Breastfeeding Pattern and Duration and Post-Partum Maternal Weight Retention

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Background/Aim: The aims were to investigate the association of breastfeeding (BF) duration with maternal postpartum weight retention (PPWR) at 12 months after delivery.

Methods: In this prospective cohort study, mothers were interviewed at birth, and at 3, and 12 months after delivery to gather information on socio-demographic and reproductive maternal characteristics, BF initiation, BF pattern at 3 months and BF duration, as well as to measure maternal anthropometric indicators.

Results: A negative association between BF intensity at 3-months and maternal PPWR was found at 3-months and 12-months after delivery. In adjusted multivariable linear regression, for each month of EBF increase between birth and 3-months postpartum, there was a mean decrease of 0.21 kg in maternal long-term PPWR; and for each month of any BF increase between birth and 12 months postpartum, there was a mean decrease of 0.11 kg in maternal long-term PPWR. Maternal younger ages weakened the negative long-term effect of BF on PPWR and the greater levels of maternal pre-gestational body mass index annulled the effect of any BF on PPWR.

Conclusion: This study supports the evidence that BF improves the reduction of PPWR and suggests that encouraging prolonged EBF and any BF may contribute to decrease PPWR.

Keywords: Postpartum; Maternal weight; Breastfeeding

Abstract

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Conclusion: This study supports the evidence that BF improves the reduction of PPWR and suggests that encouraging prolonged EBF and any BF may contribute to decrease PPWR.
Maternal covariates selected of perinatal questionnaire were: family monthly income at birth (continuous variable); maternal schooling (continuous); skin color as self-reported (white, black, mulatto/brown, mixed or others); smoking (yes/no) and alcohol consumption (yes/no) during the pregnancy; parity (primiparous/multiparous); maternal age (continuous); history of diseases (arterial hypertension and diabetes mellitus), and type of delivery (cesarean, vaginal) [13]. Pre-pregnancy BMI was calculated as kg/m². Maternal height was measured and registered in the first follow-up at three months postpartum [13]. Maternal GWG in kg was calculated as the difference between pre-pregnancy weight and the last register of weight in the prenatal card at delivery. Maternal employment status (yes/no) was obtained 3-month after delivery.

Children variables

The frequency of exclusive breastfeeding (EBF) and any BF were evaluated by means of a personal interview with the mother at the 3-month and 12-month follow-ups [15]. BF pattern was investigated at 3-month after delivery. Children were considered on EBF if they were given nothing but breastmilk, direct from the breast or pumped, and no other liquid of food with the exception of drops or syrups; as on BF if they were given any breast-milk, irrespective of whether or not they were receiving other foods; in predominant BF if they were given breast milk, herbal tea, fruit juice, and/or water; and in partial BF if they received breast milk, herbal tea, fruit juice, and/or water, other milk, and/or semisolids [16].

Child sex and gestational age were collected at birth. Gestational age was estimated using an algorithm proposed by the National Center for Health Statistics (NCHS) based on the last menstrual period [17]. If the birthweight, length and head circumference were inconsistent with the normal curves for the gestational age calculated, or if the date of the last menstrual period was unknown [18], then gestational age was determined using the Dubowitz method which was performed on almost all newborns [19].

Statistical analysis

Descriptive statistics were calculated for all basic variables that compared mothers included in the analyses with those lost to follow-up or with missing information on BF and/or maternal weight. The chi-square test assessed differences in characteristics between these groups. PPWR at 3-month and 12-month after delivery were the depend variables. The main independent variables were exclusive and any BF duration, calculated in months, and BF patterns at 3-month after delivery. For comparison of maternal PPWR mean at 3-months and 12-months according to BF patterns at 3-months, the one-way ANOVA for homogeneous variances and the ANOVA for linear trend were used. To assess whether BF could affect PPWR at 3 and 12 months after delivery, crude and adjusted β coefficients to PPWR were estimated using multiple linear regression models.

A test of interaction between independent variables was performed through the MFPIgen command (a STATA command that permits to develop an interaction analysis for specific dependent variable) [20]. Statistically significant interaction between PPWR at 12-month after delivery and maternal age, as well as between PPWR at 12-month after delivery and PG-BMI were found; so, subsequent analyses were run according to these variables. Multiple linear regression models were used to adjustment of the interaction terms. The regression models included a continuous-by-continuous interaction of the predictor variable with the interaction term (maternal age and PG-BMI).

The multiple linear regression models were adjusted for mother’s schooling, socio-economic level, mother’s skin color, parity, smoking during pregnancy, alcohol consumption, history of diseases (arterial hypertension and diabetes mellitus), type of delivery (cesarean and vaginal), pre-pregnancy maternal weight, GWG, PPWR at immediately postpartum, child sex, birth weight, and gestational age at birth. To the analysis of the effect of any BF duration over PPWR at 12 months after delivery, the variable PPWR at 3 months was added to the model. Statistical analyses were carried out using Stata version 12.0 (Stata Corp, College Station, Texas).

Results

Information on maternal PPWR and BF at 3-months and 12-months after delivery was available for 3517 and 3661 children, respectively. Table 1 compares maternal and child characteristics of the children included in the analyses, excluding those with incomplete data, with the original cohort. The follow-up rates were lower in less educated mothers, among those from families with low monthly income, with underweight or normal pre-pregnancy BMI, multiparous, and with black skin color.
Almost one fourth (23.8%) and 11.1% of the mothers were, respectively, overweight and obese at the beginning of the pregnancy (Table 2). Mean values of PPWR at immediately postpartum, 3-months and 12-months after delivery were 8.7 kg (SD 6.0), 1.9 kg (SD 5.6), and 2.0 kg (SD 6.2), respectively. Approximately 75% of the mothers experienced substantial weight retention (body weight at least 5 kg above pre-conception weight) after delivery, 27.9% at 3-months postpartum and 26.0% at 12-months postpartum. Prevalence of overweight and obesity were, respectively, 26.2% and 19.7% at 3 months and 22.6% and 25.9% at 12 months postpartum.

Table 2 shows the association between BF patterns at 3-months after delivery and maternal PPWR at 3 and 12 months. For mothers in exclusive and predominant BF at 3 months there was a decrease of 0.67 kg (95% CI: -1.01 to -0.33) and 0.78 kg (95% CI: -1.16 to -0.41), respectively, in postpartum weight, compared with those that had already weaned their infants. At 12-months after delivery the decrease in PPWR was 0.75 kg (95% CI: -1.15 to -0.34) and 0.70 kg (95% CI: -1.13 to -0.26), respectively, in mothers with exclusive and predominant BF.

Table 3 shows the results of the multivariable regression analyses for maternal PPWR at 12 months after delivery taking EBF duration between birth and 3 months after the delivery and any BF duration as continuous variables. There was an inverse association between EBF and any BF duration with maternal PPWR in crude and adjusted analyses. After adjustment for confounders, for each month of EBF increase, there was a mean decrease of 0.21 kg in maternal PPWR at 12 months after delivery. For each month of any BF increase, there was a mean decrease of 0.11 kg in maternal PPWR. Maternal younger ages weakened the long-term (12 months postpartum) effect of any BF duration on PPWR (Figure 1) and the greater levels of maternal PG-BMI annulled the long-term effect of any BF duration on PPWR (Figure 2).
on long-term PPWR reduction decrease in obese mother’s subgroup. The energy cost of breastfeeding is generally considered to represent a substantial drain in maternal nutritional metabolism [21]. Some human observational studies suggested that BF affects insulin and glucose homeostasis and showed differences in metabolic parameters between BF and non-BF women at 3 and 6 months postpartum, independently of BMI [21]. Pregnancy and the post-partum period are a time of increased vulnerability for retention of excess body fat in women [12]. After the first month postpartum the average monthly rate of weight loss is 0.5 to 1 kg [22]. Findings of the current study highlight the importance of predominant and exclusive BF in the loss of PPWR. Studies in which postpartum weight change was estimated (rather than measured directly), found no association with BF [23,24] but studies, in which postpartum weight change was measured showed greater loss of weight in women who breastfed longer, particularly at 3 to 6 months postpartum [25-27].

Maternal age associated with PPWR was not explored widely but it is known that adolescent mothers are at higher risk for becoming overweight or obese and for PPWR [28]. Others have shown that growing-adolescent pregnant women continue to accrue fat, have larger gestational weight gains and retain more of their GWG into the pregnancy to enhance fetal growth; instead they continue to gain fat throughout gestation, apparently reserving it for their own continued development [29]. The mature pregnant women who accrue maternal fat during the first and second trimesters of pregnancy mobilize it during the third. Young still-growing women do not mobilize fat reserves late in pregnancy to enhance fetal growth; instead they continue to gain fat

**Discussion**

This study found two clear associations: First, EBF and any BF are inversely associated with long-term PPWR; second, mothers who give exclusive and predominant BF at 3 months after delivery present less maternal PPWR at 3 and 12 months after delivery compared with mothers who practice partial BF and weaned. Additionally, the observed interaction between maternal age and BF duration highlights the negative effect of adolescence pregnancy on long-term PPWR reduction in young mother’s subgroup; and the interaction between PG-BMI and BF duration emphasizes a negative effect of higher BMI

<table>
<thead>
<tr>
<th>I: maternal age (years)</th>
<th>-</th>
<th>-</th>
<th>-</th>
<th>3345</th>
<th>-0.36 (-0.48; -0.23)</th>
<th>&lt;0.001</th>
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<tr>
<td>&lt;20</td>
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<td>-0.22 (-0.32; -0.11)</td>
<td>&lt;0.001</td>
<td>629</td>
<td>-0.22 (-0.30; -0.15)</td>
<td>&lt;0.001</td>
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<tr>
<td>20-35</td>
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<td>-0.16 (-0.21; -0.11)</td>
<td>&lt;0.001</td>
<td>2379</td>
<td>-0.09 (-0.13; -0.05)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>&gt;35</td>
<td>365</td>
<td>-0.12 (-0.24; -0.0003)</td>
<td>0.05</td>
<td>337</td>
<td>-0.02 (-0.12; 0.07)</td>
<td>0.61</td>
</tr>
<tr>
<td>I: maternal PG-BMI (kg/m2)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3345</td>
<td>-0.37 (-0.53; -0.21)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Underweight</td>
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<td>-0.10 (-0.26; 0.05)</td>
<td>0.18</td>
<td>134</td>
<td>-0.09 (-0.22; 0.04)</td>
<td>0.19</td>
</tr>
<tr>
<td>Normal weight</td>
<td>2123</td>
<td>-0.15 (-0.19; -0.09)</td>
<td>&lt;0.001</td>
<td>1492</td>
<td>-0.12 (-0.16; -0.08)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Overweight</td>
<td>836</td>
<td>-0.25 (-0.35; -0.15)</td>
<td>&lt;0.001</td>
<td>801</td>
<td>-0.15 (-0.22; -0.08)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Obese</td>
<td>390</td>
<td>-0.14 (-0.32; 0.04)</td>
<td>0.14</td>
<td>375</td>
<td>0.08 (-0.06; 0.23)</td>
<td>0.28</td>
</tr>
</tbody>
</table>

**Table 3:** Association between exclusive and any breastfeeding (BF) durations and maternal postpartum weight retention (PPWR) at 12 months after delivery. 2004 Cohort Pelotas, Brazil.

**Figure 1:** Adjusted linear predictor of PPWR (kg) at 12 months after delivery and any breastfeeding duration according to maternal age interaction term. 2004 Cohort, 2005-06 Follow-up (Pelotas, Southern Brazil).
duration of BF in overweight mothers may further amplify the risk of no recovery to their pre-pregnancy weight and increase the prevalence rate of obese mothers through excessive PPWR.

![Sliced plot of breastfeeding by maternal pre-gestational BMI (kg/m²)](image)

**Figure 2.** Adjusted linear predictor of PPWR (kg) at 12 months after delivery and any breastfeeding duration according to maternal pre-gestational body mass index interaction term. 2004 Cohort, 2005-06 Follow-up (Pelotas, Southern Brazil).

The higher percentage of children followed-up at ages 3 (95.7%) and 12 months (94.3%), the nature of data collection and the population-based recruitment are the strengths of this birth cohort [13]. Most of the mothers (98%) from the Pelotas 2004 cohort attended antenatal care, most of them (72.3%) starting at the first trimester of pregnancy [31]. In this manner, only a low proportion of the mothers self-reported their weight at the beginning of pregnancy. However, one limitation in the study was the accuracy of the self-reported prepregnancy weight; a degree of measurement error can be expected, self-reported measures in adult weight generally is overestimated in underweight groups and underestimated in overweight and obese groups [32]. Even though, the high correlation between weight measurement and self-reported weight would allow for adequate BMI category classification [33].

**Conclusion**

In summary, after allowing for confounders, this study found that BF intensity at 3 months postpartum was associated with reduced long-term PPWR at the first year after delivery. Two critical mothers groups were identified: younger mothers and obese mothers at the beginning of the pregnancy. Those groups got less or no benefit from BF to the prevention of long-term high PPWR.

In setting like ours where more than one third of the women were overweight or obese at the beginning of the pregnancy and that experienced an increase in that prevalence to 45.9% at 12 months after the delivery, BF promotion may be a potential intervention aimed at preventing the accumulation of postpartum body fat. Focusing in adolescent and overweight/obese pregnant women may have far reaching impact and be critically important in reducing the excessive PPWR.

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