Should overweight or obese women be encouraged to lose weight during pregnancy to improve fetal growth?

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The prevalence of childhood overweight is rising worldwide

Preschool children
Risk of overweight: BMI SDS > 1, Overweight: BMI SDS > 2

de Onis et al., AJCN 2010
Risk factors for childhood overweight

Unhealthy lifestyle:
- High energy intake
- Low physical activity

Pre- and postnatal factors:
- Exclusive formula-feeding
- Maternal smoking in pregnancy
- Gestational weight gain (GWG)
- ...
Overweight

Fetal growth / birth weight

Small for gestational age (SGA) --- Large for gestational age (LGA)

Gestational weight gain

Diet

Physical activity

Overweight
GWG: What is “optimal”?

Recommendations of the US Institute of Medicine (IOM, 2009):

<table>
<thead>
<tr>
<th>Mother</th>
<th>BMI [kg/m²]</th>
<th>GWG [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
<td>12.5 - 18.0</td>
</tr>
<tr>
<td>Normalweight</td>
<td>18.5 - 24.9</td>
<td>11.5 - 16.0</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0 - 29.9</td>
<td>7.0 - 11.5</td>
</tr>
<tr>
<td>Obese</td>
<td>≥ 30.0</td>
<td>5.0 - 9.0</td>
</tr>
</tbody>
</table>

Higher than recommended: “Excessive”
Lower than recommended: “Inadequate”
GWG and offspring’s overweight risk

<table>
<thead>
<tr>
<th>Study or subgroup</th>
<th>Odds ratio IV, random, 95% CI</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Excessive vs. adequate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beyerlein <em>et al.</em></td>
<td>1.34 (1.11, 1.61)</td>
<td></td>
</tr>
<tr>
<td>Fraser <em>et al.</em></td>
<td>1.73 (1.45, 2.05)</td>
<td></td>
</tr>
<tr>
<td>Margerison-Zilk <em>et al.</em></td>
<td>1.27 (1.10, 1.47)</td>
<td></td>
</tr>
<tr>
<td>Oken <em>et al.</em></td>
<td>1.42 (1.19, 1.69)</td>
<td></td>
</tr>
<tr>
<td>Rooney <em>et al.</em></td>
<td>1.73 (1.06, 2.80)</td>
<td></td>
</tr>
<tr>
<td>von Kries <em>et al.</em></td>
<td>1.12 (1.00, 1.26)</td>
<td></td>
</tr>
<tr>
<td>Wrottniak <em>et al.</em></td>
<td>1.48 (1.06, 2.07)</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>1.38 (1.21, 1.57)</td>
<td></td>
</tr>
<tr>
<td>Heterogeneity</td>
<td>$I^2 = 70%$</td>
<td></td>
</tr>
<tr>
<td><strong>Inadequate vs. adequate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beyerlein <em>et al.</em></td>
<td>1.05 (0.84, 1.31)</td>
<td></td>
</tr>
<tr>
<td>Fraser <em>et al.</em></td>
<td>0.80 (0.67, 0.96)</td>
<td></td>
</tr>
<tr>
<td>Margerison-Zilk <em>et al.</em></td>
<td>0.90 (0.77, 1.06)</td>
<td></td>
</tr>
<tr>
<td>Oken <em>et al.</em></td>
<td>0.91 (0.74, 1.13)</td>
<td></td>
</tr>
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<td>0.77 (0.45, 1.34)</td>
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<td>0.97 (0.84, 1.12)</td>
<td></td>
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<tr>
<td>Wrottniak <em>et al.</em></td>
<td>0.88 (0.68, 1.14)</td>
<td></td>
</tr>
<tr>
<td>Total (95% CI)</td>
<td>0.91 (0.85, 0.98)</td>
<td></td>
</tr>
<tr>
<td>Heterogeneity</td>
<td>$I^2 = 0%$</td>
<td></td>
</tr>
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CI: confidence interval; IV, inverse variance.

The lower, the better?!

*Nehring et al., Pediatr Obes 2012*
What about weight loss during pregnancy?

Certainly an extreme approach!
- But some evidence for potential beneficial effects
- Oken et al., Am J Epi 2009: Lowest risk for offspring’s overweight in overweight / obese mothers by weight loss

Could it make sense for overweight / obese mothers?
- High LGA rates
- Offspring are high risk group for overweight
- Maybe also beneficial for the mother?
Weight loss and fetal growth restriction

1. Does it work?

2. Is it safe for the mother?

3. Is it safe for the child?
Overweight

Fetal growth / birth weight

Small for gestational age (SGA) --- Large for gestational age (LGA)

Other adverse long-term outcomes

Other adverse short-term outcomes

Catch-up growth

Gestational weight gain

Diet

Physical activity

Other adverse short-term outcomes

Overweight
Setting and participants

Data:
- Birth records from obstetric units in Bavaria, Germany, 2000-2007
- n = 445,323 singleton deliveries
- n = 87,212 (19.5 %) overweight / obese mothers
- No follow-up after birth

Variables:
- Weight at first visit (median date: 8 weeks) and delivery
- Pregnancy outcomes of mother and child
- Demographic variables
Data analysis

- Odds ratios (OR) for weight loss vs. non-excessive GWG:
  - Birth weight
  - Pre-eclampsia
  - Emergency sectio
  - Preterm delivery (prior to 37+0 weeks)
- Adjusted for diabetes, smoking, offspring’s sex, parity, maternal age
- Stratified for overweight and three obesity categories (I-III):
  30-34.9, 35-39.9, ≥40 kg/m²

<table>
<thead>
<tr>
<th>Mother</th>
<th>Non-excessive GWG</th>
</tr>
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<tbody>
<tr>
<td>Overweight</td>
<td>0 - 11.5 kg</td>
</tr>
<tr>
<td>Obese</td>
<td>0 - 9.0 kg</td>
</tr>
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Observational study → Associations, no causal relations!
Prevalence of weight loss by BMI category

Figure 1. Proportions of women with different amounts of gestational weight loss (GWL) by body mass index (BMI) category: underweight (UW), normal weight (NW), overweight (OW), obese class I (OB1), obese class II (OB2) and obese class III (OB3).
Gestational weight loss seems to ‘work’...

<table>
<thead>
<tr>
<th>BMI category</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overweight</td>
<td>LGA</td>
</tr>
<tr>
<td>Obese I</td>
<td>LGA</td>
</tr>
<tr>
<td>Obese II</td>
<td>LGA</td>
</tr>
<tr>
<td>Obese III</td>
<td>LGA</td>
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</table>

Odds Ratio (95% CI)
... seems to be safe for the mother ...

- BMI category: Overweight, Pre-eclampsia
- BMI category: Obese I, Pre-eclampsia
- BMI category: Obese II, Pre-eclampsia
- BMI category: Obese III, Pre-eclampsia
- Outcome: Emerg. section

**Odds Ratio (95% CI)**

- Overweight: Odds Ratio 1.0, 95% CI 0.9 to 1.1
- Obese I: Odds Ratio 1.0, 95% CI 0.9 to 1.1
- Obese II: Odds Ratio 1.0, 95% CI 0.9 to 1.1
- Obese III: Odds Ratio 1.0, 95% CI 0.9 to 1.1
- Emerg. section: Odds Ratio 1.0, 95% CI 0.9 to 1.1
... but not for the child!
If 1000 ... women lost weight in pregnancy:

... overweight:
- 21 emergency sectios
- 26 LGA births
+ 34 preterm deliveries
+ 50 SGA births

... obese class III:
- 38 emergency sectios
- 62 LGA births
+ 5 preterm deliveries
+ 16 SGA births
Pregnancy is probably not the right time to lose weight even for overweight and (most) obese women...

... but the time before pregnancy might well be!
Outcomes differ by pre-pregnancy BMI!

Prevalence of outcomes for GWG within IOM recommendations:
Conclusion

Gestational weight loss...
... occurs almost exclusively in overweight / obese women
... may be beneficial with respect to maternal pregnancy outcomes in overweight / obese women
... is associated with adverse pregnancy outcomes related to the child in all women (except maybe obese class III)

→ Weight reduction before pregnancy might be more promising!
Many thanks to...

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