

## Symptoms of postpartum depression and early interruption of exclusive breastfeeding in the first two months of life

Sintomas de depressão pós-parto e interrupção precoce do aleitamento materno exclusivo nos dois primeiros meses de vida

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### Abstract

*This study evaluates the association between postpartum depression and interruption of exclusive breastfeeding in the first two months of life. Cohort study of 429 infants ≤ 20 days of age to four primary health care units in Rio de Janeiro, Brazil. Interruption of exclusive breastfeeding (outcome) was defined as the introduction of water, other types of liquids, milk, or formulas or any food. Postpartum depression was assessed using the Edinburgh Post-Natal Depression Scale. Associations between variables were expressed as prevalence ratios (baseline) and risk ratios (follow-up), with their respective 95% confidence intervals, estimated by Poisson regression with robust variance. Children of mothers with postpartum depressive symptoms were at higher risk of early interruption of exclusive breastfeeding in the first and second months of follow-up (RR = 1.46; 95%CI: 0.98-2.17 and RR = 1.21; 95%CI: 1.02-1.45, respectively). Considering mothers that were exclusively breastfeeding at the first month, postpartum depression was not associated with interruption of exclusive breastfeeding in the second month (RR = 1.44; 95%CI: 0.68-3.06). The results indicate the importance of maternal mental health for the success of exclusive breastfeeding.*

*Nutritional Epidemiology; Breast Feeding; Postpartum Depression*

### Introduction

According to the World Health Organization, malnutrition is associated with 60% of the 10.9 million annual deaths in children under 5 years. In the first year of life, two-thirds of these deaths are associated with inadequate feeding practices, mainly those resulting from early weaning <sup>1</sup>. Breastfeeding helps reduce the incidence of asthma and allergies and promotes growth and emotional and cognitive development <sup>2</sup>. Additionally, recent studies suggest that upon reaching adulthood, breastfed children tend to present lower blood pressure and cholesterol and lower prevalence rates for overweight/obesity and type-2 diabetes <sup>3,4,5,6</sup>.

In Brazil, despite improvement, studies have shown that only 35% of infants enjoy exclusive breastfeeding during the first four months of life (therefore less time than the recommended target of six months of exclusive breastfeeding) <sup>1,7,8</sup>. The literature on determinants of feeding practices in the first year of life (including breastfeeding and its duration) has emphasized the psychosocial factors involved in this process, particularly a possible association between postpartum depression and interruption of breastfeeding <sup>9,10</sup>.

Several recent articles show an association between maternal depression and breastfeeding duration <sup>11,12,13</sup>, but the findings are conflicting. For example, according to Henderson et al. <sup>14</sup>, postpartum depression has a negative impact on

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duration of breastfeeding. According to Gröer<sup>15</sup>, mothers that breastfeed experience less depression and rage and more positive life events than formula-feeders. Other studies show that depressive symptoms are not predictors of intention to breastfeed<sup>16,17</sup>. Misri et al.<sup>18</sup> conclude that the onset of postpartum depression precedes interruption of breastfeeding, but the severity of depression does not appear to influence duration of breastfeeding.

In Brazil, studies have shown postpartum depression prevalence rates ranging from 12% to 37%, depending on the measurement instrument and cutoff point used in the postpartum evaluation<sup>19,20,21,22,23</sup>. There are few studies on the theme in Brazil, with conflicting results. According to Falceto et al.<sup>24</sup>, mothers presenting psychiatric problems in the first month postpartum have twice the odds of interrupting breastfeeding early. More recently, Vitolo et al.<sup>23</sup> corroborated the relationship between maternal depression and interruption of exclusive breastfeeding. Meanwhile, a study in the city of São Paulo showed that breastfeeding patterns were not associated with postpartum depression<sup>20</sup>.

To help elucidate this relationship, the current study investigated the role of postpartum depression in the risk of early interruption of exclusive breastfeeding during the first months of life.

## Material and methods

### Study context

The information analyzed in this study is from a broader investigation whose main focus is the role of family violence, maternal care for children, and social support in the determination of infant growth. This is a prospective study monitoring the growth of 550 newborns selected during the first year of life at primary health clinics under the Rio de Janeiro Municipal Health Secretariat.

### Study design and population

This was a prospective cohort of 429 children  $\leq 20$  days of age brought to four primary health clinics for the heel stick test or BCG vaccination from June 2005 to December 2006 and that participated in the two complementary data collection stages, the first during the baseline visit and the second 20 to 40 days later (first month of life). The children were evaluated again during a third phase, 20 to 40 days after the second visit (second month of life).

The primary care clinics participating in the study were selected intentionally, as a function of the number of consultations in the Mother-Infant

Health Promotion Program of the Rio de Janeiro Municipal Health Secretariat and the availability of a physical area for conducting the interviews.

Selection of participants occurred when the child was received at the clinic. The selected children represent a subset of the total number of children received, as a function of the availability of interviewers and work shifts, covering Monday through Friday mornings.

The study has a power of 80% for detecting as significant differences (alpha error of 5%) a prevalence ratio or risk ratio of 2.0, considering a prevalence of 15% for early interruption of breastfeeding among the unexposed.

### Measurement and data collection

The information was obtained using a face-to-face interview with the child's mother. The study's principal investigator (M. H. H.) coordinated the field team's training. Throughout the data collection phase there was continuous supervision of interviewers, in addition to systematic retraining. In the three study phases, the evaluation included questions on the current breastfeeding situation (*"From yesterday morning until this morning, did you breastfeed your baby?"*), in addition to questions on the use of other types of milk, water, teas, juice, and other foods. The study outcome was early interruption of exclusive breastfeeding defined as the non-utilization of exclusive breastfeeding, i.e., when the child received any type of liquid or solid food, regardless of whether he or she was still receiving the mother's breast milk<sup>25</sup>.

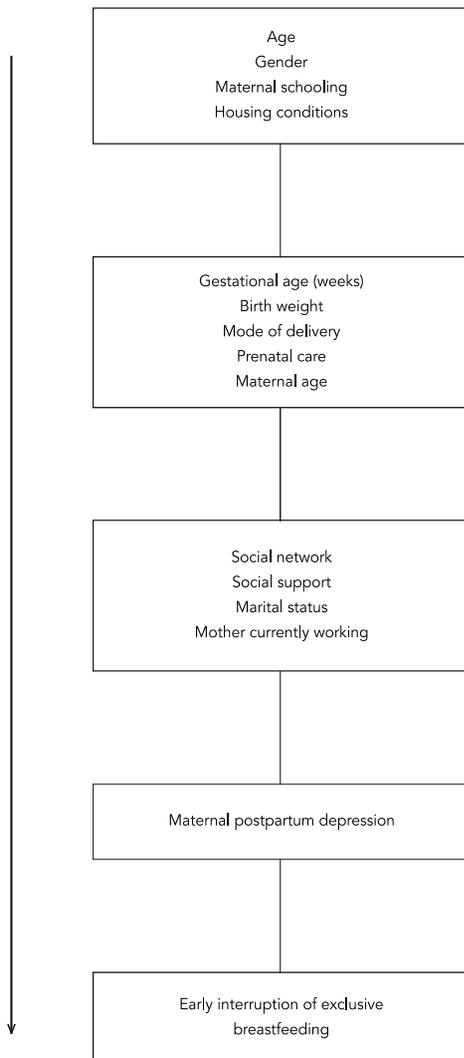
The study's main exposure variable, the suspicion of postpartum depression, was measured using the Portuguese-language version of the *Edinburgh Post-Natal Depression Scale*, applied face to face with cards, using  $\geq 12$  as the cutoff point<sup>26</sup>.

The other study variables were structured according to a hierarchical approach, using as the reference a theoretical-operational model on the determinants of early interruption of exclusive breastfeeding (Figure 1).

This model includes the following co-variables: demographic (child's gender and age in days); socioeconomic (maternal schooling,  $\leq 4$  years and  $> 4$  years); and an indicator of housing conditions, derived from a score based on the following household variables: crowding; construction material, flooring, electricity, type of internal plumbing, source of water, and garbage collection, classified as unsatisfactory (score  $\leq 8$ ) or satisfactory (score  $> 8$ )<sup>27</sup>; maternal variables (age  $< 18$  and  $\geq 18$  years), health care during pregnancy (number of prenatal visits), childbirth conditions

Figure 1

Theoretical-operational model for determination of early interruption of exclusive breastfeeding in the first months of life.



(mode of delivery: natural versus cesarean or forceps), and child's condition at birth (birth weight: < 2,500g or  $\geq$  2,500g; and prematurity: yes or no). The interview also recorded the mother's work, marital status, social network, and social support. Maternal work was evaluated with the question "Are you [the child's mother] *currently working outside the home?*" (yes or no). Marital status was recorded with a question having 6 different alternatives and categorized as living versus not living with husband/partner. Social network was

recorded with the question "How many relatives do you feel comfortable with and can talk about almost everything?", arranged in order in the analysis: 0, 1, 2, and 3 or more relatives. Social support was measured by a social support scale prepared for the Medical Outcomes Study<sup>28</sup> and adapted to Portuguese<sup>29,30</sup>. To calculate the social support scale's standardized scores, points were ascribed to each possible answer, varying from one (never) to five (always) for the 19 questions comprising the questionnaire. The scores were calculated as the sum of the total points for the answers in each of the five dimensions covered by the scale and divided by the maximum number of possible points that could be obtained in the same dimension, in order to standardize the results for all the dimensions, since these consisted of different numbers of questions. The result for the ratio (total points obtained/maximum possible points for the dimension) was multiplied by 100. The variable included in the analyses was obtained by the sum of the standardized scores for the five dimensions, divided by five, having been dichotomized as < 75 (unsatisfactory) and  $\geq$  75 standardized points (satisfactory).

The study was approved by the Institutional Review Board of the Institute of Social Medicine, Rio de Janeiro State University (UERJ).

#### Data processing and analysis

Data were stored in Epi Info 6.4 (Centers for Disease Control and Prevention, Atlanta, USA), and 20% of the keying-in was reviewed.

The analytical strategy began with calculation of baseline prevalence and cumulative incidences (at one and two months of age) for early interruption of exclusive breastfeeding, according to exposure variable categories. Risk of early interruption of exclusive breastfeeding was also calculated according to exposure variable categories, conditioned according to whether the infant was in exclusive breastfeeding in the first month of life. Thus, the study evaluates the early interruption of exclusive breastfeeding from four perspectives: (1) baseline prevalence; (2) cumulative incidence until the first month of life; (3) cumulative incidence until the second month of life; and (4) cumulative incidence at two months among infants still on exclusive breastfeeding at one month.

Simple associations between outcomes and each exposure variable were expressed as prevalence ratios (baseline) and relative risks (at one and two months of age) and their respective 95% confidence intervals (95%CI). Multivariate analyses were based on a Poisson regression model with robust variance in order to express indepen-

dent associations as prevalence ratios (baseline) and relative risks (at one and two months of age) and their respective 95%CI<sup>31</sup>.

The modeling process followed the logic of the determination model's hierarchical structure, and each variable's effect on the outcome was controlled for the variables at the same (or higher) levels. At each hierarchical level, variables were incorporated in a multivariate model, and the only variables submitted as potential confounders to the multivariate models at the subsequent levels were those whose association with the outcome remained within a significance level of up to 20% ( $p \leq 0.20$ ), after backwards stepwise procedures, always controlling for variables from the higher levels. Associations between the outcome and the study variables were defined as statistically significant at  $p < 0.05$ . Data analysis used Stata/SE 9.1 (Stata Corp., College Station, USA).

## Results

Mean age of the 429 children participating in the first interview (baseline) was 9.1 days (SD = 3.9). Mean age was 34.2 days (SD = 4.7) at the second interview (first month) and 62.8 days (SD = 2.8) at the second month.

Baseline prevalence of early interruption of exclusive breastfeeding was 20.8%. Among the 295 children in exclusive breastfeeding at baseline and that returned for the second interview after 20 to 40 days, risk of early interruption of exclusive breastfeeding was 33.2%. Accumulated incidence of early interruption of exclusive breastfeeding was 57.9% at the second month of life. Meanwhile, among the 138 children that remained on exclusive breastfeeding until the first month of life and that returned for the following visit, risk of early interruption of exclusive breastfeeding was 26.1%.

Table 1 shows the variables associated with baseline prevalence of early interruption of exclusive breastfeeding, which was more prevalent among older infants and some 60% higher among those with unsatisfactory living conditions. Early weaning was more common among premature infants. Social network, measured by the number of relatives with whom the mother felt comfortable talking about almost any subject, was inversely related to weaning prevalence, while postpartum depression was associated with an increase of some 80%.

Table 2 shows the variables associated with early interruption of exclusive breastfeeding in the first month of life. Marital status (living without husband/partner) and postpartum depres-

sion were associated with an increase of some 40% in the risk of early interruption of exclusive breastfeeding during this period, but the 95%CI for the relative risks also indicate that these results were consistent with a lack of association.

Table 3 shows that age and postpartum depression were the only variables associated with cumulative incidence of early interruption of exclusive breastfeeding up to two months.

Table 4 shows that among the infants that remained on exclusive breastfeeding up to the first month of life, age and prematurity were the only factors significantly associated with early interruption of exclusive breastfeeding.

## Discussion

The results of this study show that children of mothers with symptoms of postpartum depression present an increased risk of early weaning, both in the first days of life and in the following two months, even after controlling for potential confounders. However, considering mothers that continue exclusive breastfeeding up to one month, presenting symptoms of postpartum depression at the beginning of follow-up does not constitute a risk for the early introduction of other foods in the second month. These findings are consistent with other studies<sup>12,23,32,33</sup>. According to Henderson et al.<sup>14</sup>, women with postpartum depression at any time in the 12 months of follow-up showed greater probability of suspending breastfeeding than women without depression. Additionally, according to Hatton et al.<sup>10</sup>, mothers with depressive symptoms at six weeks after childbirth are less likely to breastfeed. Specifically, postpartum depression appears to be associated with mothers' increased difficulty in initiating breastfeeding<sup>10</sup>.

Interestingly, socioeconomic factors like schooling and housing conditions do not prove relevant in determining early interruption of exclusive breastfeeding in the two months of follow-up, a tendency that appears to be corroborated by other studies<sup>34,35,36</sup>. For example, Scott et al.<sup>35</sup>, investigating changes in the determinants of initiation of breastfeeding, conclude that psychosocial factors like maternal perception of the father's attitudes (and her own) in relation to breastfeeding were stronger predictors of breastfeeding than socio-demographic and biomedical variables. More recently, Carvalhaes et al.<sup>36</sup>, studying factors associated with exclusive breastfeeding in Botucatu, São Paulo State, showed that socioeconomic and demographic variables were not associated with early interruption of exclusive breastfeeding in infants  $\leq 4$

Table 1

Baseline prevalence (P) of early interruption of exclusive breastfeeding, crude and adjusted prevalence ratios (PR), and 95% confidence intervals (95%CI) for association between early interruption of exclusive breastfeeding and selected variables. Rio de Janeiro, Brazil, 2005-2007.

Variable	n *	P (%)	PR	95%CI	p-value	PR	95%CI	p-value
<b>Level 1</b>								
Age (days) **		Continuous	1.06	1.01-1.10	0.012 ***	1.05 #	1.01-1.10 #	0.015 ***
Gender								
Female	210	21.4	1.07	0.74-1.54	0.733	1.02 #	0.70-1.49 #	0.925
Male	219	20.1	1.00			1.00		
Maternal schooling (years)								
≤ 4	45	28.9	1.46	0.88-2.41	0.139	1.36 #	0.85-2.19 #	0.199
> 4	384	19.8	1.00			1.00		
Housing conditions **								
Unsatisfactory	97	28.9	1.61	1.09-2.38	0.017	1.56 #	1.05-2.31 #	0.026
Satisfactory	318	17.9	1.00			1.00		
<b>Level 2</b>								
Number of prenatal visits		Continuous	1.02	0.93-1.11	0.683 ***	1.03 ##	0.95-1.12 ##	0.478
Maternal age (years)								
< 18	52	15.4	0.72	0.37-1.39	0.326	0.65 ##	0.336-1.28 ##	0.213
≥ 18	377	21.5	1.00			1.00		
Mode of delivery								
Normal	279	19.4	1.00			1.00		
Cesarean/Forceps	150	23.3	1.21	0.83-1.76	0.331	1.03 ##	0.67-1.60 ##	0.890
Birth weight (g)								
< 2,500	403	21.1	0.73	0.29-1.83	0.502	0.66 ##	0.25-1.73 ##	0.398
≥ 2,500	26	15.4	1.00			1.00		
Prematurity **								
Yes	34	35.3	1.00			1.00		
No	388	19.3	0.55	0.33-0.90	0.018	0.47 ##	0.27-0.81 ##	0.006
<b>Level 3</b>								
Social network (number relatives) **		Ordinal	0.74	0.63-0.88	0.001 ***	0.77 ###	0.64-0.91 ###	0.003 ***
Mother currently working								
Yes	10	10.0	1.00			1.00		
No	410	20.7	2.07	0.32-13.5	0.445	2.13 ###	0.34-15.9 ###	0.394
Marital status								
Living with husband/partner	346	19.7	1.00			1.00		
Not living with husband/partner	82	25.6	1.30	0.85-2.00	0.224	1.19 ###	0.77-1.83 ###	0.440
Social support								
Unsatisfactory	95	31.6	1.00			1.00		
Satisfactory	332	17.8	0.56	0.39-0.82	0.003	0.88 ###	0.56-1.36 ###	0.557
<b>Level 4</b>								
Maternal postpartum depression								
No	328	16.5	1.00			1.00		
Yes	95	35.8	2.17	1.51-3.1	< 0.001	1.81 §	1.22-2.67 §	0.003

\* Totals may vary due to missing values for some variables;

\*\* Variables selected as potential confounders for subsequent levels;

\*\*\* Wald linear trend test;

# Adjusted for age, gender, maternal schooling, and housing conditions;

## Adjusted for age, housing conditions, number of prenatal visits, maternal age, mode of delivery, birth weight, and prematurity;

### Adjusted for age, housing conditions, prematurity, social network, maternal work, marital status, and social support;

§ Adjusted for age, housing conditions, prematurity, and social network.

Table 2

Incidence (I) of early interruption of exclusive breastfeeding in the first month of life, crude and adjusted relative risks (RR), and 95% confidence intervals (95%CI) for association between early interruption of exclusive breastfeeding and selected variables. Rio de Janeiro, Brazil, 2005-2007.

Variable	n *	I (%)	RR	95%CI	p-value	RR	95%CI	p-value
<b>Level 1</b>								
Age (days)		Continuous	0.98	0.95-1.02	0.346 **	0.99 ***	0.95-1.02 ***	0.431 **
Gender								
Female	137	30.7	0.86	0.62-1.20	0.387	0.86 ***	0.62-1.20 ***	0.383
Male	158	35.4	1.00			1.00		
Schooling maternal (years)								
≤ 4	29	31.0	0.93	0.52-1.64	0.796	0.94 ***	0.52-1.69 ***	0.834
> 4	266	33.5	1.00			1.00		
Housing conditions								
Unsatisfactory	63	34.9	1.06	0.72-1.56	0.761	1.08 ***	0.73-1.59 ***	0.708
Satisfactory	225	32.9	1.00			1.00		
<b>Level 2</b>								
Number of prenatal visits #		Continuous	1.07	1.00-1.14	0.052 **	1.05 ##	0.98-1.13 ##	0.131
Maternal age (years)								
< 18	39	30.8	0.92	0.55-1.51	0.732	1.00 ##	0.61-1.65 ##	1.000
≥ 18	256	33.6	1.00			1.00		
Mode of delivery								
Normal	199	31.2	1.00			1.00		
Cesarean/Forceps	96	37.5	1.20	0.86-1.68	0.273	1.08 ##	0.75-1.56 ##	0.671
Birth weight (g)								
< 2,500	19	31.6	0.95	0.48-1.88	0.877	1.04 ##	0.48-2.24 ##	0.921
≥ 2,500	276	33.3	1.00			1.00		
Prematurity								
Yes	18	16.7	1.00			1.00		
No	272	34.6	2.07	0.73-5.91	0.172	1.91 ##	0.72-5.11 ##	0.195
<b>Level 3</b>								
Social network (number relatives)		Ordinal	1.06	0.90-1.26	0.478 **	1.07 ###	0.89-1.27 ###	0.482
Mother currently working								
Yes	34	41.2	1.00			1.00		
No	257	32.3	0.78	0.51-1.22	0.279	0.93 ###	0.57-1.53 ###	0.779
Marital status #								
Living with husband/partner	238	30.7	1.00			1.00		
Not living with husband/partner	56	42.9	1.40	0.98-2.00	0.067	1.32 ###	0.91-1.93 ###	0.149
Social support								
Unsatisfactory	53	37.7	1.00			1.00		
Satisfactory	240	32.5	0.86	0.58-1.27	0.455	0.81 ###	0.52-1.24 ###	0.328
<b>Level 4</b>								
Maternal postpartum depression								
No	238	30.7	1.00			1.00		
Yes	52	44.2	1.44	1.01-2.07	0.047	1.45 §	0.98-2.16 §	0.063

\* Totals may vary due to missing values for some variables;

\*\* Wald linear trend test;

\*\*\* Adjusted for age, gender, maternal schooling, and housing conditions;

# Variables selected as potential confounders for subsequent levels;

## Adjusted for number of prenatal visits, maternal age, mode of delivery, birth weight, and prematurity;

### Adjusted for number of prenatal visits, social network, maternal work, marital status, and social support;

§ Adjusted for number of prenatal visits and marital status.

Table 3

Incidence (I) of early interruption of exclusive breastfeeding up to two months of life, crude and adjusted relative risks (RR), and 95% confidence intervals (95%CI) for association between early interruption of exclusive breastfeeding and selected variables. Rio de Janeiro, Brazil, 2005-2007.

Variable	n *	I (%)	RR	95%CI	p-value	RR	95%CI	p-value
<b>Level 1</b>								
Age (days) **		Continuous	0.96	0.95-0.97	< 0.001 ***	0.96 #	0.95-0.97 #	< 0.001 ***
Gender								
Female	100	57.0	0.93	0.74-1.16	0.503	1.00 #	0.85-1.17 #	0.986
Male	122	61.5	1.00			1.00		
Maternal schooling (years)								
≤ 4	20	60.0	1.01	0.69-1.47	0.959	1.08 #	0.82-1.42 #	0.583
> 4	202	59.4	1.00			1.00		
Housing conditions								
Unsatisfactory	44	63.6	1.07	0.83-1.38	0.620	1.00 #	0.83-1.20 #	1.000
Satisfactory	171	59.7	1.00			1.00		
<b>Level 2</b>								
Number of prenatal visits		Continuous	1.01	0.96-1.07	0.661 ***	0.99 ##	0.95-1.03 ##	0.658
Maternal age (years)								
< 18	31	54.8	0.91	0.65-1.28	0.591	0.86 ##	0.67-1.12 ##	0.269
≥ 18	191	60.2	1.00			1.00		
Mode of delivery								
Normal	150	59.3	1.00			1.00		
Cesarean/Forceps	72	59.7	1.01	0.80-1.27	0.956	0.89 ##	0.74-1.07 ##	0.217
Birth weight (g)								
< 2,500	14	64.3	1.09	0.72-1.63	0.688	0.81 ###	0.44-1.49 ##	0.502
≥ 2,500	208	59.1	1.00			1.00		
Prematurity **								
Yes	12	66.7	1.00			1.00		
No	208	58.7	0.88	0.58-1.33	0.547	0.64 ##	0.34-1.17 ##	0.144
<b>Level 3</b>								
Social network (number relatives)		Ordinal	1.02	0.91-1.13	0.774 ***	0.97 ###	0.89-1.06 ###	0.499
Mother currently working								
Yes	27	66.7	1.00			1.00		
No	192	58.9	0.88	0.66-1.18	0.403	0.89 ###	0.70-1.15 ###	0.377
Marital status								
Living with husband/partner	175	57.1	1.00			1.00		
Not living with husband/partner	46	67.4	1.18	0.93-1.50	0.176	1.08 ###	0.89-1.31 ###	0.460
Social support								
Unsatisfactory	42	64.3	1.00			1.00		
Satisfactory	179	58.7	0.91	0.71-1.18	0.485	0.93 ###	0.76-1.13 ###	0.461
<b>Level 4</b>								
Maternal postpartum depression								
No	178	55.6	1.00			1.00		
Yes	40	75.0	1.35	1.08-1.68	0.008	1.21 §	1.02-1.45 §	0.028

\* Totals may vary due to missing values for some variables;

\*\* Variable selected as potential confounder for subsequent levels;

\*\*\* Wald linear trend test;

# Adjusted for age, gender, maternal schooling, and housing conditions;

## Adjusted for age, number of prenatal visits, maternal age, mode of delivery, birth weight, and prematurity;

### Adjusted for age, prematurity, social network, maternal work, marital status, and social support;

§ Adjusted for age and prematurity.

Table 4

Incidence (I) of early interruption of exclusive breastfeeding in second month of life among infants with exclusive breastfeeding up to first month of life, crude and adjusted relative risks (RR), and 95% confidence intervals (95%CI) for association between early interruption of exclusive breastfeeding and selected variables. Rio de Janeiro, Brazil, 2005-2007.

Variable	n *	I (%)	RR	95%CI	p-value	RR	95%CI	p-value
<b>Level 1</b>								
Age (days) **		Continuous	1.08	1.00-1.17	0.044 ***	1.08 #	1.00-1.17 #	0.049 ***
Gender								
Female	66	22.7	0.78	0.44-1.38	0.395	0.79 #	0.45-1.39 #	0.412
Male	72	29.2	1.00			1.00		
Maternal schooling (years)								
≤ 4	12	25.0	0.95	0.34-2.66	0.929	1.03 #	0.36-2.93 #	0.953
> 4	126	26.2	1.00			1.00		
Housing conditions								
Unsatisfactory	22	27.3	1.01	0.48-2.14	0.981	0.98 #	0.45-2.15 #	0.959
Satisfactory	111	27.0	1.00			1.00		
<b>Level 2</b>								
Number of prenatal visits **		Continuous	0.90	0.81-1.01	0.067 ***	0.92 ##	0.83-1.03 ##	0.137
Maternal age (years)								
< 18	21	23.8	0.90	0.39-2.05	0.800	0.89 ##	0.38-2.12 ##	0.797
≥ 18	117	26.5	1.00			1.00		
Mode of delivery **								
Normal	95	29.5	1.00			1.00		
Cesarean/Forceps	43	18.6	0.63	0.31-1.27	0.198	0.57 ##	0.27-1.23 ##	0.152
Birth weight (g)								
< 2,500	10	30.0	1.16	0.43-3.15	0.765	0.61 ##	0.19-1.91 ##	0.395
≥ 2,500	128	25.8	1.00			1.00		
Prematurity **								
Yes	11	45.5	1.00			1.00		
No	126	23.8	0.52	0.25-1.08	0.079	0.51 ##	0.27-0.97 ##	0.039
<b>Level 3</b>								
Social network (number of relatives)		Ordinal	0.91	0.70-1.18	0.472 ***	0.94 ###	0.70-1.25 ###	0.657
Mother currently working								
Yes	13	30.8	1.00			1.00		
No	123	26.0	0.85	0.35-2.02	0.706	0.95###	0.40-2.25 ###	0.911
Marital status								
Living with husband/partner	114	25.4	1.00			1.00		
Not living with husband/partner	24	29.2	1.15	0.57-2.31	0.702	1.26 ###	0.60-2.63 ###	0.545
Social support								
Unsatisfactory	23	30.4	1.00			1.00		
Satisfactory	114	25.4	0.84	0.42-1.68	0.613	0.24 ###	0.60-2.57 ###	0.560
<b>Level 4</b>								
Maternal postpartum depression								
No	118	23.7	1.00			1.00		
Yes	18	38.9	1.64	0.84-3.19	0.146	1.44 §	0.68-3.06 §	0.344

\* Totals may vary due to missing values for some variables;

\*\* Variable selected as potential confounder for subsequent levels;

\*\*\* Wald linear trend test;

# Adjusted for age, gender, maternal schooling, and housing conditions;

## Adjusted for age, number of prenatal visits, maternal age, mode of delivery, birth weight, and prematurity;

### Adjusted for age, number of prenatal visits, mode of delivery, prematurity, social network, maternal work, marital status, and social support;

§ Adjusted for adjusted for age, number of prenatal visits, mode of delivery, and prematurity.

months, but only use of a pacifier and report of difficulties in breastfeeding. The role of proximal factors appears to be more evident in the determination of exclusive breastfeeding than that of more distal variables. Unfortunately, in the current study, this more proximal dimension of the theoretical model was not investigated. However, it is possible that postpartum depression not only reflects maternal psychological and emotional profiles, but also maps aspects related to “difficulties in breastfeeding” and perhaps even “use of a pacifier”. It is not difficult to imagine that mothers who present depressive symptoms in the post-natal also experience greater difficulties in breastfeeding and thus tend to offer a pacifier to their infants. According to Dennis<sup>37</sup>, due to their emotional state, depressed mothers may be more susceptible to “giving a bottle” to their infants<sup>38</sup>.

Another possible explanation refers to the relationship between postpartum depression and variables pertaining to mothering and mother-infant interaction. Dennis & MacQueen<sup>13</sup>, reflecting on one of the possible pathways producing this relationship, highlight the importance of postpartum depression's effects on the mother's emotional state, interfering in her availability for mothering or relating to and interacting with her child. Immediate postpartum depressive symptoms can lead to early interruption of breastfeeding due to feelings of low self-esteem and self-confidence, which can generate an exaggerated perception of the mother's difficulties in breastfeeding. This suggests that mothers who suffer postpartum depression can lose their confidence in their maternal role and not perceive the benefits of breastfeeding<sup>38</sup>. According to Pippins et al.<sup>11</sup>, further research is needed to understand the most relevant and persistent symptoms before or during pregnancy that are associated with the decision to breastfeed.

Another area explored in the literature to explain this relationship refers to the depressed mother's negative perception of the child's behavior. According to Dennis & MacQueen<sup>13</sup>, postpartum depression involves decreased satisfaction in these women in breastfeeding their children. These mothers apparently perceive their infants as insecure after nursing, which leads them to view their own breast milk as insufficient and thus consider the need for supplementation.

The protective effect of social networks deserves attention. Mothers who report having relatives in whom they trust and with whom they can talk about nearly everything show lower prevalence rates for early interruption of exclusive breastfeeding at the beginning of follow-up. Meanwhile, in the infant's second month of

life (Table 4), marital status appears relevant in the determination of weaning, i.e., living with a husband/partners protects from early weaning. According to Barreira & Machado<sup>39</sup>, family members can potentially exert the greatest impact on initiating and continuing to breastfeed. Recent studies have highlighted the role of paternal participation in the success of breastfeeding<sup>24,40,41</sup>. For example, Falceto et al.<sup>24</sup> observe that a mother who feels her partner actively supporting breastfeeding (talking about its importance or facilitating her role) tends to breastfeed longer. Vari et al.<sup>41</sup> suggest that social support that incorporates pre and post-natal contacts and that are mediated by health professionals can influence the duration of exclusive breastfeeding and the woman's satisfaction with this practice.

Four comments of a methodological nature deserve highlighting. The first relates to the population group being studied. The women interviewed in this study attend public health clinics in the city of Rio de Janeiro, and a large share of them had been exposed to health promotion activities and encouragement for breastfeeding. Thus, this group of women could be expected to be more prone to exclusive breastfeeding and perhaps less exposed to the risk of postpartum depression, due to the support offered by the health professionals involved in these programs. In this sense, any attempt to extrapolate these findings to women not supported with similar conditions should be done with caution, since the putative relationship between postpartum depression and early interruption of exclusive breastfeeding may not be as evident in situations in which both postpartum depression and weaning are more frequent.

The second aspect to be considered is how breastfeeding was measured (24-hour recall), which may have led to an outcome misclassification bias. This measurement only reveals what the infant ingested in the previous 24 hours and may include both children that were really in exclusive breastfeeding as well as others who ingested breast milk only during that 24-hour recall period, but who at some moment tried or who systematically ingest other types of food beside the mother's breast milk. One cannot assess with certainty the direction and potential magnitude of this bias, but there is no strong indication that such misclassification is differential in relation to exposure, which suggests the possibility that the data presented here actually underestimated the association. In addition, this form of outcome measurement does not allow evaluating the effect of postpartum depression on the duration of breastfeeding.

A third possible limitation refers to the moment at which the study's central exposure (postpartum depression) was measured, namely in the immediate postpartum. Boyd et al.<sup>42</sup> suggest that this scale would be more appropriate for use as close as possible to the second week postpartum, and that its application closer to delivery might not be capable of detecting the phenomenon in all its intensity. Still, there is evidence that earlier measurement is predictive of depression in subsequent months<sup>43,44</sup>. In the current study, the interview on postpartum depression was held on average 9 days after delivery. As for the cutoff point used here, a validation study in Brazil showed a sensitivity of 72% and specificity of 88%<sup>26</sup>.

Losses to follow-up, which totaled 13.2% at one month and 28.86% at two months of life, are another possible limitation to this study's validity. It is conceivable that mothers with depressive symptoms experience greater difficulty in attending follow-up interviews, which could represent a kind of selective follow-up loss if they were also more prone to early interruption of breastfeeding, as appears to be supported by the literature on the theme. If this conjecture is true, the associations presented here between postpartum

depression and early interruption of exclusive breastfeeding may have been underestimated. However, no significant difference was observed between the proportion of women with depressive symptoms among losses (18.5%) and those who remained in follow-up (17.5%) ( $p = 0.836$ ). Significant differences were only observed for age ( $p = 0.015$ ), mode of delivery ( $p = 0.083$ ), and marital status ( $p = 0.079$ ), whereby the infants who remained in the follow-up were younger, more frequently born of cesarean or forceps delivery, and children of mothers who lived with a husband/partner. The impact of these heterogeneities on the study's results is difficult to assess, and one should be cautious in interpreting the findings, especially given the number of losses observed during the second period of follow-up (i.e., there is no way of ensuring that the mechanisms generating the losses are ignorable).

Finally, we emphasize the contribution of these results to the development of health promotion activities in relation to postpartum depression and encouragement for exclusive breastfeeding. The findings point to the importance of a special view towards maternal mental health in the postpartum, like other health conditions and quality of life for these women.

## Resumo

*Avaliou-se a associação entre depressão pós-parto e interrupção precoce do aleitamento materno exclusivo nos dois primeiros meses de vida. Estudo de coorte com 429 crianças ≤ 20 dias de idade em quatro unidades de saúde no Rio de Janeiro, Brasil. Considerou-se como interrupção precoce do aleitamento materno exclusivo a introdução de chá, água, suco, leite artificial ou qualquer outro alimento. Na avaliação da depressão pós-parto utilizou-se a Edinburgh Post-natal Depression Scale. Associações foram expressas como razões de prevalências (linha de base) e riscos relativos (primeiro e segundo meses de vida) e respectivos intervalos de 95% de confiança estimados via regressão de Poisson com variância robusta. Filhos de mulheres com sintomas de depressão pós-parto apresentam maior risco de interrupção precoce do aleitamento materno exclusivo nos dois meses de seguimento (RR = 1,46; IC95%: 0,98-2,17 e RR = 1,21; IC95%: 1,02-1,45, respectivamente). Entre mães que amamentam exclusivamente até o primeiro mês de vida, depressão pós-parto não se associou à interrupção precoce do aleitamento materno exclusivo (RR = 1,44; IC95%: 0,68-3,06). Esses achados apontam para a importância da saúde mental materna no sucesso do aleitamento materno exclusivo.*

*Epidemiologia Nutricional; Aleitamento Materno; Depressão Pós-Parto*

## Contributors

All the authors participated in the different stages of the research and the design and drafting of the article. M. H. Hasselmann coordinated the study, conducted the data analysis, and wrote the first draft of the article. G. L. Werneck contributed to the drafting of the article and data analysis and interpretation. C. V. C. Silva assisted in interpreting the results and drafting the article. The final version was reviewed and approved by all the authors.

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