Exposure to phthalates and phenols in relation to gestational blood glucose homeostasis

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Introduction

• Late pregnancy is characterised by insulin resistance, which can lead to gestational diabetes mellitus (GDM)⁴.
• Endocrine disrupting chemicals (EDCs), such as phthalates and bisphenol A (BPA), have been associated with insulin resistance and type 2 diabetes in non-pregnant adults⁵-⁶.
• By contrast, recent studies of pregnant women have found:
  o Negative relationships between phthalates and stimulated blood glucose⁷;
  o No association between phthalates or BPA and GDM⁸.
• No studies have examined triclosan (TCS) in relation to GDM, or gestational insulin resistance (IR) or secretion in relation to EDC exposure.

Method

• 232 mothers without type 1/2 diabetes with singleton male pregnancies were recruited from a single UK centre as part of a large prospective study (Cambridge Baby Growth Study).
• Serum was collected at 10-17 weeks of gestation.
• 18 EDCs (16 metabolites of 9 phthalate diesters, 9 phenols) were measured using liquid chromatography/tandem mass spectrometry.
• GDM was diagnosed from an oral glucose tolerance test at 28 weeks of gestation using IADPSG criteria.
• Homeostasis Model Assessment (HOMA)-IR and β-cell function were calculated.
• Regressions controlled for age, BMI, deprivation index, ethnicity, smoking, and parity.

Objective

• To investigate the relationship between maternal phthalate and phenol exposure at 10-17 weeks of gestation and glucose homeostasis at 28 weeks of gestation.

Results

Maternal characteristics (mean ± SD)

<table>
<thead>
<tr>
<th></th>
<th>Mothers with GDM (n = 47, 20.3%)</th>
<th>Mothers without GDM (n = 155, 79.7%)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>33.1 ± 4.4</td>
<td>33.7 ± 3.8</td>
<td>0.30</td>
</tr>
<tr>
<td>Pre-pregnancy BMI (kg/m²)</td>
<td>25.4 ± 5.1</td>
<td>23.7 ± 3.7</td>
<td>0.051</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>28 (100%)</td>
<td>119 (96.7%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0%)</td>
<td>4 (3.3%)</td>
<td></td>
</tr>
<tr>
<td>Current smoker</td>
<td>1 (4.7%)</td>
<td>4 (2.5%)</td>
<td>0.99</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>22 (46.8%)</td>
<td>88 (47.6%)</td>
<td>0.99</td>
</tr>
<tr>
<td>1</td>
<td>19 (40.4%)</td>
<td>75 (40.5%)</td>
<td></td>
</tr>
<tr>
<td>&gt;2</td>
<td>6 (12.8%)</td>
<td>22 (11.9%)</td>
<td></td>
</tr>
<tr>
<td>Index of Multiple Deprivation (units)</td>
<td>9.43 ± 3.48</td>
<td>9.35 ± 4.27</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Associations with parameters of glucose homeostasis

• Amongst mothers without GDM, mono-(2-ethylhexyl) phthalate (MEHP)¹ and mono(carboxyisorcyl) phthalate (MCIP)² were associated with 120-min plasma glucose (adjusted β = 0.297 and 0.238, p = 0.002 and 0.013).

EDC characteristics

• 6 phthalate metabolites (MEB, MiBP, MnBP, MEHP, MECPP, MCIP) and 3 phenols (BPA, TCS, BP-3) were detectable in >60% serum samples.
• Median concentrations were 1.56, 3.78, 1.34, 1.14, 0.52, 0.18, 1.76, 0.93, and 0.34 µg/l, respectively.

Associations with incident GDM

• Only mono-isobutyl phthalate (MiBP)¹ and TCS were significantly associated with incident GDM in continuous and quartile analyses.

Conclusion

• Our results provide further evidence of a diabetogenic effect of phthalates, and suggest for the first time a possible ameliorating effect of TCS.

References