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 [1]
- Reduction in couple fecundity [2]
- Allergic diseases, behavioral and neurodevelopment impairment in children [3]
- Increased asthma risk in children [4]

Is **Fast Food** an Exposure Source?

✓ **Processed** ✓ **Packaged** ✓ **Handled**

Source: : http://www.foodnavigator.com/Markets/Cargill-spends-10m-on-food-processing-upgrade

Source: https://followmyfoodtrail.wordpress.com/2014/03/21/wendys-new-chicken-salads-definitely-worth-the-hype/

Source: https://sarahfitzpatrick.wordpress.com/2011/10/25/fish-class-assignment-2-bain-bowl/

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
- **Exposure:** Fast Food (kilocalories) modeled dichotomously (Yes/No); categorically (0%, 1-49% 50%+) total dietary intake
- **Outcome:** Urinary measures of BPA, DEHP (MEHP, MEHHP, MEOHP, MECPP 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.
- Regression Model Analysis in SAS Version 9.3 (SAS Institute, Inc., Cary, NC)

Results

- Majority of participants had **detectable levels** of chemicals:
  Phthalates >97% and **BPA >90%**
- **35%** had **consumed fast food** in the last 24 hours

Main Analysis:

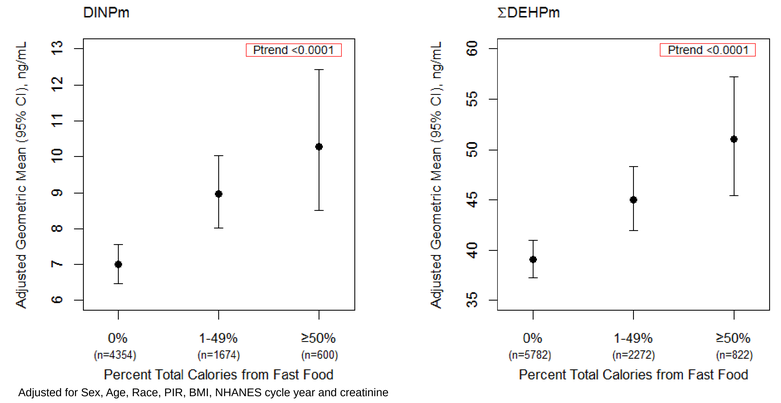
Percent Change in Chemical Concentration by Fast Food Exposure Level, NHANES 2003-2010

	Adjusted[1] BPA Percent Change (95%CI)	Adjusted[1] ∑DEHPm Percent Change (95%CI)	Adjusted[1] DINPm Percent Change (95%CI)
Crude Consumption			
Did Not Eat Fast Food	ref-	ref-	ref-
Ate Fast Food	2.4 (-2.6,7.6)	18.6** (10.4,27.5)	32.2** (20.0,45.5)
Fast Food as % of Total Calories			
0% Fast Food	ref-	ref-	ref-
1-49% Fast Food	0.3 (-5.3,6.1)	15.1* (6.8,24.1)	28.0** (16.1,41.1)
50-100% Fast Food	10.6 (-0.8,23.4)	30.6** (16.9,45.8)	46.8** (24.6,72.8)

[1]Adjusted for Sex, Age, Race, PIR, BMI, NHANES cycle year and creatinine

* p<0.01; ** p<0.0001

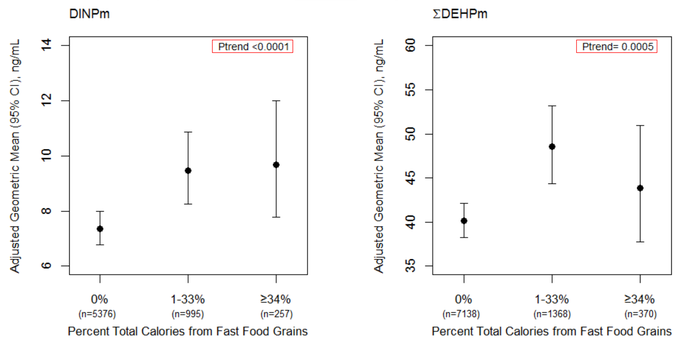
Adjusted Geometric Means Phthalate Concentration by Fast Food Exposure Level



Adjusted for Sex, Age, Race, PIR, BMI, NHANES cycle year and creatinine

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

Adjusted Geometric Mean Phthalate Concentration by Fast Food Grain Exposure Level

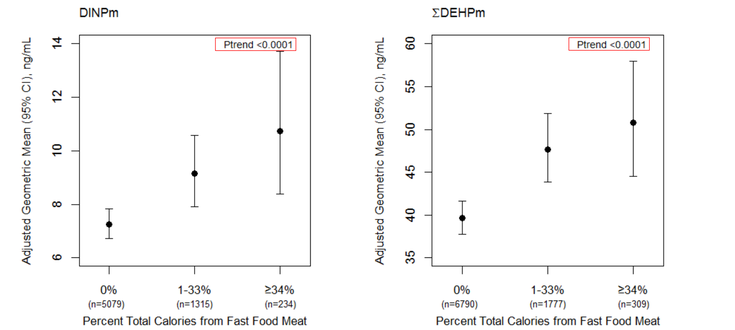


Adjusted for Sex, Age, Race, PIR, BMI, NHANES cycle year, creatinine and Non-fast food grain %

Source: http://oneduofinsama.me/2013/08/03/the-benefits-of-great-grains/

Source: http://www.myfreegrocerysamples.com/awesome_deals/target-5-00-off-20-00-meat-coupon/

Adjusted Geometric Means Phthalate Concentration by Fast Food Meat Exposure Level



Adjusted for Sex, Age, Race, PIR, BMI, NHANES cycle year, creatinine and Non-fast food meat %

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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3. Braun JM, Sathyanarayana S, Hauser R. Phthalate exposure and children's health. CO-Pediatrics. 2013; 25: 247-254.
4. Bornehag CG, Sundell J, Weschler C J, et al. The association between asthma and allergic symptoms in children and phthalates in house dust: a nested case-control study. Environ Health Perspect. 2004; 112(14): 1393–1397.

Acknowledgements:

- Department of Environmental and Occupational Health, MISPH
- National Institute of Environmental Health Sciences R00ES019881

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