Fast Food: A Source of Exposure to Phthalates and Bisphenol A in a Nationally Representative Sample

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Introduction

Certain phthalates and bisphenol A (BPA) are industrial chemicals widely used in consumer products that can adversely impact human health. Diet is hypothesized to be a major source of exposure but little is known about the impact of specific food sources.

- **BPA**: Bisphenol A is found in polycarbonate, plastic products, and epoxy resin (food can lining)
- **DEHP & DINP**: Di (2-ethylhexyl) Phthalate & Di-iso-nonyl Phthalate are plasticizers that impart flexibility to polyvinyl chloride (PVC): tubing, plastic gloves, food containers, building material, etc.

Exposures are associated with:

- Metabolic disorders and diabetes
- Reduction in couple fecundity
- Allergic diseases, behavioral and neurodevelopment impairment in children
- Increased asthma risk in children

**Is Fast Food an Exposure Source?**

- Processed
- Packaged
- Handled

**OBJECTIVE: To test the association between fast food consumption and urinary levels of high molecular weight phthalates (DEHP & DINP) and BPA**

Methods

- National Health and Nutrition Examination Survey (NHANES), 2003-2010 data
  - NHANES Mobile Exam Center
  - 24-hour food recall
  - Urine sample
- Nationally representative of persons aged 6 to 85 years old
- **Exposures**: Fast Food (kilocalories) modeled dichotomously (Yes/No); categorically (0%, 1-49% 50%+) total dietary intake
- **Outcome**: Urinary measures of BPA, DEHP, (MEHP, MEHHP, MEOHP, MEOPP metb) & DINP (MCOP metb)
- **Sample Size**: BPA: n = 8792
- **DEHP**: n: 8876
- **DINP**: n: 6628
- **Confounders**: age, sex, household poverty-income ratio (PIR), race/ethnicity, body mass index (BMI), NHANES cycle year, urinary creatinine and survey weights

Results

- Majority of participants had **detectable levels** of chemicals:
  - Phthalates > 87% and BPA > 90%
- 35% had **consumed fast food** in the last 24 hours

**Main Analysis:**

**Percent Change in Chemical Concentration**

**by Fast Food Exposure Level, NHANES 2003-2010**

<table>
<thead>
<tr>
<th>Consumption Level</th>
<th>Adjusted BPA Percent Change (95%CI)</th>
<th>Adjusted DEHP Percent Change (95%CI)</th>
<th>Adjusted DINP Percent Change (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did Not Eat Fast Food</td>
<td>ref</td>
<td>ref</td>
<td>ref</td>
</tr>
<tr>
<td>Ate Fast Food</td>
<td>2.4 (2.6, 7.6)</td>
<td>18.0* (10.4, 27.5)</td>
<td>32.2* (20.0, 45.5)</td>
</tr>
<tr>
<td>Fast Food as % of Total Calories</td>
<td>0% Fast Food</td>
<td>ref</td>
<td>ref</td>
</tr>
<tr>
<td>1-49% Fast Food</td>
<td>0.3 (5.3, 6.1)</td>
<td>15.1* (6.8, 24.1)</td>
<td>28.0* (16.1, 41.1)</td>
</tr>
<tr>
<td>50-100% Fast Food</td>
<td>10.6 (8.2, 23.4)</td>
<td>30.6* (16.9, 45.8)</td>
<td>46.8* (24.6, 72.6)</td>
</tr>
</tbody>
</table>

**Sub-Analysis**: In adjusted regression analysis of food groups - **meat** and **grains** were associated with **elevated phthalate levels**

Conclusions

- Fast food is not a potential source of exposure for BPA
- Fast food is a significant route of exposure for high molecular weight phthalates (DEHP and DINP)
- Positive dose-response effect exists between fast food and DEHP and DINP (p<0.0001)
- Meat and grains are the drivers of this association between fast food and DEHP and DINP

**Implications**:

- Further research to investigate which components of the fast food industry (production and storage, cooking process, packaging, etc.) contribute to this association
- Greater policy awareness of phthalate substitution given evidence of the stronger DINP associations, a DEHP replacement phthalate

References


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