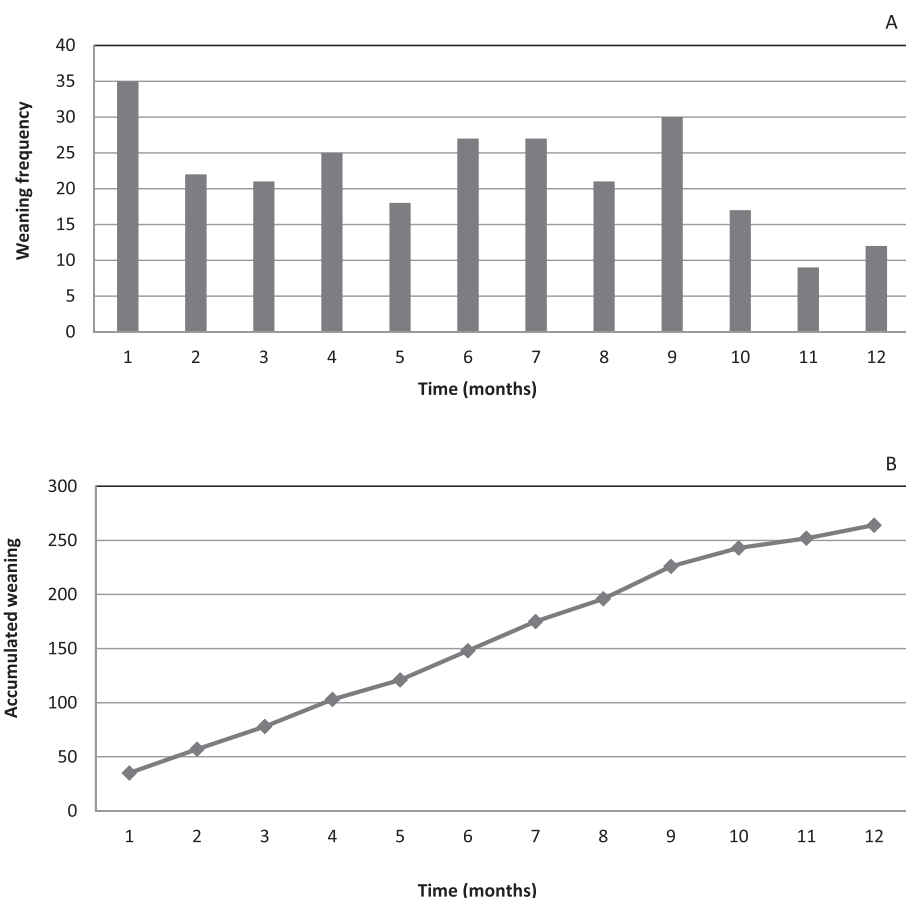
Fig. 2. Evolution of weaning during the first year after birth. (A) Number of babies that waned each month. (B) Accumulated rate of weaning along the studied period.

supplements at hospital (OR = 1.72), and bedsharing (OR = 2.99). Factors negatively linked to BF prevalence included the use of analgesia/anaesthesia (OR = 5.44), and use of a teat or pacifier in the first week (OR = 2.38). The Hosmer and Lemeshow test produced a *p*-value of 0.519.

4. Discussion

Currently, there are no doubts regarding the benefits of BF in newborn and maternal health and the upbringing process [1]. Therefore, increasing BF rates should be a desirable goal in all societies.

In our study, a cohort of 401 women with intention to breastfeed were followed from the 20th week of pregnancy until either weaning or the first year of the newborn, thereby allowing us to study the BF phenomenon in the short and long term in the same sample group and observe how various factors affect BF prevalence in a distinct way throughout the BF process over time.

Even though intention to breastfeed is a strong and consistent predictor of BF prevalence [5], our results point to other factors that could play an important role in BF success in this group of mothers.

Upon viewing the results of our study in the global context, it is noticeable that factors independently affecting BF in the first stage are different from those affecting onwards. Indeed, health-related parameters of the mother – such as smoking during pregnancy and anaemia 24 h after birth – only appear to affect breastfeeding in the 1st month, and not onwards. The fact that physiological variables seem to be crucial only in early stages, suggests that breastfeeding initiation could be conditioned —at least in part—by physiological mechanisms that must be initiated and adjusted for successful BF, even if there is intention to breastfeed. Once BF is settled they do not seem to affect BF continuation.

There is a considerable amount of literature regarding the relationship between smoking and BF prevalence and duration. Our study is congruent with previous studies that link smoking during pregnancy to lower BF rates at early stages [19]. Possible physiological mechanisms have been proposed—such as tobacco being related to changes in maternal hormone levels—that are likewise associated with reduced lactation [20]. However, other researchers [21] have suggested a socio-demographic explanation of this relationship. Whether the reason for this association is physiological, socio-demographic or a combination of both, pregnant women should be encouraged to cease smoking due to the harmful effects that maternal smoking has on newborn health [22].

Another significant health-related variable in the first month is anaemia 24 h after birth. The same result has also been observed by other studies that relate anaemia after birth (2–3 days) with lower BF rates during the first month [23]. A possible physiological explanation of this phenomenon could be the significant connection observed between anaemia and the delay of lactogenesis II, which is inversely related to BF success [24]. This is of great importance in our context since 17% of the mothers exhibited anaemia in the third trimester, while nearly half (46%) exhibited it 24 h after birth.

Besides physiological variables, socio-cultural factors also affect BF in the first stages in mothers with intention to breastfeed. When analysing health-related behaviour, such as BF, across different cultural environments, we must consider the importance of what is classified as normative in a particular context. Cultural norms are inherited in such a way that most of our daily acts are unconscious, with BF being a clear example of this [25]. Cultural factor relationship with BF has also been confirmed in our study, with immigrant women exhibiting higher BF rates than Spanish women in the 1st month, even after adjusting with other covariates. These results are in agreement with similar studies

Table 2

Univariate and multiple variate logistic regression analysis of factors associated with breastfeeding prevalence at the 1st month after birth.

		Univariate analysis		Multivariate analysis		
		UOR	p	AOR	95% (CI)	p
Physiological variables						
Smoking during P	No	**3.73**	**<0.001**	**3.65**	**(1.29–10.34)**	**0.015**
Smoking during BF	No	**2.38**	**0.037**			
BMI 1st trimester	<25	1.331	0.421			
Diet during P	Adequate	0.90	0.843			
Physical activity during P	Adequate	1.40	0.336			
Weight gain during P	Adequate	**2.42**	**0.011**			
Perceived breast enlargement	Yes	1.50	0.240			
Anaemia at 3rd trimester	No	**2.18**	**0.043**			
Anaemia 24 h after birth	No	**3.49**	**0.002**	**4.56**	**(1.59–13.04)**	**0.005**
Spontaneous labour onset	Yes	1.13	0.744			
Eutocic birth	Yes	1.20	0.619			
Use of oxytocin in labour	No	0.80	0.555			
Use of analgesia in labour	No	1.16	0.841			
Apgar score 5 min	≥9	1.108	0.872			
Neonatal weight	2500 -4000 g	0.261	0.192			
Socio-cultural variables						
Maternal age (years)	≥30	1.833	0.097			
Marital status	Partner	1.55	0.499			
Country of origin	Outside Spain	**8.71**	**0.034**	**8.99**	**(1.07–75.69)**	**0.043**
Years of education	(≥12 years)	**2.52**	**0.014**			
Working status	Works regularly	1.18	0.667			
Pre-pregnancy BF intention	Yes	**3.80**	**0.000**	**3.73**	**(1.39–10.02)**	**0.009**
Comfortable with public BF	Yes	**3.06**	**0.003**			
Previous BF experience	Yes	1.83	0.129			
Use of a teat or pacifier (1st week)	No	**13.80**	**<0.001**	**8.81**	**(2.55–30.34)**	**0.001**
Bedsharing	Yes	**4.77**	**<0.001**	**8.41**	**(3.04–23.25)**	**0.000**
Health professionals' intervention variables						
Attendance to ME courses	Yes	**2.65**	**0.016**	**3.54**	**(1.06–11.75)**	**0.039**
Attendance to ME courses by partner	Yes	2.41	0.106			
Skin-to-skin contact	≥30 min	3.31	0.052			
Early breastfeeding (2 h)	Yes	**3.14**	**0.005**			
Formula supplements at hospital	No	**5.96**	**<0.001**	**7.37**	**(2.16–25.12)**	**0.001**

Abbreviations: UOR, unadjusted odds ratio; AOR, adjusted odds ratio; CI, confidence interval; P, pregnancy; BF, breastfeeding; BMI, body mass index; ME, maternal education.

conducted in our region [9,11] and in other European countries [26] showing that immigrant women had higher BF rates than local women. Also, in the present study, 83% of the women had decided to breastfeed before pregnancy, which suggests that BF was the natural way for these women to feed their newborns and it appears to be an independent factor in the 1st month.

In the context of this study, maternal education courses are offered to all pregnant women and their partners in the 3rd trimester. These courses consist of eight sessions driven by a midwife, of which two of them are specifically centred on BF. Participation in these courses by women was wide (87%), and appears to affect BF success only in the early stages. The same was observed in similar studies conducted in our region [9]. However, maternal education course attendance by a partner (21% of attendance) has shown to be an independent factor positively linked to BF rates in the 6th month. This also supports other results in the literature that correlate perinatal BF intervention including father/partners with higher BF prevalence [27].

In addition to this, there are several parameters that strongly affect BF success not only at the first stage but at all time-points. They are use of teat or pacifier at the 1st week, infant formula supplements at hospital and bedsharing. Even if the first two of them are practices related to the first days after birth their influence goes a lot further independently affecting BF prevalence also at the 6th and 12th month. In our study cohort, 51% of newborns received formula supplements during their stay at the hospital. Given the negative impact of these practices on BF, an indication from healthcare professional should be rigorously evaluated and mothers and relatives should be advised of the effects of formula supplementation on BF success. Also, using a teat or pacifier during the first week is not recommended until BF is successfully established (at

up to 3 or 4 weeks after birth); however, their use is evidently widespread since 43% of the mothers in our study used them. As such, mothers and relatives should be clearly informed of the negative consequences of this widespread practice on BF. Another factor affecting BF prevalence in the multivariate analysis at all time points is bedsharing. This result is in agreement with those of other studies, which state that bedsharing promotes BF initiation and duration [28]. This is of great importance since it is currently a very controversial issue after an article related it to sudden infant death syndrome [29], while others have described it as a protective factor against it [30]. Therefore, professional efforts should be used to inform pregnant women of the actual knowledge regarding bedsharing and how to practice it in a secure way [31].

It is clear that prolonged BF would only occur after a successful initiation, but we have also found some variables affecting BF rates only in the middle and long term. It is surprising how variables independently affecting BF at the 6th and 12th month are almost identical, although the model is statistically stronger at the 12th month. These variables are: education level, use of analgesia in labour, and being comfortable with public BF. A higher education level is a well-established parameter which determines BF prevalence [32] and as such appears positively and significantly liked to higher BF rates at all time points and remains an independent factor in the 6th and 12th month in our study.

In our environment, the vast majority of births take place in hospitals and are highly medicalised with many interventions. The use of analgesia/anaesthesia and oxytocin during labour stage is widespread in our context; in fact, 94% of the mothers in our study used analgesia (89% epidural analgesia), while 75% used oxytocin. Reasons for not using analgesia could be due to lack of time (very short labour stage or late arrival at hospital) or because mothers demand a more physiological

Table 3

Univariate and multiple variate logistic regression analysis of factors associated with breastfeeding prevalence at the 6th month.

		Univariate analysis		Multivariate analysis		
		UOR	p	AOR	95% (CI)	p
Physiological variables						
Smoking during P	No	2.07	0.009			
Smoking during BF	No	1.38	0.286			
BMI 1st trimester	<25	1.85	0.006			
Diet during P	Adequate	1.58	0.150			
Physical activity during P	Adequate	1.54	0.042			
Weight gain during P	Adequate	1.97	0.001			
Perceived breast enlargement	Yes	1.68	0.018			
Anaemia 3rd trimester	No	1.40	0.211			
Anaemia 24 h after birth	No	1.29	0.236			
Spontaneous labour onset	Yes	1.42	0.112			
Eutocic birth	Yes	1.11	0.625			
Use of oxytocin in labour	No	1.52	0.093			
Use of analgesia in labour	No	4.20	0.022	4.65	(1.15–18.66)	0.030
Apgar score 5 min	≥9	3.18	0.004			
Neonatal weight	2500-4000 g	1.56	0.213			
Socio-cultural variables						
Maternal age (years)	≥30	1.47	0.109			
Marital status	Partner	1.22	0.675			
Country of origin	Outside Spain	1.09	0.742			
Years of education	(≥12 years)	3.13	<0.001	2.45	(1.30–4.63)	0.006
Working status	Works regularly	1.14	0.596			
Pre-pregnancy BF intention	Yes	2.91	<0.001			
Comfortable with public BF	Yes	2.14	<0.001	1.80	(1.12–2.90)	0.016
Previous BF experience	Yes	1.18	0.458			
Use of a teat or pacifier (1st week)	No	3.89	<0.001	3.06	(1.87–5.02)	<0.001
Bedsharing	Yes	2.22	0.002	2.61	(1.45–4.68)	0.001
Health professionals' intervention variables						
Attendance to ME courses	Yes	2.04	0.016			
Attendance to ME courses by partner	Yes	2.01	0.013	2.10	(1.13–3.93)	0.020
Skin-to-skin contact	≥30 min	1.68	0.061			
Early breastfeeding (2 h)	Yes	2.23	0.010			
Formula supplements at hospital	No	3.06	<0.001	2.48	(1.51–4.10)	<0.001

Abbreviations: UOR, unadjusted odds ratio; AOR, adjusted odds ratio; CI, confidence interval; P, pregnancy; BF, breastfeeding; BMI, body mass index; ME, maternal education.

process with the least medical intervention during childbirth. Although the non-analgesia/anaesthesia group was very small and statistical analysis could thus be affected, in our study the use of analgesia seems to affect BF only in the middle and long term. Therefore, we suggest that not using analgesia would also be accompanied by the desire for physiological nourishment, which includes prolonged BF.

Bearing in mind that public BF is not always considered acceptable in Western societies, it is likely that being comfortable with public BF could influence BF rates [33]. In our study, only 53% of women thought (when asked during pregnancy) that they would be comfortable with public BF, and our results indicate that being comfortable with public BF is positively related to higher BF rates in the 6th and 12th month after adjusting for other covariates, and also in the 1st month in the univariate analysis. Changing societal attitudes towards public BF through laws that would allow mothers to comfortably breastfeed in public places should thus be considered an additional strategy to create a "BF friendly" society, which would have a great impact on communities' attitudes [34].

5. Limitations and strengths

A major limitation of this study is that only women who had the intention to breastfeed during pregnancy were included. As such, we have not addressed issues surrounding mothers that have no intention to breastfeed and the factors that result in this decision. Further studies should also be conducted to clarify the reasons for not intending to breastfeed, which should help to define a global strategy on BF promotion that includes all women.

On the other hand, limiting the study to women with previous BF

intention allows us to gain a deeper knowledge of what conditions BF when the mother is willing to do it. Besides, BF prevalence has been approached from numerous perspectives to evaluate various factors from the first month to the end of the first year in the same sample group. This facilitates the acquisition of a panoramic view of the issue that can aid in the design of diverse interventions that would help to fulfil maternal expectations regarding this beneficial practice.

Also, the data for this study was collected some years ago and society might have changed in some aspects, mostly socio-cultural, but even so, most of the results presented come along with recent published articles in the field [6,11,19,23,27,31].

Finally, this study was located in Bilbao, a city of northern Spain. Although results could be extrapolated to similar western societies, they might not faithfully reflect the reality of other socio-cultural different communities.

6. Conclusions

BF is a very complex phenomenon affected by multiple and diverse variables. The studied variables affect BF differently over the studied time points. The health parameters of the mother (smoking and anaemia) seem to affect BF only at the beginning, and once BF is settled they have no additional effect on BF prevalence. Besides physiological factors, there are also other socio-cultural variables affecting BF at this early stage.

Middle and long term BF affecting variables are mainly identical and include mostly socio-cultural aspects (education level and feelings about public BF) and also BF related practices, especially in the first days after birth (use of pacifiers and infant formula supplements). Moreover,

Table 4

Univariate and multiple variate logistic regression analysis of factors associated with breastfeeding prevalence at the 12th month.

		Univariate analysis		Multivariate analysis		
		UOR	p	AOR	95% (CI)	p
Physiological variables						
Smoking during P	No	1.02	0.939			
Smoking during BF	No	0.88	0.669			
BMI at 1st trimester	<25	1.30	0.258			
Diet during P	Adequate	1.33	0.404			
Physical activity during P	Adequate	1.16	0.487			
Weight gain during P	Adequate	1.25	0.313			
Perceived breast enlargement	Yes	1.45	0.106			
Anaemia at 3rd trimester	No	0.92	0.769			
Anaemia 24 h after birth	No	1.33	0.189			
Spontaneous labour onset	Yes	0.83	0.408			
Eutocic birth	Yes	**1.62**	**0.035**			
Use of oxytocin in labour	No	**1.61**	**0.045**			
Use of analgesia in labour	No	**5.31**	**<0.001**	**5.44**	**(2.00–14.82)**	**0.001**
Apgar score 5 min	≥9	1.37	0.468			
Neonatal weight	2500–4000 g	0.97	0.944			
Socio-cultural variables						
Maternal age (years)	≥30	0.96	0.878			
Marital status	Partner	2.05	0.103			
Country of origin	Outside Spain	2.14	0.114			
Years of education	(≥12 years)	**2.00**	**0.027**	**1.97**	**(1.00–3.88)**	**0.050**
Working status	Works regularly	0.68	0.119			
Pre-pregnancy BF intention	Yes	**2.46**	**0.006**			
Comfortable with public BF	Yes	**1.94**	**0.002**	**1.59**	**(1.00–2.52)**	**0.047**
Previous BF experience	Yes	**1.76**	**0.010**			
Use of a teat or pacifier (1st week)	No	**3.06**	**<0.001**	**2.38**	**(1.44–3.92)**	**0.001**
Bedsharing	Yes	**2.85**	**0.001**	**2.99**	**(1.52–5.86)**	**0.001**
Health professionals' intervention variables						
Attendance at ME courses	Yes	1.09	0.782			
Attendance at ME courses by partner	Yes	1.29	0.317			
Skin-to-skin contact	≥30 min	1.39	0.203			
Early breastfeeding (2 h)	Yes	1.38	0.349			
Formula supplements at hospital	No	**2.44**	**<0.001**	**1.72**	**(1.07–2.76)**	**0.026**

Abbreviations: UOR, unadjusted odds ratio; AOR, adjusted odds ratio; CI, confidence interval; P, pregnancy; BF, breastfeeding; BMI, body mass index; ME, maternal education.

bedsharing is also a key factor in BF prevalence as seems to positively affect BF rates at all time points. On the other hand, the use of a teat or pacifier in the first week has a strong negative effect and is associated with lower BF rates at all time points.

The results presented in this study suggest that the following interventions should be considered:

1. Encourage healthy practices such as smoking cessation for pregnant women or women wanting to become pregnant by warning against the risks of smoking during BF while also focusing on the benefits of BF over formula among smoking mothers.
2. Monitor for anaemia during pregnancy and try to avoid it in the final stages of pregnancy.
3. Review hospital practices concerning infant formula supplements and advise mothers and relatives of the link between artificial formula and lower BF rates, and also of the negative impact of using a teat or pacifier in the first weeks.
4. Support pregnant women that choose to bedshare by giving precise information on its benefits and the situations in which it should be avoided.
5. Motivate mother and also fathers/partners to participate in antenatal education courses, especially in those related to BF.
6. Make BF visible in society and support it with public policies and laws so that mothers and society feel that is the natural way of feeding babies.

Declaration of competing interest

The authors report no conflicts of interest.

References

[1] Global strategy for infant and young child feeding [homepage on the Internet]. Ginebra, Available from: https://www.who.int/maternal_child_adolescent/documents/9241562218/en/, 2003.
[2] Encuesta nacional de salud 2017, Determinantes de salud. alimentación e higiene bucodental. [homepage on the Internet], Available from: https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736176783&menu=resultados&secc=1254736195650&idp=1254735573175, 2017.
[3] Protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services [homepage on the Internet], Available from: https://www.who.int/nutrition/publications/guidelines/breastfeeding-facilities-maternity-newborn/en/, 2017.
[4] C.L. Jones, I. Culpin, J. Evans, R.M. Pearson, Relative effects of breastfeeding intention and practice on maternal responsiveness, Infant Ment Health J. 41 (1) (2020) 82–93, https://doi.org/10.1002/imhj.21832.

[5] O. Lutsiv, E. Pullenayegum, G. Foster, C. Vera, L. Giglia, B. Chapman, et al., Women's intentions to breastfeed: a population-based cohort study, BJOG 120 (12) (2013 Nov) 1490–1498.

[6] S.A.S. Moimaz, N.B. Rocha, C.A.S. Garbin, T.A. Rovida, N.A. Saliba, Factors affecting intention to breastfeed of a group of Brazilian childbearing women, Women Birth. 30 (2) (2017 Apr) e119–e124.

[7] W. Wang, Y. Lau, A. Chow, K.S. Chan, Breast-feeding intention, initiation and duration among Hong Kong Chinese women: a prospective longitudinal study, Midwifery 30 (6) (2014 Jun) 678–687.

[8] E.C. Odom, R. Li, K.S. Scanlon, C.G. Perrine, L. Grummer-Strawn, Reasons for earlier than desired cessation of breastfeeding, Pediatrics 131 (3) (2013 Mar) e726–e732.

[9] I. Artieta-Pinedo, C. Paz-Pascual, G. Grandes, A. Bacigalupe, J. Payo, I. Montoya, Antenatal education and breastfeeding in a cohort of primiparas, J. Adv. Nurs. 69 (7) (2013 Jul) 1607–1617.

[10] M. Oribe, A. Lertxundi, M. Basterrechea, H. Begiristain, L. Santa Marina, M. Villar, et al., Prevalence of factors associated with the duration of exclusive breastfeeding during the first 6 months of life in the INMA birth cohort in gipuzkoa, Gac Sanit. 29 (1) (2015) 4–9. Jan-Feb.

[11] M. Villar, L. Santa-Marina, M. Murcia, P. Amiano, S. Gimeno, F. Ballester, et al., Social factors associated with non-initiation and cessation of predominant breastfeeding in a mother-child cohort in Spain, Matern. Child Health J. 22 (5) (2018 May) 725–734.

[12] Strengthening the reporting of observational studies in epidemiology. [homepage on the Internet], Available from: www.strobe-statement.org.

[13] Obesity: Preventing and managing the global epidemic [homepage on the Internet], Available from: https://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/, 2002.

[14] Guía práctica clínica de atención en el embarazo y el puerperio. [homepage on the Internet], Available from: https://www.mscbs.gob.es/organizacion/sns/planCalidadSNS/pdf/Guia_practica_AEP.pdf, 2014.

[15] F. Mata, I. Chulvi, J. Roig, J.R. Heredia, F. Isidro, J.D. Benitez Sillero, et al., Physical exercise prescription during pregnancy, Revista Andaluza de Medicina del Deporte 3 (2) (2010) 68–79.

[16] L. Kaiser, L.H. Allen, American dietetic association. Position of the American dietetic association: nutrition and lifestyle for a healthy pregnancy outcome, J. Am. Diet. Assoc. 108 (3) (2008 Mar) 553–561.

[17] F.C. Battaglia, L.O. Lubchenco, A practical classification of newborn infants by weight and gestational age, J. Pediatr. 71 (2) (1967 Aug) 159–163.

[18] Calculadora en excel para ajustar el tamaño muestral. [homepage on the Internet], Available from: https://www.fisterra.com/mbe/investiga/9muestras/tamano_muestral.xls.

[19] C. Lechosa Muniz, M. Paz-Zulueta, E.C. Del Rio, S.M. Sota, M. Saez de Adana, M. M. Perez, et al., Impact of maternal smoking on the onset of breastfeeding versus formula feeding: A cross-sectional study, Int J Environ Res Public Health. 16 (24) (2019), https://doi.org/10.3390/ijerph16244888. Dec 4.

[20] B. Bahadori, N.D. Riediger, S.M. Farrell, E. Uitz, M.F. Moghadasian, Hypothesis: smoking decreases breast feeding duration by suppressing prolactin secretion, Med. Hypotheses 81 (4) (2013 Oct) 582–586.

[21] L.H. Amir, S.M. Donath, Does maternal smoking have a negative physiological effect on breastfeeding? The epidemiological evidence, Birth 29 (2) (2002 Jun) 112–123.

[22] M. Napierala, J. Mazela, T.A. Merritt, E. Florek, Tobacco smoking and breastfeeding: Effect on the lactation process, breast milk composition and infant development. A critical review, Environ Res. 151 (2016 Nov) 321–338.

[23] S. Horie, K. Nomura, S. Takenoshita, J. Nakagawa, M. Kido, M. Sugimoto, A relationship between a level of hemoglobin after delivery and exclusive breastfeeding initiation at a baby friendly hospital in Japan, Environ Health Prev Med. 22 (1) (2017) 40, 017-0650-7 Apr 20.

[24] M.J. Salahudeen, A.M. Koshy, S. Sen, A study of the factors affecting time to onset of lactogenesis-II after parturition, J. Pharm. Res. 6 (1) (2013) 68–72.

[25] L.A. Nommsen-Rivers, C.J. Chantry, R.J. Cohen, K.G. Dewey, Comfort with the idea of formula feeding helps explain ethnic disparity in breastfeeding intentions among expectant first-time mothers, Breastfeed. Med. 5 (1) (2010 Feb) 25–33.

[26] G. Ibanez, N. Martin, M. Denantes, M.J. Saurel-Cubizolles, V. Ringa, A.M. Magnier, Prevalence of breastfeeding in industrialized countries, Rev. Epidemiol. Sante Publique 60 (4) (2012 Aug) 305–320.

[27] J. Abbass-Dick, H.K. Brown, K.T. Jackson, L. Rempel, C.L. Dennis, Perinatal breastfeeding interventions including fathers/partners: a systematic review of the literature, Midwifery 75 (2019 Aug) 41–51.

[28] H.L. Ball, D. Howel, A. Bryant, E. Best, C. Russell, M. Ward-Platt, Bed-sharing by breastfeeding mothers: who bed-shares and what is the relationship with breastfeeding duration? Acta Paediatr. 105 (6) (2016 Jun) 628–634.

[29] E.A. Mitchell, A. Esmail, D.R. Jones, M. Clements, Do differences in the prevalence of risk factors explain the higher mortality from sudden infant death syndrome in New Zealand compared with the UK? N. Z. Med. J. 109 (1030) (1996 Sep 27) 352–355.

[30] K.A. Marinelli, H.L. Ball, J.J. McKenna, P.S. Blair, An integrated analysis of maternal-infant sleep, breastfeeding, and sudden infant death syndrome research supporting a balanced discourse, J. Hum. Lact. 35 (3) (2019 Aug) 510–520.

[31] P.S. Blair, H.L. Ball, J.J. McKenna, L. Feldman-Winter, K.A. Marinelli, M.C. Bartick, et al., Bedsharing and breastfeeding: the academy of breastfeeding medicine protocol #6, revision 2019, Breastfeed. Med. 15 (1) (2020 Jan) 5–16.

[32] L. Dubois, M. Girard, Social inequalities in infant feeding during the first year of life. The longitudinal study of child development in Québec (LSCDQ 1998–2002), Public Health Nutr. 6 (8) (2003 Dec) 773–783.

[33] L.H. Amir, Breastfeeding in public: "You can do it?", 014-0026-1. eCollection 2014, Int. Breastfeed J. 9 (1) (2014) 187. Dec 20.

[34] A. Brown, Breastfeeding as a public health responsibility: a review of the evidence, J. Hum. Nutr. Diet. 30 (6) (2017 Dec) 759–770.