Hormone-Disrupting Chemicals BPA and Phthalates in Food Packaging

A summary of the study
"Food Packaging and Bisphenol A and Bis(2-Ethyhexyl) Phthalate Exposure: Findings from a Dietary Intervention," published in *Environmental Health Perspectives* on March 30, 2011

What was the purpose of the study?

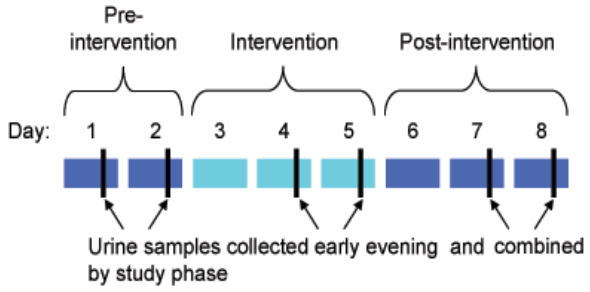
The purpose of this study was to determine how food packaging affects levels of the chemicals bisphenol A (BPA) and phthalates in the urine of adults and children. These chemicals are a potential health concern because they can affect hormone systems. BPA and the phthalate DEHP are both found widely in food packaging. BPA is used to make polycarbonate plastics and is used in the linings of food cans, and DEHP is found in some plastics used to make food containers and plastic wraps. For comparison, we also measured urine levels of some phthalates that do not come primarily from food packaging.

Who participated?

Five families from the San Francisco Bay Area participated. Each family had two parents living at home along with two children between the ages of three and 11. We selected families who had indicated that they were likely to have some regular exposure to food packaging containing BPA and phthalates, as a result of eating meals prepared outside the home, canned foods, canned sodas, or frozen dinners; drinking from polycarbonate water bottles; or microwaving in plastic.

What did we do?

We collected urine samples from the families before, during, and after a 3-day period when the families ate food that was prepared and stored with minimal canned foods or plastic food packaging. The diet intervention and sample collection took place in January 2010. The study had three phases, as described below:



n = 20 individuals from 5 families

- **Pre-intervention phase:** Family members ate their normal diets on days 1 and 2 of the study. Everyone provided urine samples on both evenings, and these samples were tested for BPA and phthalate levels. This provided us with information about chemical levels from the families' normal dietary practices.

- **Intervention phase:** We provided families with three full days' worth of freshly prepared organic meals and snacks. A caterer prepared and delivered the food, avoiding foods packaged in plastic and canned foods. The foods were stored in glass and stainless steel containers. During the three days of this intervention period, families were very diligent about eating only the foods we provided. At the end of days 4 and 5 of the study (the second and third days of the intervention), family members provided urine samples, and samples were tested for BPA and phthalate levels. This provided us with information about chemical levels from the period when the families were eating food that was not packaged in containers suspected to include BPA or DEHP.
- **Post-intervention phase:** Families returned to their normal diets for three days (days 6-8 of the study). They provided urine samples on days 7 and 8 of the study, and samples were tested for BPA and phthalate levels. This provided us with information about chemical levels very shortly after the families had returned to their regular dietary practices.

What chemicals did we test for and why?

The study tested for bisphenol A (BPA) and for seven chemicals in urine that allowed us to assess exposure to four different phthalates: DEHP, which is found in some food packaging, as well as DEP, DBP, BBP and DMP (see table below), which are not used heavily in food packaging but are found in consumer products. We expected the intervention to lower levels of BPA and DEHP, since food packaging is estimated to be a major exposure source. We did not expect to see reduced exposure to the phthalate DEP, which is used in fragrances, so including DEP helped us assess the validity of our study. The body quickly transforms the phthalates from consumer products into the chemicals (listed in the table) that we measured in urine.

Chemicals tested

Abbreviation	Full name	Chemical measured in urine
BPA	Bisphenol A	BPA
DEHP	bis(2-ethylhexyl) phthalate	• MEHP, mono-2-ethylhexyl phthalate • MEOHP, mono-(2-ethyl-5-oxyhexyl phthalate) • MEHHP, mono-(2-ethyl-5-hydroxyhexyl) phthalate
DEP	diethyl phthalate	MEP, monoethyl phthalate
DBP	di-butyl phthalate	MBUP, monobutyl phthalate
BBP	butyl benzyl phthalate	• MBUP, monobutyl phthalate • MBZP, monobenzyl phthalate
DMP	di-methyl phthalate	MMEP, monomethyl phthalate

What are BPA and DEHP?

BPA is used to make polycarbonate plastics and epoxy resins, which are used to line food cans. BPA can also be found in other types of plastics and in thermal receipt paper. DEHP is an additive to plastics that is used to increase flexibility. It is found in PVC and other plastics. BBP and DBP are used in consumer products including cleaners, paints, glues, plastics and nail polish. DEP is most commonly found in products that include fragrance.

BPA and phthalates are known as endocrine-disrupting chemicals (EDCs) because of their effects on hormone systems. BPA has been shown to mimic the hormone estrogen, and exposure has been associated with effects on the developing brain, reproductive system, and mammary and prostate glands in laboratory studies. DEHP, BBP, DBP and DMP are also EDCs, and have been demonstrated to interfere with androgen signaling and male reproductive development in laboratory and human studies.

What did the study results show?

While the families were eating the fresh food diet we provided, their BPA levels dropped on average by over 60 percent. When families returned to their normal diets, their BPA levels increased back to pre-intervention levels. For the three chemicals that measure DEHP exposures, all three dropped by over 50 percent during the intervention. Reductions were even more pronounced for the highest exposures; for example, the highest exposure level in the group of 20 participants dropped by about 75 percent for BPA and about 95 percent for DEHP. For the three phthalates not found in food packaging—DEP, DBP, BBP and DMP—we did not see a meaningful decrease in exposures during the intervention.

These findings suggest that a substantial portion of exposure to BPA and DEHP is from food packaging or meals outside the home. Therefore, people can reduce their exposure by preparing food from fresh ingredients and avoiding purchasing or storing foods in plastic and cans. This study also suggests that removing BPA and DEHP from food packaging could significantly decrease exposures for adults and children who use packaged and prepared foods.

Why did BPA and DEHP levels not go down to zero/more?

BPA and DEHP are used to make many things besides food packaging. BPA is used to make thermal paper register receipts as well as many other items, such as hard, shatterproof plastic items like CDs and glasses lenses, that don't make their way into our bodies as easily as food. DEHP is found in variety of products such as shower curtains, children's toys and medical devices. BPA and DEHP can migrate from these products into household air and dust, where they can be ingested or inhaled. Because BPA and DEHP are in our environment, they are sometimes found even in fresh foods.

What can individuals do to reduce their exposures to BPA and DEHP?

Suggestions for reducing exposure to BPA and DEHP include cooking at home with fresh foods and making some very basic changes in the kitchen, such as avoiding canned foods, choosing glass and stainless steel food and beverage containers, and not microwaving in plastic. People may also want to consider eating fewer meals out, and dining at places that use more fresh ingredients.

How could public policies reduce exposures to BPA and DEHP?

The study findings suggest that if manufacturers voluntarily reformulated packaging to remove BPA and phthalates, or if these chemicals were banned from food packaging, a large portion of the population would experience an immediate reduction in the levels of these chemicals in their bodies. Industry and government should consider the safety of any substitute chemicals before they are put into use.

Who conducted and funded the study?

The Study was conducted by Breast Cancer Fund and Silent Spring Institute, with funding from the Passport Foundation.

For more information
Contact Connie Engel (cengel@breastcancerfund.org) with general questions or Janet Ackerman (ackerman@silentspring.org) with questions about the data analysis and results.

Special thanks to the families who participated and to the caterer who prepared the food for the intervention phase.

Silent Spring Institute is a scientific research organization that studies links between the environment and women's health. www.silentspring.org

The Breast Cancer Fund translates the growing body of scientific evidence linking breast cancer and environmental exposures into public education and advocacy campaigns that protect our health and reduce breast cancer risk. www.breastcancerfund.org

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