

Consumer Reports Test Methodology for Bisphenols and Phthalates in Food

The objectives of this study were to: 1) determine the levels of bisphenol A, bisphenol F, bisphenol S, 10 different food relevant phthalates, and three phthalate replacement compounds in various supermarket and fast food products; 2) compare the exposure estimates from the analyses to both the available tolerable daily intake levels and identified levels of concerns in research for these chemicals; 3) use this information to inform the public about the occurrence and risks of harmful bisphenols and phthalates in food; and 4) urge regulatory agencies to act to stop or reduce contamination of food with bisphenols and phthalates and the resulting human exposure. We tested 85 products (67 supermarket staples and 18 fast foods) and a total of 239 samples, which included baked products and grains, beverages, condiments, fast foods, fruits and vegetables, infant foods, meat and poultry products, milk and other dairy products, seafood products, vegetable oils, and others. The products' packaging types included aluminum foil, paper wrap, can, foam tray, plastic wrap, glass with lined lid, paper wrap, paper bag, paperboard/cardboard, plastic bag, and pouch. We selected the products based on available data on their likelihood to contain bisphenols and phthalates and purchased two or three samples of each product from supermarket and fast food chains mostly in New York, New Jersey, and Connecticut between February 2023 and April 2023.

SAMPLE PREPARATION

Each sample was masked, blind coded, and shipped to an independent, accredited laboratory for bisphenols and phthalates analyses. Where necessary, perishable samples were transferred into brown high-density polyethylene or HDPE jars or Ziploc bags and frozen before shipment to the lab. Empty samples of the HDPE jars and Ziploc bags were also shipped to the lab for analysis as controls. At the labs, sample preparation was performed in fume hoods verified to be free from bisphenols or phthalate contamination. Water, sample containers, and other materials used for the analyses were monitored for contamination to account for any biases in sample results.

TESTING

The samples were prepared and analyzed in accordance with the following methods:

- Bisphenol A (BPA), Bisphenol F (BPF), and Bisphenol S

(BPS) by Liquid Chromatography Mass Spectrometry, LC-MS/MS: Method Reference; J. Chromatogr A. 1306 (2013): 45-58.

- Phthalates (BBzP, DBP, DiBP, DCHP, DEP, DEHP, DnHP, DMP, DiNP, and DNOP), and Phthalate Replacements (DEHA, DINCH, and DEHT) by Gas Chromatography Mass Spectrometry (GC-MS/MS).

Sample analysis was precluded by a multipoint calibration curve spanning the entire concentration range of interest. Calibration curves were performed at the beginning of each run and verified during analysis. The testing conformed to the quality control criteria and performance requirements set in the cited official methods, as well as to those in ISO 17025.

DATA ANALYSES

We reported the average of the two or three samples and defined total bisphenols as the sum of average concentrations of BPA, BPF, and BPS detected in the samples tested of a product. We defined total phthalates as the sum of average concentrations of BBP, DBP, DiBP, DCHP, DEP, DEHP, DnHP, DMP, DiNP, and DNOP detected in the samples tested of the product. To estimate the average concentration of a bisphenol, phthalate, or phthalate replacement in a product, we applied a method used by many risk assessors,¹ including the Environmental Protection Agency². If a bisphenol, phthalate, or phthalate replacement was detected or measurable in any of the samples of the product, the samples that had test results below the method reporting limit, or MRL, were assumed to have a concentration of half the MRL for that bisphenol, phthalate, or phthalate replacement. If the bisphenol, phthalate, or phthalate replacement was not detected in any of the samples tested of the product, we assumed a concentration of zero for all the samples of that product for the bisphenol, phthalate, or phthalate replacement. This approach to risk assessment appropriately considered important uncertainties about potential levels of undetected risk in samples with test results below the MRL.

RISK ASSESSMENT

We estimated a U.S. adult intake of the tested bisphenols and phthalates from a serving of each product and, where appropriate and applicable, compared the intake estimates to the exposure limits in Table 1 below.

TABLE 1. HEALTH-BASED EXPOSURE LIMITS SELECTED FOR RISK ASSESSMENT

Chemical	EPA RfD ug/kg bw/d	EFSA TDI ug/kg bw/d	ECHA RfD ug/kg bw/d	Lowest Intake Associated w/Endpoints of Concern ug/kg bw/d
BPA	50	0.2 (4)*	N/A	N/A
BBP	200	500	500	0.06 - 0.58
DBP	100	10	6.7	0.19 - 2.86
DiBP	N/A	10**	8.3	0.08 - 0.51
DEHP	20	50	34	0.03 - 242.5
DiNP	N/A	150	N/A	N/A
BBP, DBP, DEHP, DiNP (Group Phthalates)	N/A	50	N/A	N/A

*European Food Safety Agency (EFSA) old temporary Tolerable Daily Intake (TDI).

**EFSA DBP's TDI assigned to DiBP because of their similar chemical structures.

ECHA = European Chemicals Agency; EPA = U.S. Environmental Protection Agency.

¹ Xue J, Zartarian V, Wang S, et al. (2010), "Probabilistic Modeling of Dietary Arsenic Exposure and Dose and Evaluation with 2003-2004 NHANES Data." *Environmental Health Perspectives*, 118(3): 345-35.

² Environmental Protection Agency, "Regional Guidance on Handling Chemical Concentration Data Near the Detection Limit in Risk Assessments." <https://www.epa.gov/risk/regional-guidance-handling-chemical-concentration-data-near-detection-limit-risk-assessments>