



## ORIGINAL ARTICLE

## Relationship of delayed lactogenesis II to maternal perception of insufficient milk: A longitudinal study

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### KEYWORDS

Breast feeding;  
Weaning;  
Lactation;  
Postnatal care

### Abstract

**Aim:** To analyze the relationship of delayed lactogenesis II with maternal perception of insufficient milk.

**Methods:** A prospective, multicenter, longitudinal observational study was conducted. Data were obtained at discharge and between 1 and 5 months postpartum on the perception of insufficient milk and related variables, by means of a self-administered questionnaire, and subsequent postal and online follow-up. Logistic regression analysis was used to develop the explanatory model.

**Results:** A total of 260 puerperal mothers participated. Of these, 31.9% had insufficient milk and 23.6% had delayed lactogenesis II. During postpartum admission, delayed lactogenesis II (OR = 2.26; 95%CI = 1.07–4.79), difficulty in breastfeeding (OR = 1.02; 95%CI = 1.00–1.03), and professional help in breastfeeding (OR = 0.70; 95%CI = 0.50–0.97) were associated with maternal perception of insufficient milk.

**Conclusions:** The occurrence of breastfeeding difficulties during postpartum admission and at discharge, especially when there is delayed lactogenesis II, should be considered risk indicators, suggesting the need for additional support to standardized care. The PIM is a suitable indicator to assess the quality of professional breastfeeding support in improvement interventions.

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**PALABRAS CLAVE**

Lactancia materna;  
Destete;  
Lactancia;  
Atención postnatal

**Relación del retraso de la lactogénesis II con la percepción materna de leche insuficiente: un estudio longitudinal****Resumen**

**Objetivo:** Analizar la relación del retraso de la lactogénesis II con la percepción materna de leche insuficiente.

**Método:** Se realizó un estudio observacional longitudinal prospectivo, multicéntrico. Se obtuvieron datos al alta y entre 1 y 5 meses postparto sobre la percepción de leche insuficiente y las variables relacionadas, mediante un cuestionario autoadministrado, y posterior seguimiento postal y online. Para el desarrollo del modelo explicativo, se realizó un análisis de Regresión Logística.

**Resultados:** Participaron un total de 260 púerperas. El 31,9% de ellas percibió leche insuficiente y el 23,6% presentó retraso de la lactogénesis II. Durante el ingreso posparto, se relacionó con la percepción materna de leche insuficiente el retraso de la lactogénesis II (OR = 2,26; IC95% = 1,07–4,79), la dificultad para amamantar (OR = 1,02; IC95% = 1,00–1,03), y la ayuda de los profesionales en la lactancia (OR = 0,70; IC95% = 0,50–0,97).

**Conclusiones:** La aparición de dificultades en la lactancia durante el ingreso posparto y al alta, especialmente cuando existe un retraso de la lactogénesis II, deben considerarse indicadores de riesgo, que sugieren la necesidad de un apoyo adicional a los cuidados estandarizados. La PIM es un indicador adecuado para evaluar la calidad del apoyo profesional a la lactancia en intervenciones de mejora.

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**What is known?**

Maternal perception of insufficient milk is one of the main reasons why breastfeeding is abandoned before 6 months.

**That contribute?**

During postpartum hospital admission, the delay in milk let-in or breastfeeding difficulties influence the perception of insufficient milk, while the help and support of professionals is beneficial.

continued with complementary feeding up to two years of age or as long as the mother wishes to breastfeed.<sup>5</sup>

Many mothers stop breastfeeding prior to 6 months of age, citing lack of milk as the main reason.<sup>6</sup> Perceived insufficient milk (PIM) is the state in which the mother has or perceives that she has an inadequate milk intake or supply to satisfy her baby's hunger and/ or weight<sup>7</sup> and can occur at any time during breastfeeding.<sup>8</sup>

The frequency of the phenomenon of perceived insufficient milk has been estimated at percentages ranging from 29%<sup>9</sup> to 76.2%.<sup>10</sup> It is affected by maternal beliefs, infant behaviours, and, perhaps, maternity care during postpartum hospitalisation. During the first few days, mothers are often more anxious about meeting their babies' nutritional needs,<sup>11</sup> and may report PIM when they observe that very little milk is coming out or that their milk is watery and that milk is not suitable, especially if they are referring to colostrum, because they believe it does not satisfy the baby.<sup>12,13</sup> PIM is also influenced by infant behavioural patterns, where a crying infant is interpreted as a sign of hunger and puts a series of maternal beliefs and concerns into motion that leads to the mother's perception of insufficient milk.<sup>8,10</sup>

Lactogenesis II is the beginning of abundant milk production after birth. Adequate hormone levels (prolactin, insulin, adrenal cortisol, thyroid hormones) and a decrease in progesterone (due to placental outflow)<sup>14</sup> are required. Lactogenesis II is perceived by mothers as a sudden increase in breast fullness, turgor, or milk leakage as milk is produced. It generally takes approximately 60 h after birth and can vary between 24 and 102 h postpartum. It is considered as delayed when it occurs after 72 h.<sup>15</sup> Delayed lactogenesis II presents in some 23.3%<sup>16</sup> and is associated with a

**Introduction**

Breastfeeding is the ideal form of nutrition for any newborn; it brings well-known dose-dependent benefits to the infant, the mother, the family, and society,<sup>1</sup> since it reduces mortality and morbidity in both mothers and their babies, and has a positive impact on the economy and the environment.<sup>1,2</sup> For instance, breastfed infants have a significantly lower risk of contracting lower respiratory tract infections, otitis media, and gastroenteritis compared to infants who are not breastfed;<sup>3</sup> in the mother, it lowers the risk of developing breast and ovarian cancer, as well as a reduced risk of type II diabetes.<sup>4</sup> Consequently, breastfeeding exclusively is recommended until [the child is] 6 months of age, and then

shorter duration of lactation,<sup>16,17</sup> in addition to the mother's perception of insufficient milk.<sup>10,13,18</sup>

Lactation takes place during postpartum hospitalisation, coinciding with the care provided to the mother and newborn during this period. Both this care<sup>5</sup> and the perception of milk<sup>19</sup> are related to the subsequent development of lactation; for example, early and uninterrupted skin-to-skin contact after birth between mother and newborn, allowing newborns to stay with their mothers, supporting and helping mothers to initiate breastfeeding and manage any difficulties that may arise, together with discouraging the administration of any food or liquid to newborns other than breast milk.<sup>2</sup>

To date, the influence of PIM or delayed lactogenesis II on the duration and exclusivity of breastfeeding has been studied, with few studies relating the influence of delayed lactogenesis II on PIM. Therefore, the aim of this study was to analyse the relationship between the delay in lactogenesis II and mothers' perception of insufficient milk during the first months postpartum in a sample of Spanish women.

## Method

### Design

A prospective, longitudinal, observational study was carried out in a cohort of breastfeeding mothers during the postpartum period. This work is part of a multicentre project to adapt tools to evaluate care during childbirth from the mother's viewpoint.

### Study population and scope

An accidental sample of 621 women was enrolled, whose delivery took place at the Hospital Vega Baja (Orihuela, Alicante), the Hospital General de Alicante, or the Hospital Mutua Terrassa (in Tarrasa, Barcelona), and who were breastfeeding at the time of discharge, in the period between 20 October 2013 and 29 February 2016. Mothers were recruited mainly at discharge from the hospital following delivery, and, in some cases, also during gestational follow-up visits. The initial sample size was calculated for a predicted 20 independent variables to be included in a logistic regression model, following a classical criterion of 10 cases per independent variable<sup>20</sup> and a follow-up response rate of 40%.

The sample included women who were breastfeeding at discharge, who understood and spoke Spanish, with a single newborn having a gestational age of 36 weeks or more. Mothers whose clinical situation or that of their infants might interfere with breastfeeding (e.g., mothers with HIV, infants with cleft palate or cleft lip, or Down's syndrome) were excluded.

For the study sample, only those mothers for whom data regarding the onset of lactogenesis II and complete follow-up for 1–5 months postpartum were selected.

## Variables

To measure the outcome variable, PIM, the conceptual proposal of Hill and Humenick<sup>7</sup> was used. A mother was considered to have perceived PIM when, on the follow-up form (between 1–5 months postpartum), she answered affirmatively to the question, "During the time you have breastfed, have you ever had difficulties/ problems with the amount of breast milk?" and ticked the option "My milk is/was insufficient for the baby's needs." PIM was also considered when they had discontinued breastfeeding and, among a list of proposed reasons, they ticked the options "I had too little milk or my milk was not good," or "Because the baby was hungry."

The main explanatory variable was the time of lactogenesis II onset. Maternal perception of milk let-down, a valid indicator to measure this variable,<sup>15</sup> was used to capture the information. This information was obtained by means of the following question: "Have you noticed milk let-down? (When milk let-down occurs, you may notice, for example, dripping, tingling, or swelling in the breasts)." In addition, the woman was asked to record the approximate date and time this occurred, to determine whether or not the onset of lactogenesis II was delayed.

Information was also gathered on the socio-demographic characteristics of the participants: variables such as maternal age, country of origin (Spanish/non-Spanish), cohabitation (living with a partner, living with a partner a few days a month, not living with a partner), level of education (primary/or less, school certificate/vocational training/baccalaureate, university studies or more, annual family income (less than 6000 euros, between 6000–8999 euros, between 9000–11999 euros, between 12000–17999 euros, 18000–29999 euros, 30000–44999 euros, 45000–60000 euros, more than 60000 euros), and tobacco use (non-smoker, smoker, smoker during pregnancy and non-smoker after delivery).

As for obstetric and neonatal characteristics: data were obtained concerning gestational age on the day of delivery, parity (primiparous/multiparous), type of delivery (eutocic, instrumented, emergency caesarean section, scheduled caesarean section), type of anaesthesia (none or local, epidural or spinal), postpartum skin-to-skin contact (immediately, within the first 30 min, within 30–60 min, after the first 60 min, at discharge not yet possible), hospitalisation of the newborn (not hospitalised, hospitalised within the first 6 h of life, hospitalised after 6 h of life).

Information on breastfeeding during the postpartum stay was elicited from variables such as past experience (yes, no, no previous children), expected time of breastfeeding (6 months or more, has not decided, or fewer than 6 months), use of dummies (yes/no), and use of nipple shields (yes/no). Type of breastfeeding during admission (Exclusively Breastfeeding (EBF), predominantly breastfeeding, partially breastfeeding), type of breastfeeding at discharge (EBF, predominantly breastfeeding, partially breastfeeding), and type of breastfeeding after discharge (EBF, predominantly breastfeeding, partially breastfeeding, not breastfeeding). Difficulty in breastfeeding during the hospital stay was measured on a Likert-type scale (0–100), on which 0 indicated "It was very easy." and 100 "It was

**Table 1** Sample characteristics (N = 260).

	n	(%)
<b>Sociodemographic variables</b>		
<i>Country of origin</i>		
Spain	243	(93.5)
Other countries	17	(6.5)
<i>Level of education</i>		
Primary studies (or less)	17	(7.5)
Certificate of Education/Vocational Training/Baccalaureate	96	(40.2)
University or higher	126	(52.3)
<i>Cohabitation</i>		
Living together as a couple all the time	236	(97.9)
Only a few days a month/ not living together	5	(2.1)
<i>Annual family income</i>		
Less than 6000 euro	15	(6.5)
Between 6000–8999 euro	16	(7.0)
Between 9000–11999 euro	15	(6.5)
Between 12000–17999 euro	34	(14.8)
Between 18000–29999 euro	64	(27.8)
Between 30000–44999 euro	51	(22.2)
Between 45000–60000 euro	25	(10.9)
More than 60000 euro	10	(4.3)
<i>Smoking status</i>		
Non-smoker	165	(68.8)
Smoker	49	(20.4)
<i>Smoker during pregnancy, not during postpartum</i>	26	(10.8)
<b>Clinical obstetric variables</b>		
<i>Parity</i>		
Primiparous	152	(58.5)
Multiparous	108	(41.5)
<i>Type of birth</i>		
Eutocic	170	(65.4)
Instrumented	44	(16.9)
Emergency caesarean	38	(14.6)
Scheduled caesarean	8	(3.1)
<i>Type of anaesthesia</i>		
None or local	40	(15.6)
Epidural or spinal	217	(84.4)
<i>Admission to NICU</i>		
No	231	(90.6)
Yes, prior to 6 h of life	21	(8.2)
Yes, after 6 h of life	3	(1.2)
<i>Skin-to-skin</i>		
Immediately	168	(69.7)
In the first 30 min	26	(10.8)
Between 30 and 60 min	12	(5.0)
After the first 60 min	8	(3.3)
After the first 120 min	17	(7.1)
Still not possible at discharge	10	(4.1)
<b>Breastfeeding variables</b>		
<i>Previous experience</i>		
Yes	92	(36.5)

**Table 1** (Continued)

	n	(%)
Did not breastfeed previous child	7	(2.8)
No previous children	153	(60.7)
<i>Time planning to breastfeed</i>		
6 months or more	106	(44.4)
Undecided/ less than 6 months	133	(55.6)
<i>Type of feeding during hospitalisation</i>		
Exclusive breastfeeding	159	(66.8)
Predominantly or partial breastfeeding	79	(33.2)
<i>Type of feeding at discharge</i>		
Exclusive breastfeeding	179	(74.9)
Predominantly or partial breastfeeding	60	(25.1)
<i>Type of feeding following discharge (1-5 months)</i>		
Exclusive breastfeeding	138	(53.3)
Predominantly breastfeeding	29	(11.2)
Partial breastfeeding	48	(18.6)
No breastfeeding	43	(16.7)
<i>Use of dummies or nipples</i>		
Yes	73	(30.3)
No	168	(69.7)
<i>Use of nipple shields</i>		
Yes	42	(17.6)
No	196	(82.4)
<i>Professional breastfeeding support</i>		
Totally disagree	8	(3.3)
Strongly disagree	6	(2.5)
Neither disagree or agree	20	(8.4)
Strongly agree	63	(26.4)
Completely agree	142	(59.4)
<i>Mother's perception of enough milk (PIM)</i>		
Yes	83	(31.9)
No	177	(68.1)
<i>Delayed lactogenesis II</i>		
Yes	49	(23.6)
No	159	(76.4)

BF: Breastfeeding; PIM: Perceived insufficient milk.

impossible for me.” Additionally, information on maternal self-efficacy for breastfeeding was obtained using the Spanish version of the BSES-SF scale, an instrument for which there is adequate evidence of validity and reliability, with a reported Cronbach's alpha coefficient of 0.92.<sup>21</sup> The BSES-SF is a unidimensional scale with 14 items that are scored on a 5-point Likert-type scale. The lowest score is 14 points (no self-efficacy for breastfeeding) and the highest score is 70 points (the greatest self-efficacy for breastfeeding possible). As regards professional support for breastfeeding, mothers were asked to rate their degree of agreement or disagreement with the statement: “Since the birth, professionals have offered me the help I needed to breastfeed” on a 5-point Likert scale.

Finally, the type of breastfeeding offered by the mothers was based on the definitions proposed by the World Health Organisation (WHO).<sup>22</sup> EBF was considered when the baby

**Table 2** Difficulty to nurse during hospitalisation and Maternal Self-Efficacy for breastfeeding (N = 260).

Item	n	mean	SD	Min	Max
Difficulty in breastfeeding	220	24.62	27.44	0	100
Self-efficacy for breastfeeding	226	53.12	11.03	18	70

**Table 3** Relationship of sociodemographic, obstetric, and breastfeeding variables with the perception of insufficient milk at 1–5 months postpartum (N = 260).

	n (%)		$\chi^2$	p
	PIM	No PIM		
<b>Sociodemographic variables</b>				
<i>Country of origin</i>				
Spain	77 (31.8)	165 (68.2)	.04	.84
Not Spain	5 (29.4)	12 (70.6)		
<i>Marital status</i>				
Living with partner all the time	74 (31.4)	162 (68.6)	.17	.65
Only some days per month/ not living together	2 (40.0)	3 (60.0)		
<i>Family income</i>				
<18000 euro	31 (19.5)	15 (21.1)	.08	.77
≥18000 euro	128 (80.5)	56 (78.9)		
<i>Level of studies</i>				
None or basic	25 (33.8)	44 (26.7)	1.26	.26
Baccalaureate or higher	49 (66.2)	121 (73.3)		
<i>Smoker</i>				
Yes	7 (9.3)	18 (10.9)	.13	.71
No	68 (90.7)	147 (89.1)		
<b>Obstetric variables</b>				
<i>Type of delivery</i>				
Vaginal	64 (77.1)	150 (84.7)	2.26	.13
Caesarean	19 (22.9)	27 (15.3)		
<i>Type of anaesthesia</i>				
None/local	15 (18.3)	25 (14.3)	.68	.40
Epidural/spinal	67 (81.7)	150 (85.7)		
<i>Skin-to-skin</i>				
Yes	61 (81.3)	133 (80.1)	.04	.82
No	14 (18.7)	33 (19.9)		
<i>Admission to neonatal unit</i>				
Yes	9 (11.1)	15 (8.6)	.40	.52
No	72 (88.9)	159 (91.4)		
<b>Breastfeeding variables</b>				
<i>Previous experience</i>				
Yes	26 (32.9)	66 (38.2)	.62	.42
No	53 (67.1)	107 (61.8)		
<i>Time planned</i>				
≥6 months	33 (44.0)	73 (44.5)	.005	.94
<6 months	42 (56.0)	91 (55.5)		
<i>Milk let-down prior to discharge</i>				
Yes	43 (56.6)	95 (55.9)	.01	.91
No	33 (43.4)	75 (44.1)		
<i>Use of dummy</i>				
Yes	27 (35.5)	46 (27.9)	1.44	.23
No	49 (64.5)	119 (72.1)		
<i>Use of nipple shields</i>				
Yes	19 (25.3)	23 (14.1)	4.45	.035
No	56 (74.7)	140 (85.9)		
<i>Professiona breastfeeding support</i>				
Totally disagree	5 (6.7)	3 (1.8)	10.35	.003
Strongly disagree	4 (5.3)	2 (1.2)		
Neither agree nor disagree	7 (9.3)	13 (7.9)		
Strongly agree	23 (30.7)	40 (24.4)		
Completely agree	36 (48.0)	106 (64.6)		
<i>Delayed lactogenesis II</i>				
Yes	22 (33.8)	27 (18.9)	5.55	.018
No	43 (66.2)	116 (81.1)		

BF: Breastfeeding; PIM: Perceived insufficient milk.

**Table 4** Differences in self-efficacy and difficulty breastfeeding during hospitalisation with maternal perception of insufficient milk 1–5 months postpartum (N = 260).

Variable	n	Media	DS	Difference means	95% CI	p
<i>Self-efficacy for breastfeeding</i>						
PIM	69	49.44	12.34	5.28	1.94	<b>.002</b>
No PIM	157	54.73	10.02		–	
<i>Difficulty breastfeeding</i>						
PIM	76	32.63	30.53	–11.74	8.63	<b>.004</b>
No PIM	163	20.89	25.12		–	
<i>Maternal age</i>						
PIM	76	33.80	4.30	–.34	–	.88
No PIM	167	33.46	4.87		–	
<i>Baby's age on day of survey</i>						
PIM	83	76.07	29.75	–1.91	–.88	.63
No PIM	177	74.16	30.85		–	
PIM: Perceived insufficient milk.					6.00	

**Table 5** Factors related to maternal perception of insufficient milk 1–5 months postpartum (N = 260).

Variable	β	OR	p	95% CI
Delayed lactogenesis II	.818	2.266	<b>.032</b>	1.073–4.787
Difficulty breastfeeding	.017	1.017	<b>.005</b>	1.005–1.029
Professional breastfeeding support	–.361	0.697	<b>.034</b>	0.500–0.973

β: regression coefficient; OR: Odds Ratio; BF: Breastfeeding.

received only breast milk and, eventually, medication or oral rehydration salts. Predominantly breastfeeding was considered if the mother offered other non-nutritive liquids (such as juices or glucose solution) in addition to breast milk, and partially breastfeeding, when the mother also offered formula or other foods.

### Data collection

Data about the time of lactogenesis II onset, socio-demographic characteristics, breastfeeding during postpartum hospitalisation, and type of breastfeeding during hospitalisation and at discharge were obtained at discharge, using a self-report form. Women who were discharged without having perceived milk let-down were telephoned between two and seven days postpartum to enquire about the timing of let-down.

Follow-up between 1 and 5 months postpartum was performed by email, as well as by post when mothers preferred or did not have e-mail. Data on PIM and type of breastfeeding were obtained at the time of follow-up.

### Data analysis

A descriptive analysis of the study variables, arithmetic mean, standard deviation, and frequency distributions were conducted for qualitative variables.

Differences between the characteristics of the initial sample and the sample included at follow-up were explored for the main descriptive variables (time of onset of lactogenesis II, socio-demographic characteristics, breastfeeding

during postpartum hospitalisation, and at discharge). In the follow-up group, differences for these variables were explored using PIM as the dependent variable. For hypothesis testing, the Student's t-test for independent samples was used for quantitative variables, and Pearson's chi-square for qualitative variables.

A forward stepwise logistic regression model was carried out, selecting the optimal set of variables using the likelihood ratio test. Only those cases were included for which data were available for all covariates, without imputation of missing values. Covariates for which statistically significant differences ( $p \leq .05$ ) were identified in the bivariate analysis were incorporated as covariates. All statistical analyses were performed using IBM SPSS® software (version 22.0).

### Ethical considerations

This research project received the approval of the Clinical Research Ethics Committee of the General Directorate of Public Health and Higher Centre for Public Health Research (CEIC-DSGSP/CSISP) of the Valencian Community, in addition to the ethics and research committee of each participating hospital. During recruitment into the study, a member of the research team provided verbal and written information about the study, including details regarding the voluntary nature of participation and data confidentiality. Written consent was obtained from all study participants. The study data were anonymised and only members of the research team had access to the data.

## Results

Of the 621 women initially enrolled in the study, 260 (41.9%) completed follow-up. Mothers who participated in the follow-up had a higher level of education ( $\chi^2 = 35.1$ ,  $p < .01$ ), greater family income ( $\chi^2 = 18$ ,  $p < .01$ ), more Spanish were ( $\chi^2 = 23$ ,  $p < .01$ ), used more dummies during postpartum admission ( $\chi^2 = 10.9$ ,  $p < .01$ ), and breastfed more exclusively during admission ( $\chi^2 = 4.9$ ,  $p = .02$ ) and at discharge ( $\chi^2 = 8.1$ ,  $p < .01$ ). However, no differences were observed with respect to the number of previous children, past breastfeeding experience, expected time of breastfeeding, type of delivery, admission of the infant to a neonatal unit after delivery, or time of initiation of skin-to-skin contact after delivery.

The 260 mothers who completed follow-up had a mean age of 33.56 years ( $SD = 4.69$ ), 93.5% ( $n = 243$ ) were Spanish 52.3% ( $n = 126$ ), had a university education, and most of them lived with their partner (96.3%,  $n = 232$ ). By centre, 28.8% ( $n = 75$ ) of the sample belonged to the Vega Baja hospital, 34.2% ( $n = 89$ ) to the Tarrasa hospital, and 36.9% ( $n = 96$ ) to the Alicante hospital. The mean age of the babies at the time of the survey between 1–5 months postpartum was 74.77 ( $SD = 30.46$ ) days. Descriptive results for sociodemographic, obstetric, and breastfeeding variables can be found in [Tables 1 and 2](#).

With respect to the relationship of the study variables with PIM, statistically significant results were identified for the use of nipple shields ( $p = 0.035$ ), assistance provided by breastfeeding professionals ( $p = 0.003$ ), and delayed lactogenesis II ([Table 3](#)). Furthermore, mothers with PIM exhibited lower mean breastfeeding self-efficacy scores and greater difficulty in breastfeeding during postpartum hospitalisation ([Table 4](#)); these findings were also statistically significant.

The main variable related to PIM in the multivariate model ([Table 5](#)) was delayed lactogenesis II ( $OR = 2.266$ ) and, to a lesser degree, difficulty in breastfeeding during hospital stay ( $OR = 1.017$ ). Help provided by professionals was a protective factor for PIM ( $OR = 0.697$ ).

## Discussion

The maternal perception of insufficient milk and its risk factors during the first few days postpartum, including delayed lactogenesis II, were probed in this study. Multivariate analysis revealed that, in addition to delayed onset of lactogenesis II, maternal difficulty in breastfeeding during hospitalisation and the availability of professional assistance with breastfeeding were also relevant variables.

The results demonstrated that delayed onset of lactogenesis II was associated with PIM. Similar results were also reported in other studies in Nicaragua<sup>11</sup> and Mexico.<sup>10</sup> Even though the delay in lactogenesis exhibits a decrease in milk production (less than 9.2 g of milk per feeding at 60 h postpartum)<sup>15</sup> and is a temporary situation, it can lead to low milk perception later on, given that the perception of milk production at 4–6 days following birth correlates significantly with milk production at 6 weeks later,<sup>23,24</sup> and could substantially affect milk production once lactation has already been established.<sup>25</sup> One possible explanation for this

relationship between delayed lactogenesis II and PIM might be that the mother loses confidence in her ability to produce milk,<sup>17</sup> causing mothers to cope by introducing breastmilk substitutes, decreasing the frequency of feedings, and reinforcing the idea that breastmilk alone does not suffice to feed their infants.<sup>11,13</sup>

PIM was also associated with difficulty in breastfeeding during postpartum hospital stay. Other authors have reported that difficulties at the beginning of breastfeeding are associated with PIM. Mohebati et al also confirmed the association between problems with breastfeeding, such as inadequate latch, problems with nipples, breast engorgement, and PIM.<sup>10</sup> Such issues are known to affect milk production and milk transfer.<sup>13</sup>

In our study, mothers who did not report PIM expressed a higher degree of agreement with the help provided by professionals during their postpartum hospital stay. Overcoming the difficulties of the first few days and having an adequate breastfeeding support system are critical for the course and continuation of breastfeeding.<sup>26,27</sup>

Resolving the difficulties of the first days and having an adequate breastfeeding support system are crucial for the course and continuation of breastfeeding.<sup>26,27</sup>

Several authors point out that mothers with more support report less PIM<sup>18</sup> because it helps to reduce their doubts and worries<sup>28</sup> and increases their confidence in breastfeeding.<sup>29</sup>

Other variables that have been related to PIM in earlier studies were not included in our multivariate model following the selection strategy of the optimal set of variables, despite the fact that in the bivariate analysis, we did identify significant difference regarding PIM. First of all, self-efficacy, which has identified in multiple studies to be a protective factor for PIM: Mothers with lower self-efficacy scores tend to perceive PIM more frequently.<sup>30</sup> However, self-efficacy reveals a strong correlation with perceived postpartum breastfeeding difficulties and professional support,<sup>11</sup> which would explain why the inclusion of this variable in the model does not improve its predictive utility. Similarly, the use of nipple guards, the other variable we identified in the bivariate analysis, but not in the final multivariate model, tends to be related to some of these problems, such as poor latch-on or nipple problems.<sup>31</sup>

As for the limitations of this study, the sample was accidental. Generalisation of the results should be made with caution, as certain characteristics of the subjects in the follow-up sample, having a higher level of education and income, and a higher rate of exclusive breastfeeding at discharge, are related to a longer duration of breastfeeding.<sup>32</sup> The results in a less breastfeeding-friendly sample might be different, for example, one with a greater negative effect of delayed lactogenesis II on PIM and should be explored in future studies.

As for the outcome variable, the perception of PIM, it may be concurrent with delayed lactogenesis II in some cases. In addition, measuring PIM at different times of follow-up (between the first and sixth month postpartum) may have led to a decreased incidence of PIM in those who responded to the survey earlier. To probe the possible effect of infant age at the time of the follow-up survey on maternal perception of PIM at postpartum, infant age at the time of the



follow-up survey was included in the bivariate analysis and did not account for differences in PIM. However, future studies should include additional information on the perception of PIM at different times during postpartum.

As for the clinical utility of the results, not only delayed lactogenesis II, but maternal perception of difficulties in breastfeeding initiation during hospitalisation should be established as risk indicators for maternal perception of PIM, and consequently, for early breastfeeding cessation. The manifestation of problems at any point during breastfeeding underscores the need for additional support as early as possible, especially when there is also a delay in lactogenesis II.<sup>10</sup> Moreover, these results are consistent with the idea that mothers that receive more support report less PIM<sup>19</sup>; thus, PIM may be a suitable indicator to assess the quality of professional breastfeeding support in interventions seeking to improve breastfeeding.

As conclusions of the study, delayed lactogenesis II is related to maternal perception of insufficient milk during the first months postpartum. In addition, other factors such as difficulty in breastfeeding and professional support perceived by the mother during postpartum hospitalisation are also related to PIM. Difficulty with breastfeeding during the postpartum hospitalisation and at discharge, in particular when there is a delay in lactogenesis II, should be regarded as risk indicators for the provision of additional breastfeeding support. Furthermore, PIM could be a fitting indicator to assess the quality of professional breastfeeding support in interventions that aim for improvement.

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## Conflict of interests

None.



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## References

1. Victora CG, Bahl R, Barros AJD, França GVA, Horton S, Krasevec J, et al. Breastfeeding in the 21st century: epidemiology, mechanisms, and lifelong effect. *Lancet*. 2016;387:475–90, [http://dx.doi.org/10.1016/S0140-6736\(15\)01024-7](http://dx.doi.org/10.1016/S0140-6736(15)01024-7).
2. OMS, UNICEF, Available from: <https://apps.who.int/iris/bitstream/handle/10665/326162/9789243513805-spa.pdf?sequence=1&isAllowed=y>, 2018.
3. Rouw E, von Gartzten A, Weißenborn A. The importance of breastfeeding for the infant. *Bundesgesundheitsblatt Gesundheitsforsch Gesundheitsschutz*. 2018;61:945–51, <http://dx.doi.org/10.1007/s00103-018-2773-4>.
4. Chowdhury R, Sinha B, Sankar MJ, Taneja S, Bhandari N, Rollins N, et al. Breastfeeding and maternal health outcomes: a systematic review and meta-analysis. *Acta Paediatr Int J Paediatr*. 2015;104:96–113, <http://dx.doi.org/10.1111/apa.13102>.
5. WHO, Available from: Guideline: Protecting, promoting and supporting breastfeeding in facilities providing maternity and newborn services [Internet]. World Health Organization; 2017. p. 1–136 [http://apps.who.int/bookorders.%0Ahttp://apps.who.int/iris/bitstream/handle/10665/259386/9789241550086-eng.pdf?sequence=1%0Ahttp://www.who.int/elena/titles/full\\_recommendations/breastfeeding-support/en/%0Ahttp://apps.who.int/iris/bitstream/10665/259386/1/](http://apps.who.int/bookorders.%0Ahttp://apps.who.int/iris/bitstream/handle/10665/259386/9789241550086-eng.pdf?sequence=1%0Ahttp://www.who.int/elena/titles/full_recommendations/breastfeeding-support/en/%0Ahttp://apps.who.int/iris/bitstream/10665/259386/1/)
6. Brown CRL, Dodds L, Legge A, Bryanton J, Semenic S. Factors influencing the reasons why mothers stop breastfeeding. *Can J Public Health*. 2014;105:179–86, <http://dx.doi.org/10.17269/cjph.105.4244>.
7. Hill PD, Humenick SS. Insufficient milk supply. *J Nurs Scholarsh*. 1989;21:145–8, <http://dx.doi.org/10.1111/j.1547-5069.1989.tb00120.x>.
8. Huang Y, Liu Y, Yu XY, Zeng TY. The rates and factors of perceived insufficient milk supply: a systematic review. *Matern Child Nutr*. 2022;18:e13255, <http://dx.doi.org/10.1111/mcn.13255>.
9. Díaz-Gómez M, Ruzafa-Martínez M, Ares S, Espiga I, De Alba C. Motivaciones y barreras percibidas por las mujeres españolas en relación a la lactancia materna. *Rev Esp Salud Pública*. 2016;90:1–18. Available from: [https://www.sanidad.gob.es/biblioPublic/publicaciones/recursos\\_propios/resp/revista\\_cdrom/VOL90/ORIGINALES/RS90C.MDGes.pdf](https://www.sanidad.gob.es/biblioPublic/publicaciones/recursos_propios/resp/revista_cdrom/VOL90/ORIGINALES/RS90C.MDGes.pdf)
10. Mohebati LM, Hilpert P, Bath S, Rayman MP, Raats MM, Martinez H, et al. Perceived insufficient milk among primiparous, fully breastfeeding women: is infant crying important? *Matern Child Nutr*. 2021;17:1–12, <http://dx.doi.org/10.1111/mcn.13133>.
11. Safon C, Keene D, Guevara WJU, Kiani S, Herkert D, Muñoz EE, et al. Determinants of perceived insufficient milk among new mothers in León, Nicaragua. *Matern Child Nutr*. 2016;13:1–10, <http://dx.doi.org/10.1111/mcn.12369>.
12. Lou Z, Zeng G, Huang L, Wang Y, Zhou L, Kavanagh KF. Maternal reported indicators and causes of insufficient milk supply. *J Hum Lact*. 2014;30:466–73, <http://dx.doi.org/10.1177/0890334414542685>.
13. Pérez-Escamilla R, Buccini GS, Segura-Pérez S, Piwoz E. Perspective: should exclusive breastfeeding still be recommended for 6 months? *Adv Nutr*. 2019;10:931–43, <http://dx.doi.org/10.1093/advances/nmz039>.
14. Kent JC. How breastfeeding works. *J Midwifery Womens Health*. 2007;52:564–70, <http://dx.doi.org/10.1016/j.jmwh.2007.04.007>.
15. Chapman DJ, Pérez-Escamilla R. Maternal perception of the onset of lactation is a valid, public health indicator of lactogenesis stage II. *J Nutr*. 2000;130:2972–80, <http://dx.doi.org/10.1093/jn/130.12.2972>.
16. Brownell E, Howard CR, Lawrence R, Dozier AM. Delayed onset lactogenesis II predicts the cessation of any or

- exclusive breastfeeding. *J Pediatr.* 2012;161:608–14, <http://dx.doi.org/10.1016/j.jpeds.2012.03.035>.
17. Huang L, Xu S, Chen X, Li Q, Lin L, Zhang Y, et al. Delayed lactogenesis is associated with suboptimal breastfeeding practices: a prospective cohort study. *J Nutr.* 2020;150:894–900, <http://dx.doi.org/10.1093/jn/nxz311>.
  18. Segura-Pérez S, Richter L, Rhodes EC, Hromi-Fiedler A, Vilar-Compte M, Adnew M, et al. Risk factors for self-reported insufficient milk during the first 6 months of life: a systematic review. *Matern Child Nutr.* 2022;18 Suppl 3:e13353, <http://dx.doi.org/10.1111/mcn.13353>.
  19. Sandhi A, Lee GT, Chipojola R, Huda MH, Kuo SY. The relationship between perceived milk supply and exclusive breastfeeding during the first six months postpartum: a cross-sectional study. *Int Breastfeed J.* 2020;15:1–11, <http://dx.doi.org/10.1186/s13006-020-00310-y>.
  20. Ortega M, Cayuela A. Regresión logística no condicionada y tamaño de muestra: una revisión bibliográfica. *Rev Esp Salud Publica.* 2002;76:85–93. Available from: [https://www.sanidad.gob.es/biblioPublic/publicaciones/recursos\\_propios/resp/revista\\_cdrom/vol76/vol76\\_2/RS762C\\_85.pdf](https://www.sanidad.gob.es/biblioPublic/publicaciones/recursos_propios/resp/revista_cdrom/vol76/vol76_2/RS762C_85.pdf)
  21. Oliver-Roig A, D'Anglade-González ML, García-García B, Silva-Tubio JR, Richart-Martínez M, Dennis C-L. The Spanish version of the breastfeeding self-efficacy scale-short form: reliability and validity assessment. *Int J Nurs Stud.* 2012;49:169–73, <http://dx.doi.org/10.1016/j.ijnurstu.2011.08.005>.
  22. OMS. Unicef. Indicadores para evaluar las prácticas de alimentación del lactante y del niño pequeño. Parte 1. Definiciones. Vol. 1. Washington, DC; 2009. Available from: <https://www.slan.org.ve/libros/Lactancia-OMS.pdf>.
  23. Hill PD, Aldag JC, Chatterton RT, Zinaman M. Comparison of milk output between mothers of preterm and term infants: the first 6 weeks after birth. *J Hum Lact.* 2005;21:22–30, <http://dx.doi.org/10.1177/0890334404272407>.
  24. Hill PD, Aldag JC. Milk volume on day 4 and income predictive of lactation adequacy at 6 weeks of mothers of nonnursing preterm infants. *J Perinat Neonatal Nurs.* 2005;19:273–82, <http://dx.doi.org/10.1097/00005237-200507000-00014>.
  25. Kent JC, Gardner H, Geddes DT. Breastmilk production in the first 4 weeks after birth of term infants. *Nutrients.* 2016;8:9–14, <http://dx.doi.org/10.3390/nu8120756>.
  26. Gianni ML, Bettinelli ME, Manfra P, Sorrentino G, Bezze E, Plevani L, et al. Breastfeeding difficulties and risk for early breastfeeding cessation. *Nutrients.* 2019;11:1–10, <http://dx.doi.org/10.3390/nu11102266>.
  27. Kent JC, Ashton E, Hardwick CM, Rea A, Murray K, Geddes DT. Causes of perception of insufficient milk supply in Western Australian mothers. *Matern Child Nutr.* 2021;17:1–11, <http://dx.doi.org/10.1111/mcn.13080>.
  28. Silbert-Flagg D, Busch J, Bataille J. Mothers' perceptions of the influence of a breastfeeding support group in achieving their breastfeeding goals. *Clin Lact.* 2020;11:74–83, <http://dx.doi.org/10.1891/CLINLACT-D-19-00019>.
  29. Blixt I, Mårtensson LB, Ekström AC. Process-oriented training in breastfeeding for health professionals decreases women's experiences of breastfeeding challenges. *Int Breastfeed J.* 2014;9:1–9, <http://dx.doi.org/10.1186/1746-4358-9-15>.
  30. Menekse D, Tiryaki Ö, Karakaya Suzan Ö, Cinar N. An investigation of the relationship between mother's personality traits, breastfeeding self-efficacy, and perception of insufficient milk supply. *Health Care Women Int.* 2021;42:925–41, <http://dx.doi.org/10.1080/07399332.2021.1892114>.
  31. Kronborg H, Foverskov E, Nilsson I, Maastrup R. Why do mothers use nipple shields and how does this influence duration of exclusive breastfeeding? *Matern Child Nutr.* 2017;13:1–13, <http://dx.doi.org/10.1111/mcn.12251>.
  32. Meedya S, Fahy K, Kable A. Factors that positively influence breastfeeding duration to 6 months: a literature review. *Women and Birth.* 2010;23:135–45, <http://dx.doi.org/10.1016/j.wombi.2010.02.002>.