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ORIGINAL ARTICLE

PREDICTORS OF EXCLUSIVE BREASTFEEDING: A LONGITUDINAL STUDY

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ABSTRACT

Objective: to investigate factors influencing the maintenance of exclusive breastfeeding up to six months postpartum. **Methods:** a longitudinal study was conducted with 150 pregnant women receiving care at primary health care units in a municipality in northwestern Paraná, Brazil. The dependent variable was exclusive breastfeeding, and the independent variables included sociodemographic, obstetric, neonatal, and psychosocial factors. Data were collected between October 2019 and November 2020 using structured questionnaires and the Infant Feeding Intentions Scale. Descriptive and inferential statistical analyses were performed, including frequency distributions and Cox regression modeling. **Results:** fewer than half (43.3%) of the women maintained exclusive breastfeeding for six months. Among the independent variables, previous breastfeeding experience, absence of gestational risk, and intention to breastfeed were positive predictors. In the final model, only gestational risk and intention to breastfeed remained significant. **Conclusion:** the findings highlight characteristics requiring special attention and reinforce the essential role of health professionals in implementing actions that address modifiable factors influencing breastfeeding.

Keywords: Breastfeeding. Weaning; High Risk Pregnancy. Child Health. Women's Health. Maternal and Child Health.

INTRODUCTION

The superiority and nutritional quality of breast milk (BM) as the exclusive source of food during the first six months of life are well established. It is fundamental for health promotion and for reducing maternal and infant morbidity and mortality, with lasting effects throughout life[1]. Furthermore, breastfeeding (BF) provides significant economic and environmental benefits, contributing to the sustainable development of societies [2-3].

Despite this evidence, in 2023, only 48% of children worldwide were exclusively breastfed until six months of age. Asia had the highest rates (60%), while North America had the lowest (26%). In Latin America, the rate was 43%, and in Brazil, 45.8%, with the South region showing the best results (54.3%)[4-5].

These figures reflect the multifactorial nature of exclusive breastfeeding (EBF), which is influenced by biological, social, and contextual factors, highlighting the need for ongoing research and targeted interventions[6]. National studies indicate that returning to work, lack of social support, low education, and maternal age under 20 years are frequent barriers[7]. Conversely, vaginal delivery, multiparity, early initiation of breastfeeding, and rooming-in favor breastfeeding success [8-9].

Other negatively associated factors include pacifier or bottle use, family pressure, perception of insufficient milk, and maternal conditions such as mastitis, nipple fissures, and breast engorgement[10]. In contrast, maternal knowledge, perceived self-efficacy, and social support have proven to be protective[10-2]. Postpartum depression and maternal obesity have also been linked to shorter EBF duration [9,13].

Given this multifactorial context, it is crucial to identify reliable predictors in different social

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realities to inform clinical strategies and public policies promoting EBF. Although significant advances have been achieved, current rates remain below the targets established by the World Health Organization[4-5].

In this context, this study aimed to identify predictors of exclusive breastfeeding up to 180 days postpartum. The findings are expected to guide health care, educational, and management actions, and to support future research on effective interventions to prolong EBF in Brazil.

METHOD

This longitudinal study was conducted in primary health care units (UBS) in a municipality located in northwestern Paraná, Brazil. The estimated population of the municipality in 2020 was 88,922 inhabitants. Its primary health care network comprised 19 UBS and 24 Family Health Strategy (ESF) teams, covering approximately 94% of the population[14-15].

Data collection was carried out between October 2019 and November 2020 among women who received prenatal care in the 19 UBS of the municipality. The number of participants recruited from each UBS was proportional to the number of pregnant women followed at that unit. The study population consisted of mother–child dyads who agreed to participate in the research and signed the informed consent form (ICF).

The inclusion criteria for pregnant women were: minimum age of 18 years, gestational age between 30 and 37 weeks, having had at least three prenatal consultations, and ability to understand the data collection instruments. Pregnant women with HIV infection, users of drugs or special medications, illiterate, non-Brazilian nationals, twin pregnancies, or those who could not be located after three attempts on alternate days and times were not included in the study.

Regarding neonates, those born with an Apgar score greater than or equal to seven and above 36 weeks of gestational age were included in this study. Newborns who had been admitted to the neonatal intensive care unit (NICU) or had congenital fetal malformation or any physical alteration that made breastfeeding impossible were not included in the study.

A total of 170 participants agreed to take part in the study. There was a loss of 20 participants due to change of address (n = 6), preterm birth (n = 3), and data inconsistency (n = 11). The final sample comprised 150 mother-child dyads (88.2%) who completed all stages of the study.

Data collection was carried out in three stages. The first stage involved interviews conducted before or after prenatal consultations at the 19 primary health care units in the municipality, by previously trained health professionals. The second stage took place within ten days after birth, using information from the mother's and child's outpatient records. The third stage occurred six months after delivery, through telephone contact or home visits conducted by the researcher.

The dependent variable was the maintenance of exclusive breastfeeding (EBF) up to six months after delivery, defined as feeding the child exclusively with BM, either directly at the breast or expressed, without the introduction of any other liquids or solids, except for prescribed medications, vitamins, or minerals.

The independent variables were grouped into four categories: a) maternal sociodemographic: age, self-reported race/color, living with a partner (yes/no), marital status (single, married, or divorced), years of schooling (< 8 or ≥ 8 years), paid work (yes/no), smoking (yes/no), and pre-pregnancy body mass index (eutrophic, overweight, or obese); b) obstetric: gestational risk (low or high risk), parity (primiparous or multiparous), previous breastfeeding experience (yes/no), and type of delivery (cesarean or vaginal); c) newborn-related: sex, birth weight, and gestational age; and d) psychosocial: planned pregnancy (yes/no) and intention to breastfeed (yes/no).

Data collection was carried out using structured instruments, including the Infant Feeding Intentions Scale (IFI), which assesses the strength and timing of maternal intentions to provide only breast milk (BM) up to six months postpartum. It consists of five items rated on a Likert scale from 0 to 4 points. The total score ranges from 0 to 16, with 0 indicating a low intention and 16 indicating a strong intention to exclusively breastfeed for six months[16].

Exploratory data analysis was performed. Categorical variables were expressed as absolute and relative frequencies, and continuous variables as mean (M) and standard deviation (SD), to characterize mothers and newborns according to breastfeeding duration.

Cox proportional hazards regression models were constructed to determine the individual effect of each covariate and to select those to be included in the multiple analysis, considering variables with $p < 0.20$. Initially, three variables were significant and were included in the final model (Model 5). Subsequently, multiple Cox models were built to assess the effect of groups of covariates (Models 1, 2, 3, and 4). The models were compared using the Likelihood Ratio Test (LRT).

From the adjustment of the final model (Model 5), at a 5% significance level, it was possible to evaluate the significance of each risk factor in the presence of others, as well as the risk ratio between different groups of breastfeeding women. The proportional hazards assumption of the Cox model was verified using Schoenfeld residuals for all models, and the effects of the factors were evaluated based on the hazard ratio (HR). All data were entered in Microsoft Excel® and subsequently analyzed using R software, version 4.0.2.

The study was approved by the Research Ethics Committee of the State University of Maringá/UEM (CAAE 20430819.6.0000.0104).

RESULTS

The sociodemographic, obstetric and psychosocial characteristics of the 150 women and the NB are shown in Table 1, as well as the results of the Cox analysis of the variables analyzed individually.

Table 1. Absolute (n), relative (%), mean (M) and standard deviation (SD) values, hazard ratio (HR), and p-value of maternal sociodemographic, obstetric, neonatal, and psychosocial variables according to the number of days of exclusive breastfeeding (EBF) in a municipality within the 14th Regional Health Department of the State of Paraná, 2019–2020. PR-Brazil, 2021

Variables	Classification	Less than 180 days 85 (56.7%)	180 days 65 (43.3%)	Total 150 (100%)	HR	p-value
Maternal sociodemographic variables						
Age	Mean (SD)	27.9 (6.4)	28.1 (6.6)	28 (6.5)	0.998	0.902
Race/color	White	36 (24.0)	30 (20.0)	66 (44.0)	Ref.	-
	Black or brown	48 (32.0)	34 (22.7)	82 (54.7)	1.042	0.851
	Yellow	1 (0.7)	1 (0.7)	2 (1.3)	0.67	0.693
Lives with partner	No	16(10.7)	9(6.0)	25 (16.7)	Ref.	-
	Yes	69(46.0)	56(37.3)	125(83.3)	0.813	0.455
Marital status	Single	14 (9.3)	13 (8.7)	27 (18.0)	Ref.	-
	Married	68 (45.3)	51 (34.0)	119 (79.3)	1.117	0.706
	Divorced	2 (1.3)	1 (0.7)	3 (2.0)	1.335	0.703
	Widow	1 (0.7)	0 (0.0)	1 (0.7)	4.968	0.125
Years of study	< 8 years	14 (9.3)	13 (8.7)	27 (18.0)	Ref.	-
	8 years and older	71 (47.3)	52 (34.7)	123 (82.0)	1.213	0.510
Works outside the home	No	50 (33.3)	35 (23.3)	85(56.7)	Ref.	-
	Yes	35 (23.3)	30 (20.0)	65 (43.3)	0.865	0.509
Smoker	No	79 (52.7)	62 (41.3)	141 (94.0)	Ref.	-
	Yes	6 (4.0)	3 (2.0)	9 (6.0)	1.567	0.290
BMI (classified)	Low weight	2 (1.3)	3 (2.0)	5 (3.3)	Ref.	-
	Eutrophic	28 (18.7)	25 (16.7)	53 (35.3)	1.782	0.430
	Overweight	35 (23.3)	20 (13.3)	55 (36.7)	2.223	0.382
	Obesity	20 (13.3)	17 (11.3)	37 (24.7)	1.913	0.272
Obstetric variables						
Gestational risk	Low-risk pregnancy	45 (30.0)	42 (28.0)	87 (58.0)	Ref.	-
	High risk	40 (26.7)	23 (15.3)	63 (42.0)	**1.534**	**0.049***
Parity	Multiparous	55 (36.7)	40 (26.7)	95 (63.3)	Ref.	-
	Primigravida	30 (20.0)	25 (16.7)	55 (36.7)	0.953	0.834
Breastfed other children	No	48 (32.0)	28 (18.7)	76 (50.7)	Ref.	-
	Yes	37 (24.7)	37 (24.7)	74 (49.3)	**0.688**	**0.088****
Type of delivery	Cesarean	68 (45.3)	51 (34.0)	119 (79.3)	Ref.	-
	Vaginal	17 (11.3)	14 (9.3)	31 (20.7)	0.89	0.668
Newborn variables						
Sex	Female	34 (22.7)	31 (20.7)	65 (43.3)	Ref.	-
	Male	51 (34.0)	34 (22.7)	85 (56.7)	1.14	0.555

Weight (grams)	Mean (SD)	3.330(421.4)	3.313 (429.0)	3.323 (423.4)	1.00	0.733
Gestational age	Mean (SD)	38.7 (0.9)	38.6 (1.1)	39(1.0)	1.058	0.603
Psychosocial variables						
Planned pregnancy	No	50 (33.3)	38 (25.3)	88 (58.7)	Ref.	-
	Yes	35 (23.3)	27 (18.0)	62 (41.3)	0.969	0.886
IFI	Mean (SD)	12.7 (3.5)	13.5 (2.7)	13 (3.2)	**0.932**	**0.038***

Note: *significant at the 5% level; **significant at the 10% level. Variables in bold showed statistical significance in the Cox regression analysis.

When the covariates were analyzed individually in the Cox model to assess the rate of early weaning in mothers at high gestational risk, it was observed that this rate was estimated to be 1.5 times higher than in mothers with usual gestational risk. In other words, if a woman has a gestational risk considered habitual, the probability of stopping breastfeeding decreases by 65.2% compared to those at high risk, with a 95% confidence interval indicating that this reduction varies between 42.5% and 99.9% (HR: 1/1.534=0.652; CI: 0.425-0.999). Among women classified as at high gestational risk (n=63), the most common comorbidities were: gestational diabetes, with 16 cases (25%), followed by arterial hypertension, with six cases (9.5%), and morbid obesity, also with six cases (9.5%).

In women who breastfed in previous pregnancies, the risk of abandoning breastfeeding was reduced by 31.2% when compared to those who had never breastfed (HR: 0.688; CI: 0.480-0.987). It can be stated with 90% confidence that the woman who did not breastfeed other children had a 45% higher risk of ceasing breastfeeding before six months, when compared to the one who breastfed.

Table 1 shows that there was statistical significance for the results of the IFA scale. As the result increases in one unit, the risk of stopping breastfeeding decreases by 7%, and it can be stated with 95% confidence that the risk ratio varies between 0.4% and 12.8% (HR: 1-0.932=0.068; CI: 0.004-0.128). Table 2 shows that in the Likelihood Ratio Test (LRT) at the level of 5% of significance, the models with the effects of the groups of covariates (models 1, 2, 3 and 4) were not significant. On the other hand, model 5, with the variables gestational risk, having breastfed other children, and the IFI scale (significant as shown in Table 1) was significant according to the LRT.

Table 2. Hazard ratios (HR) and p-values of maternal, neonatal, and psychosocial variables according to days of exclusive breastfeeding (EBF), based on Cox regression models in a municipality in the northwest of Paraná, Brazil, 2019–2020. PR-Brazil, 2021

Variables	Classification	HR	p-value	HR	p-value
Maternal sociodemographic variables		Model 1	0.800 LRT	Model 5	0.01* LRT
Age		0.993	0.722	-	-
Race/color	White	Ref.	-	-	-
	Black or brown	1.012	0.96	-	-
	Yellow	0.651	0.682	-	-
Lives with partner	No	Ref.	-	-	-
	Yes	0.698	0.403	-	-
Marital status	Single	Ref.	-	-	-
	Married	1.233	0.611	-	-
	Divorced	1.203	0.818	-	-
	Widow	5.686	0.122	-	-
Years of study	< 8 years	Ref.	-	-	-
	8 years or over	1.557	0.194	-	-
Works outside the home	No	Ref.	-	-	-
	Yes	0.812	0.408	-	-
Smoker	No	Ref.	-	-	-
	Yes	1.933	0.171	-	-
BMI (classified)	Underweight	Ref.	-	-	-
	Eutrophic	1.96	0.379	-	-
	Overweight	2.629	0.22	-	-
	Obesity	2.77	0.181	-	-
Obstetric variables		Model 2	0.200 LRT		

Gestational risk	Low-risk pregnancy	Ref.	-	-	-
	High risk	1.478	0.078**	1.651	0.023*
Parity	Multiparous	Ref.	-	-	-
	Primipara	0.512	0.025*	-	-
Breastfed other children	No	Ref.	-	-	-
	Yes	0.433	0.004*	0.726	0.145
Type of delivery	Cesarean	Ref.	-	-	-
	Vaginal	0.934	0.806	-	-
Newborn variables		Model 3	0.900 LRT		
Sex	Female	Ref.	-	-	-
	Male	1.137	0.563	-	-
Birth weight (gr)		1	0.853	-	-
Gestational age		1.049	0.677	-	-
Psychosocial variables		Model 4	0.200 LRT		
Planned pregnancy	No	Ref.	-	-	-
	Yes	0.95	0.816	-	-
IFI		0.932	0.041*	0.925	0.021*

Note: *significant at 5%; *significant at 10%. LRT = Likelihood Ratio Test for the model. IFI = Infant Feeding Intentions Scale.

After the process of selecting variables, the resulting final model (model 5) included the variables absence of gestational risk and intention to practice EBF, which demonstrates that these selected variables are truly important to describe the time until weaning.

DISCUSSION

The present study identified factors that can influence the duration of EBF. It was evidenced that women without gestational risks, who had previously breastfed, and who intended to breastfeed for six months had greater success in breastfeeding.

These results corroborate a cohort study with women with high-risk pregnancies, in which exclusive breastfeeding during the follow-up period was lower in the high-risk group (40.0%), while formula feeding was twice as frequent in this group (34.0%) than among women with uncomplicated pregnancies (18.0%)[17].

Along the same lines, a study carried out in Saudi Arabia with 360 volunteers found that there is a relationship between overweight, pregestational maternal obesity, and gestational diabetes with low rates of EBF[18].

Gestational diabetes is associated with delayed lactogenesis, as well as neonatal hypoglycemia and prematurity, which may explain the early introduction of formula, in addition to the separation of mother and child, making skin-to-skin contact difficult, which also affects breastfeeding rates[19].

In contrast, a cohort that investigated the relationship between maternal knowledge about the benefits of breastfeeding and gestational diabetes revealed that knowledge can be advantageous for practice; however, diabetes does not seem to influence the establishment of EBF[20].

Meanwhile, it can be stated that women classified as high gestational risk can succeed in breastfeeding, provided they are supported and prepared early during prenatal care and immediately after delivery, with encouragement of skin-to-skin contact and rooming-in, emphasizing the benefits for child and maternal health, and providing confidence and maternal security to favor breastfeeding[21].

Consolidating the above, a study that evaluated the effect of complicated pregnancies (gestational diabetes, hypertension, or obesity) identified that these women were 30% less likely to offer EBF, and that the quality of guidance received in the hospital regarding breastfeeding was associated with almost three times greater chances of EBF one week after delivery[22].

In the present study, previous breastfeeding experience was confirmed as a protective factor for EBF. Similarly, a cohort of 304 women found that mothers who had breastfed other children in previous pregnancies had better rates of initiation and maintenance of breastfeeding[23].

The same association was found in a cross-sectional study conducted in China, which observed that women who had never breastfed or who had breastfed a previous child for less than six months had approximately 39% lower probability of exclusively breastfeeding the current baby,

compared to those who breastfed their first child[24]. This suggests that positive experiences favor breastfeeding, whereas negative experiences can negatively influence future attempts.

Another aspect considered by researchers[13,17,24] was the maternal burden in women with more than two children, which can make breastfeeding more challenging. Health professionals should consider this factor during breastfeeding promotion and support, providing tailored guidance to multiparous women and mothers who previously experienced difficulty breastfeeding. Additionally, it is important to encourage support from partners and family members to reduce maternal overload and promote a more peaceful and effective breastfeeding experience[25].

This study also identified maternal intention to practice EBF as a protective factor. According to a systematic review, intention to breastfeed is associated with socioeconomic, biological, social, and obstetric characteristics, and is also shaped by exposure to health services, being constructed throughout life[26].

Considering that maternal determination and willingness favor the duration of breastfeeding, health professionals should carry out educational activities during prenatal care, childbirth, and the puerperium to reduce perceived barriers to breastfeeding. This approach improves maternal attitudes and self-efficacy, enhancing knowledge, skills, and confidence of mothers and family members in consolidating EBF[27,28].

A limitation of this study is that breastfeeding was self-reported by the mothers, which may introduce bias, as they could report what is socially desirable rather than their actual behavior. The sample did not include pregnant women under 18 years, illiterate women, or those receiving private prenatal care; therefore, results cannot be generalized to these population segments.

CONCLUSIONS

In this study, the predictors of EBF identified were previous breastfeeding experience, absence of gestational risks, and intention to breastfeed, highlighting that EBF is not purely instinctive or determined solely by maternal will, but is a practice influenced by multiple factors.

By identifying these predictors, the study contributes to the formulation of more targeted strategies in prenatal and puerperal care, focusing on early identification of women at higher risk of early weaning. This enables specific interventions, such as personalized educational actions, strengthened breastfeeding counseling, training of health professionals, and involvement of family and community support networks.

It is recommended that future research evaluate the effectiveness of interventions based on risk profiles, as well as conduct qualitative studies exploring maternal motivations, barriers, and experiences with EBF. Additionally, consolidating breastfeeding as a public health practice requires strengthening existing policies, such as the Brazilian Strategy for Breastfeeding and Complementary Feeding, with continuous monitoring and adequate support at all levels of care.

PREDITORES DO ALEITAMENTO MATERNO EXCLUSIVO: ESTUDO LONGITUDINAL

RESUMO

Objetivo: investigar os fatores que influenciam a manutenção do aleitamento materno exclusivo até os seis meses após o parto. **Métodos:** estudo longitudinal com 150 gestantes atendidas em unidades básicas de saúde de um município no noroeste do estado do Paraná. A variável dependente foi a amamentação exclusiva, enquanto as variáveis independentes incluíram fatores sociodemográficos, obstétricos, neonatais e psicossociais. Os dados foram coletados entre outubro de 2019 e novembro de 2020 por meio de questionários estruturados e da escala *Infant Feeding Intentions Scale*. A análise foi realizada por meio de estatística descritiva e inferencial, incluindo distribuição de frequências e aplicação do modelo de regressão de Cox. **Resultados:** menos da metade (43,3%) das mulheres do estudo mantiveram o aleitamento materno exclusivo por seis meses. Entre os fatores independentes que influenciaram positivamente, destacam-se a experiência prévia de amamentação, a ausência de riscos gestacionais e a intenção de amamentar. No modelo final, apenas o risco gestacional e a intenção de amamentar permaneceram significativos. **Conclusão:** os resultados apontam características que exigem atenção especial e ressaltam o papel dos profissionais de saúde na mediação e implementação de ações voltadas a fatores intervenientes na amamentação que podem ser modificados.

Palavras-chave: Aleitamento Materno. Desmame. Gravidez de Alto Risco. Saúde da Criança. Saúde da Mulher. Saúde Materno-Infantil.

PREDICTORES DE LA LACTANCIA MATERNA EXCLUSIVA: ESTUDIO LONGITUDINAL

RESUMEN

Objetivo: investigar los factores que influyen en el mantenimiento de la lactancia materna exclusiva hasta seis meses después del parto. **Métodos**: estudio longitudinal con 150 gestantes atendidas en unidades básicas de salud de un municipio en el noroeste del estado de Paraná/Brasil. La variable dependiente fue la lactancia exclusiva, mientras que las variables independientes incluyeron factores sociodemográficos, obstétricos, neonatales y psicosociales. Los datos fueron recogidos entre octubre de 2019 y noviembre de 2020 por medio de cuestionarios estructurados y la escala *Infant Feeding Intentions Scale*. El análisis se realizó por medio de estadística descriptiva e inferencial, incluyendo distribución de frecuencias y aplicación del modelo de regresión de Cox. **Resultados**: menos de la mitad (43,3%) de las mujeres del estudio mantuvieron la lactancia materna exclusiva durante seis meses. Entre los factores independientes que influyeron positivamente, se destacan la experiencia previa de lactancia, la ausencia de riesgos gestacionales y la intención de amamantar. En el modelo final, solo el riesgo gestacional y la intención de amamantar permanecieron significativos. **Conclusión**: los resultados señalan características que requieren atención especial y destacan el papel de los profesionales de la salud en la mediación e implementación de acciones dirigidas a factores involucrados en la lactancia que pueden ser modificados.

Palabras clave: Lactancia Materna. Destete. Embarazo de Alto Riesgo. Salud del Niño. Salud de la Mujer. Salud Materno-infantil.

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