Does maternal obesity impede lactation?
Evidence and implications

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The public health question:
Does the obesity epidemic matter for achieving our national goals for breastfeeding?
It does if obesity affects the success of breastfeeding—and there is evidence that this is actually the case!


Fat cow syndrome

- Etiology: excessive intake of an unbalanced diet
- Clinical presentation: Impaired milk production in the early postpartum period
- Pathogenesis: extensive fatty metamorphosis of the liver
- Treatment: is often ineffective, with death as the outcome; therefore, prevention is preferred

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**Effect of high-fat feeding beginning before pregnancy on plasma insulin concentrations in rats at d 18 of pregnancy and d 3 of lactation**

### Graph

Plasma insulin concentration (μg/L) *P* < 0.05


**Effect of high-fat feeding beginning before pregnancy on plasma prolactin concentrations in rats at d 18 of pregnancy and d 3 of lactation**

### Graph

Plasma prolactin concentration (μg/L) *P* < 0.008


**Diet-induced obesity in mice is associated with abnormal side-branching and alveolar development during pregnancy**

**Whole-mount analysis of mammary glands on d 14 of pregnancy in lean (A) and obese (B) mice. Scale bar represents 1 mm.**


**Diet-induced obesity in mice is associated with lipid accumulation within alveolar cells at parturition instead of within the lumen of the ductules**

**Postpartum accumulation of triglycerides in alveolar epithelium on d 18 of pregnancy (A) and an obese mouse on d 1 of lactation (C) showing single lipid droplets (arrow) within numerous cells of the alveoli. In contrast, in the control mouse on d 1 of lactation (B), lipid secretion has occurred (lipid droplets are now in the alveolar lumen) (arrow). Scale bar represents 0.1 mm.**


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**Prepregnant BMI and duration of BF among white women**


- **Subjects:** 19-40 y old women who delivered singleton, term infants from 1/92-3/94 (n = 810) and attempted to breastfeeding their newborns
- **Outcomes:** still BF at hospital discharge (usually 2 d postpartum), duration of exclusive and any BF

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**High BMI before conception**

**High BMI at delivery**

**Events at delivery**

**Ever attempts to breastfeed**

**Early lactation failure**

**Biological, medical, mechanical, psychosocial and sociodemographic factors**

**Very early cessation of breastfeeding**
Prepregnant BMI and the duration of BF among Danish women

- **Subjects:** ≥ 18 y old women who delivered healthy, singleton term infants and attempted to breastfeed their newborns (n = 37,459); enrollment in 1997-2002
- **Outcome:** duration of any BF

**Association between prepregnant BMI and continuation of any breastfeeding**

Described data are from a manuscript by J.L. Baker et al., which is in review for publication.
Association between prepregnant BMI category and risk of cessation of breastfeeding

Described data are from a manuscript by J.L. Baker et al., which is in review for publication.

Prepregnant BMI and the initiation and the duration of BF

- Association is
  - Biologically plausible based on data from experimental and production species
  - Reproducible among white and Hispanic, but not Black, women in the US and white women in Denmark
  - Largely independent of social support for BF, which is high among Hispanic and, particularly, Danish women, and
  - It exhibits a dose-response

Prepregnant BMI, gestational weight gain and the duration of BF among White women


- Subjects: 19-40 y old women who delivered healthy, singleton term infants over a 9-y period (n = 2783) and attempted to breastfeed their newborns
- Outcomes: infant feeding method at the time of hospital discharge; duration of exclusive and any BF

Prepregnant BMI, gestational weight gain and the duration of BF among Danish women

- Subjects: ≥ 18 y old women who delivered healthy, singleton term infants and attempted to breastfeed their newborns (n = 37,459); enrollment in 1997-2002
- Outcome: duration of any BF
Prepregnant body mass index, gestational weight gain and the duration of breastfeeding among Danish women

Described data are from a manuscript by J.L. Baker et al., which is in review for publication.

The association of prepregnant BMI with GWG was additive among both American and Danish women. GWG above recommended amounts was associated with increased risk of early termination of BF among American women. GWG was not associated with early termination of BF among Danish women in fully adjusted analyses.

Prepregnant BMI and the prolactin response to suckling

- Subjects: 19-40 y old women with singleton infants and no contraindications for BF (n = 40)
- Outcome: prolactin response to suckling at d 2 and d 7 postpartum
  - Measured as the difference between the pre-suckling value and that 30 min later

Association of prepregnant BMI category with prolactin surge at d 7 postpartum

Ever attempts to breastfeed

Events at delivery

High BMI before conception

High BMI at delivery

Biological, medical, mechanical, psychosocial and sociodemographic factors

High gestational weight gain

Ever attempts to breastfeed

Delayed lactogenesis II

Early lactation failure

Very early cessation of breastfeeding

Prepregnant BMI and lactogenesis


- Subjects: 19-45 y old women with singleton fetus; stated intention to breastfeed (n = 117)
- Questionnaires about demographic and psychosocial characteristics
- Telephone interview (days 1-5 or until milk “came in”)
- Mother-Baby Assessment score

Association between the timing of lactogenesis II and maternal and infant characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Earlier onset (n = 87)</th>
<th>Later onset (n = 29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepregnant BMI*</td>
<td>24.5 ± 5.9</td>
<td>28.3 ± 6.3</td>
</tr>
<tr>
<td>Primiparity (%)</td>
<td>32.2</td>
<td>71.4</td>
</tr>
<tr>
<td>Infant MBA score</td>
<td>4.2 ± 0.5</td>
<td>4.0 ± 0.4</td>
</tr>
<tr>
<td>Duration of any BF (wk)</td>
<td>6.7 ± 8.7</td>
<td>5.5 ± 3.9</td>
</tr>
<tr>
<td>Planned duration of BF (mo)</td>
<td>8.8 ± 5.9</td>
<td>7.7 ± 3.4</td>
</tr>
</tbody>
</table>

*Abbreviations used: BMI, body mass index; MBA, Mother Baby Assessment score

- Mean ± SD
- Significantly different from earlier onset, 1P<0.05, 2P<0.01

Prepregnant BMI and psychosocial characteristics

- In general, psychosocial constructs that are known to predict the duration of BF did not modify the association between prepregnant BMI and the onset of lactogenesis II
- These included: behavioral beliefs about breast- or bottle-feeding, knowledge of BF, social learning, maternal self-confidence about BF, social support

Prepregnant BMI and maternal and infant conditions at delivery

- High prepregnant BMI is associated with higher-than-normal rates of
  - Gestational diabetes
  - Cesarean section
  - Large-for-gestational age babies
  - “Near-term” babies (“big baby blues”)
  - Difficulty in positioning and latching-on to breastfeed (no lap, large breasts, large areolas)
- These factors have not been studied directly
Prepregnant BMI and BF: Does it matter for children?

- **Subjects:** Mothers and their term infants from the DNBC (n = 3786)
- **Outcomes:** Infant weight gain between birth and age 1 y

### Association of duration of breastfeeding and timing of the introduction of solid foods with infant weight gain to age 1 y: DNBC, n = 3788

<table>
<thead>
<tr>
<th>Duration of any breastfeeding (wk)</th>
<th>Predicted infant weight gain from birth to age 1 y (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
<td>0</td>
</tr>
<tr>
<td>20-31.9</td>
<td>500</td>
</tr>
<tr>
<td>32-40</td>
<td>5500</td>
</tr>
<tr>
<td>&gt; 40</td>
<td>6000</td>
</tr>
<tr>
<td></td>
<td>6500</td>
</tr>
<tr>
<td></td>
<td>7000</td>
</tr>
<tr>
<td></td>
<td>7500</td>
</tr>
<tr>
<td></td>
<td>8000</td>
</tr>
</tbody>
</table>

**Complementary foods:**
- < 16 wk
- > 16 wk

**Significant interaction:**
- $P < 0.005$; *Significantly ($P < 0.0001$) different from > 16 wk


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**Reference woman (BMI 23.4 kg/m²)**

- +102 g
- +726 g

**Events at delivery**

- Impaired prolactin response to suckling; delayed lactogenesis II
- Very early cessation of breastfeeding

*High BMI before conception*

*High BMI at delivery*

**Biological, medical, mechanical, psychosocial and sociodemographic factors**

**Early lactation failure**

**Very early cessation of breastfeeding**
High gestational weight gain

Ever attempts to breastfeed

Impaired prolactin response to suckling, delayed lactogenesis II

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High BMI at delivery

Excessive infant growth

Early introduction of solid foods

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