BPA in Thanksgiving Canned Food

A product-testing report by the Breast Cancer Fund

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Healthy Legacy Coalition • Institute for Agriculture and Trade Policy • Clean Water Action, Massachusetts Alliance for a Healthy Tomorrow • Clean New York • Just Green Partnership

Summary

An unwelcome visitor may be joining your Thanksgiving feast: the toxic chemical bisphenol A, or BPA. This chemical, which is hormonally active and has been linked to breast cancer and a host of other health concerns, is in the lining of food cans. What's meant to be a protective barrier between the metal and the can's contents actually leaches this toxic chemical into the food we eat.

The Breast Cancer Fund wanted to know how much BPA may be in a typical Thanksgiving meal, so we tested canned foods used to make popular Thanksgiving dishes: turkey gravy; creamed corn; cranberry sauce; pumpkin and evaporated milk for pie; and green beans and cream of mushroom soup for green bean casserole.

We found that single servings of almost half of the products had levels of BPA comparable to levels that laboratory studies have linked to adverse health effects. When combined in a meal with other canned foods the result could be a Thanksgiving meal that delivers a very concerning amount of BPA.

We also found a tremendous variability in BPA levels in the canned foods we tested, even among cans of the same product made by the same company, which means that consumers have no way of knowing how much BPA is in the canned food they're buying and consuming.

Last, our tests detected no BPA in Ocean Spray Cranberry Sauce. The company has stated that it does use BPA in its cans, and that independent tests also indicate no leaching of BPA into the food. Further research is needed to understand why this is the case.

These findings point to a troubling fact: Consumers are being exposed to BPA through eating canned foods, and have absolutely no way of knowing what their levels of exposure might be.

The immediate solution for those preparing Thanksgiving dinner is to seek alternatives to canned foods. Luckily, there are simple and inexpensive replacements (see Alternatives on page 6), and we have collected easy can-free recipes at **www.breastcancerfund.org/thanksgiving.**

The big-picture solution is to get this toxic chemical linked to breast cancer and other serious health problems out of all food packaging, and to ensure that any replacement is proven to be safe. That's the goal of the Breast Cancer Fund's Cans Not Cancer campaign: to convince canned food manufacturers to replace BPA in their cans with a safer alternative.

Our Cans Not Cancer campaign is about our health, our children's health, and a safer future in which breast cancer rates have dropped because we've reduced our exposure to toxic chemicals.

Join us at www.breastcancerfund.org/cansnotcancer.

What We Tested and What We Found

For this report, the Breast Cancer Fund sent 28 canned food items—four cans each of seven typical Thanksgiving canned food products—to Anresco Laboratories, an independent testing laboratory in San Francisco.

WE TESTED:

- Campbell's Cream of Mushroom Soup
- Campbell's Turkey Gravy
- Carnation Evaporated Milk (Nestlé)
- Del Monte Fresh Cut Sweet Corn, Cream Style
- Green Giant Cut Green Beans (General Mills)
- Libby's Pumpkin (Nestlé)
- Ocean Spray Jellied Cranberry Sauce

The Breast Cancer Fund and our partner organizations purchased a set of each of the seven products from current stock at regionally well-known grocery outlets in four states: California, Massachusetts, New York and Minnesota. All products were well within the recommended "best if used by" dates printed on the cans.

We tested for BPA levels in the food. Contents of each sample were removed, pureed in BPA-free materials, and assessed for BPA levels using Gas Chromatography-Mass Spectrometry (GCMS). The estimated limit of detection was 1 microgram/kg (1 part per billion, or ppb). (See the appendix for detailed testing methodology.)

BPA Levels in Popular Thanksgiving Canned Foods

CANNED ITEM	CALIFORNIA	MASSACHUSETTS	MINNESOTA	NEW YORK
Campbell's Cream of Mushroom Soup	43	30	83	57
Campbell's Turkey Gravy	57	9	125	5
Carnation Evaporated Milk	2	2	3	7
Del Monte Fresh Cut Sweet Corn, Cream Style	4	79	221	Below Detection
Green Giant Cut Green Beans	5	7	18	3
Libby's Pumpkin	3	38	42	54
Ocean Spray Jellied Cranberry Sauce	Below Detection	Below Detection	Below Detection	Below Detection

Variability

The range of BPA levels detected in the tests—from non-detectable to 221 ppb—is consistent with those found in a literature review conducted by the Breast Cancer Fund of previous tests of BPA in canned foods, which documents a range from non-detectable to 385 ppb.[1] The current tests revealed that there is tremendous variability among cans of the same product made by the same company, which is also consistent with other product testing data. For instance, BPA levels in Del Monte creamed corn ranged from non-detectable to 221 ppb, and levels in Campbell's Turkey Gravy ranged from 5 to 125 ppb. Four of the seven canned foods purchased in Minnesota contained the highest BPA levels, while three of the California products contained the lowest levels.

The variability in BPA concentrations did not correspond with product expiration dates. Expiration dates ranged from May 2012 through April 2014. Within each type of food, expiration dates across locations were within one or two months of each other. In cases where cans of a single food type had different expiration dates, there was no consistent pattern of BPA concentrations. All products had different lot numbers, suggesting that they were from different canning facilities or production batches.

We can surmise that inconsistencies in the canning process across facilities and batches, as well as storage and transportation conditions, may account for variability in BPA levels. In the end, what's clear is that consumers have no way of assessing BPA levels.

Our tests detected no BPA in any of the four cans of Ocean Spray Cranberry Sauce. The company has stated that it does use BPA in its cans, and that independent tests also indicate no leaching of BPA into the food. Further research is needed to understand why this is the case.

Exposure Level

A single 120 g serving of a food with a BPA concentration at or above 11 ppb would lead to exposures comparable to those that lab studies have associated with disruptions to in utero brain development.[2,3] Twelve of the food cans we tested would lead to exposures at these levels in a woman of average weight (65.4 kg, or 144 lbs.).[4]

Additional adverse health effects, such as abnormalities in breast development, which can increase the risk of developing breast cancer; and effects on reproductive development, prostate weight, testis weight, puberty onset, body weight, metabolic immune system functions, and gender-related behaviors including aggression and some social behaviors can occur at levels of BPA consumption approaching those that might occur from consuming multiple servings of canned foods, especially those with higher levels of BPA. [2-9] These effects are most pronounced for prenatal and early-life exposures to BPA, raising concerns about pregnant women consuming a large quantity of canned foods as part of their Thanksgiving meal.

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Data from the U.S. Centers for Disease Control and Prevention indicate that most Americans have detectable levels of BPA in their urine,[10] despite rapid metabolism of the chemical, suggesting that people are consistently exposed and re-exposed to BPA through the chemical's presence in foods and from other sources. A Thanksgiving meal made from the products tested for this report could result in a relatively high intake of BPA in a single day, which would add to the lower, but consistent, exposure levels of a regular diet that includes more moderate use of canned foods. Also, many people may consume more canned food in the winter when fresh fruits and vegetables are less available.

BPA and Its Health Effects

BPA is considered an endocrine-disrupting chemical because of its effects on hormone systems. It can mimic the hormone estrogen, and studies have shown that exposure to even low doses (parts per billion and even parts per trillion) of the chemical—levels comparable to the amount an average person can be exposed to through food packaging—can increase the risk of breast and prostate cancer, infertility, early puberty in females, type-2 diabetes, obesity and attention deficit hyperactivity disorder.[2-9]

In regard to breast cancer, lab studies have shown that BPA alters mammary gland development in rats and mice.[11,12] Prenatal exposures of rats and mice to BPA have also been shown to result in precancerous and mammary tumors.[13-15] Furthermore, when scientists have exposed human cell cultures to BPA, they have seen increased breast cancer cell proliferation and damage to DNA.[16,17] Recent research found that when pregnant mice drank water laced with BPA at environmentally relevant doses, it altered the long-term hormone response of their offspring in ways that could increase the offspring's risk for developing breast cancer.[9] Even more worrying, recent evidence demonstrates that BPA exposure may reduce the efficacy of chemotherapeutic and hormonal treatments for breast cancer.[18-20]

A Principal Route of BPA Exposure: Food Packaging

BPA is a chemical used to make, among other things, the epoxy-resin linings of metal food cans. The BPA lining forms a barrier between the metal and the food, which helps create a seal so that the food is safe from bacterial contamination. But while BPA-based epoxy resins solve one food-safety problem, they unfortunately create another, as BPA can leach from the resin, make its way into food, and ultimately end up in people.[21] In fact, 93 percent of Americans have detectable levels of BPA in our bodies, according to the CDC.[10]

Why does BPA leach from the epoxy-resin can liner?
The epoxy resin is formed using two chemicals, BPA and epichlorohydrin.[22] When these two molecules bind, the resulting copolymer can be incomplete and unstable, allowing BPA to migrate from the liner into food.[23] Because BPA is lipophilic, or fat-seeking, it tends to leach more into fatty foods.[24] After aggregating the results of tests of 300 canned food products, the Breast Cancer Fund demonstrated that canned foods that are salty or fatty, such as soup, meals (e.g., ravioli in sauce) and vegetables tend to have the highest BPA content.[1]

In March 2011, the Breast Cancer Fund and Silent Spring Institute published a groundbreaking study in *Environmental Health Perspectives* that provides clear and compelling evidence that food packaging is a major source of exposure to BPA.[25]

For that study, we provided five families with fresh food—not canned or packaged in plastic—for three days. The effect was significant. While the families were eating our food, their BPA levels dropped an average of 66 percent. When families returned to their regular diets, their BPA levels returned to pre-intervention levels.

This study suggests that removing BPA from food packaging will remove a significant source of BPA exposure.

Research has also uncovered a relationship between household income and BPA exposure, showing that people with the highest BPA exposure were from the lowest income groups.[26,27] This data may be attributed to the fact that canned foods are cheaper, last longer and are more readily available in low-income neighborhoods than fresh foods.

ALTERNATIVES TO CANNED THANKSGIVING FOODS

Canned food is certainly convenient. Fortunately, there are simple and inexpensive replacements for canned food so that you don't have to expose your Thanksgiving guests to BPA:

Green Bean Casserole

While many recipes for the Thanksgiving staple green bean casserole call for canned cream of mushroom soup and canned green beans, you can make your casserole BPA-free by using fresh or frozen beans and soup in a Tetra Pak carton. Or, you can make your own mushroom sauce with fresh mushrooms and stock (which can also be found in Tetra Pak cartons). By skipping the cans, you're also probably cutting down on the sodium.

Creamed Corn

While canned creamed corn is convenient, it can also be loaded with BPA. For an easy BPA-free alternative, cook frozen corn with some cream, salt, pepper and butter. Add flour or corn starch to thicken.

Cranberry Sauce

Though the cranberry sauce we tested didn't contain BPA, other brands could. Fortunately, making cranberry sauce without the can couldn't be simpler. Just boil fresh or frozen cranberries with equal parts sugar and water and watch the berries burst. For some variety, add zest of an orange peel, cinnamon or raisins.

Gravy

Traditional gravy made with pan drippings and flour can be tricky, especially when it comes at the end of meal preparations when everyone is standing around waiting for the gravy to thicken so dinner can start. If you traditionally use canned gravy to avoid this spectacle but want to avoid the BPA, try buying gravy in a cardboard Tetra Pak carton or in a jar.

Pumpkin Pie

Pumpkin puree in a can is a staple of many Thanksgiving pantries. Fortunately, some stores carry pumpkin puree in Tetra Pak cartons. Or, try making the pie from scratch. Sugar pie pumpkins are readily available at many grocery stores, or you can substitute another type of winter squash, like butternut. Making a pie from scratch takes a little more work, but is worth the effort. And nothing beats the smell of roasting pumpkin in the oven. Instead of evaporated milk, use heavy cream (you may want to add a little less than the recipe calls for since it can be richer and thinner than evaporated milk). Another option is to evaporate the milk yourself. Store-bought evaporated milk is just milk with about 60 percent of the water removed. Simmer milk on the stove until it is reduced by just over half to make your own.

Visit **www.breastcancerfund.org/thanksgiving** for easy recipes for a can-free Thanksgiving meal.

BPA Myths and Facts

MYTH: These are just small amounts of BPA that don't really matter.

FACT: Increasingly, scientists are learning that low doses of some chemicals can disrupt hormone systems, especially when exposures occur early in life—a critical window of development.

People are not exposed to one chemical at a time, but rather to multiple chemicals throughout their lives. Studies have shown that exposures to multiple chemicals can either act additively (in other words, the combination is like a higher dose of either chemical)[28,29] or synergistically (the combination greatly increases the effects of either chemical).[30,31] In addition, endocrine disruptors like BPA can interact with the body's natural hormone levels,[32] so even a small exposure can increase total hormonal activity.

Several studies have shown that BPA exerts effects similar to those of diethylstilbestrol, or DES, which was prescribed to millions of pregnant women between 1947 and 1970.[33] It took researchers many years to discover DES's devastating effects on women's risk of various cancers, including breast cancer. And now we know that the daughters of women who took DES during pregnancy have an increased chance of developing breast cancer.[34] We don't want to wait and learn that the next generation of children exposed to regular doses of BPA also has an increased risk of cancer.

It's difficult to study these low-dose hormonal effects in human health studies for several reasons: (1) it may take years or decades for the effects to unfold; (2) since the chemicals are common, we can't compare people who are exposed with people who aren't exposed the way we would when we test a drug; (3) in everyday life, we're exposed to many different chemicals, and the effects of these multiple chemicals are difficult to tease out from the effects of a single chemical; and (4) it would be unethical to purposefully expose humans to chemicals of concern to measure the health effects of those chemicals.

MYTH: The amounts of BPA in canned foods are lower than those found in polycarbonate bottles (including some baby bottles and water bottles).

FACT: The amounts of BPA we found in canned foods tested for this report were higher than those reported for water bottles held at room temperature.[1] Levels in water bottles only approached those we found in cans when the bottles were heated.

MYTH: BPA from cans is so quickly metabolized in the body that it cannot affect health.

FACT: A number of studies have sought to understand how humans metabolize BPA. Even though blood levels may be much lower than urine levels, studies looking at urine levels have found associations with several clinical disorders in humans,[35] including miscarriages;[36] obesity; cardiovascular and metabolic disorders;[37] male reproductive dysfunction;[38] and behavioral issues in girls.[39] The human data on these disorders are entirely consistent with the data that associate BPA exposure in animals with the same kinds of negative health effects.

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BPA Myths and Facts *(cont.)*

MYTH: Alternatives to BPA are only available for the rich who can afford and have access to fresh food.

FACT: If we get BPA out of food packaging, everyone will benefit. Meanwhile, there are some steps people can take to reduce their BPA exposure at home that don't cost much more. Packaging alternatives like Tetra Pak cartons and frozen vegetables do not rely on plastics that contain BPA. Dry pasta and beans are actually cheaper than canned. But there's only so much any of us—regardless of income—can do to avoid canned food, as it is used in schools, hospitals, cafeterias and restaurants. We can't fully protect ourselves without market and policy change. Companies and legislators need to hear from us that we want BPA-free food packaging, and that all of us, regardless of income, should be protected.

MYTH: Advocacy groups are the only ones concerned about BPA.

FACT: The EU has banned BPA from baby bottles, as have Canada, China and a number of other countries. Here in the United States, 11 states have restricted the use of BPA in infant feeding products. These nations and states are acting on the evidence from more than 200 laboratory studies that raise concerns about the negative health effects of BPA.

The Endocrine Society, the world's oldest, largest and most active organization devoted to research on hormones, issued its first-ever scientific statement on BPA in 2009, saying that BPA can interfere with our hormone system even at exquisitely low doses and that this is especially true for children exposed during critical windows of development (including before birth). The statement's authors said that while they still have questions about BPA, there's clearly enough evidence to begin reducing exposures; the statement also said that the Endocrine Society should "actively engage in lobbying for regulation seeking to decrease human exposure" to BPA. More recently, the American Medical Association recognized BPA as an endocrine-disrupting agent, and urged that products containing the chemical be identified. The AMA supports industry efforts to stop producing baby bottles and sippy cups made with BPA.

MYTH: BPA is only found in conventional canned foods. Organic canned foods are free of BPA.

FACT: Many consumers think that if a product is organic, it must be safe. But the organic label only tells us about the food in the can. It doesn't tell consumers anything about the chemicals lining the can, which can get into the food and then into people. In fact, a September 2011 report by the Breast Cancer Fund documents the presence of BPA in organic canned food marketed to children. Consumers have a right to know if the foods they buy are made with organic ingredients, but they also have a right to trust that the packaging is free of harmful chemicals.

Market Solutions: Cans Not Cancer

The findings of this report outline the urgent need to remove BPA from food packaging—a major source of exposure to this toxic hormone disruptor. That's why the Breast Cancer Fund has launched the Cans Not Cancer campaign to convince canned food manufacturers to replace BPA with a safer alternative that's not linked to disease.

Since April 2011, consumers have sent more than 50,000 messages to canned food manufacturers urging them to get BPA out of canned foods and replaced with a safer alternative.

Fortunately, some companies are beginning to listen. Due in large part to increased consumer demand for BPA-free packaging, many companies are beginning to signify interest in finding alternatives. Some canned food companies are altering their packaging processes by either changing to a BPA-free can liner or changing the food packaging altogether. Eden Foods began transitioning away from BPA in 1999 and uses a substance that was used in cans long before BPA was introduced to the canned food industry. This lining, an oleoresinous c-enamel, is a mixture of an oil and a resin extracted from various plants, such as pine or balsam fir.

Some companies are transitioning from cans to Tetra Pak cartons, made of 70 percent paperboard combined with thin layers of LDPE (low density polyethylene) and aluminum foil.[42] Other companies, including Trader Joe's and General Mills' Muir Glen, have said they are moving away from BPA, but are not disclosing what alternatives they are using, so consumers have no way of knowing if the alternatives are safer than BPA. In order for consumers to have confidence that products are safe, BPA alternatives must be fully studied for health effects, and companies transitioning to alternative liners must be transparent about which replacement they are using.

These market moves are a hopeful sign that some companies are leading the way to BPA-free food packaging, but more needs to happen, and quickly. The Breast Cancer Fund's Cans Not Cancer campaign is pushing the entire canned food industry to not only eliminate BPA from their products but also require that they be transparent about their alternatives and only use those that are safe.

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Join us at www.breastcancerfund.org/cansnotcancer.

Policy Solutions

While market changes are important, we need public policy solutions that enforce voluntary corporate efforts as well as protect all consumers by ensuring the entire food and food-packaging industry is BPA-free. Moreover, it is critical that the Food and Drug Administration's process for approving food-packaging additives be strengthened to ensure that BPA replacements are safe. To that end, the Breast Cancer Fund supports federal legislation authored by Rep. Edward Markey, D-Mass., that would ban BPA from all food and beverage containers. Rep. Markey's legislation also requires the FDA to review food packaging additives that have been previously approved and to limit the use of any substance the FDA determines may pose health risks, based on new scientific information. This bill, the Ban Poisonous Additives Act, was introduced in Congress on January 25, 2011 and has the support of more than 50 public health, environmental, labor and faith-based groups. Read more at **www.breastcancerfund.org/bpaact.**

In addition, 11 states have enacted legislation to limit the amount of BPA in infant food containers. While these laws do not cover the kinds of canned foods tested in this report, they send a strong signal to the marketplace that states are taking action to protect consumers from harmful chemicals in food packaging.

Appendix — Details on the Testing Method

Food samples were composited by stainless steel blender in an unlidded Mason jar, from which 15 g were taken for analysis (samples were fortified as needed). BPA was extracted using QuEChERS method with 15 ml ACN. In a plastic (polypropylene) centrifuge tube, 15 g sample + 1.5 NaCl + 6 g MgSO4 +15 ml ACN were shaken for 2 minutes. The mixture was centrifuged for 10 minutes at 4000 RPM. 10 ml of ACN top layer were evaporated and taken through derivatization. The BSTFA/TMCS volume was modified to 1 ml and was added to the residue, at which point it was placed in an oven for 30 minutes at 80 degrees C. After cooling, the derivatization agent was evaporated under N2 and the residue was reconstituted in 4 ml of chloroform. Sample was microfuged at 10,000 RPM. 1 µl samples were injected into the Gas Chromatograph Mass Spectrometer (GCMS). The estimated level of detection was 1 µg/kg.

GCMS operating parameters: Shimadzu GC-17A equipped with MS QP4000. 150 degree C for 2 minutes then 20 degree/minute to 300 C and hold 20 minutes. Flow @ 1.0 ml/minute. Interface at 300 degrees C. Injector at 250 degrees C. SIM (m/z): 372, 357. Two spiked samples yielded the following recoveries: Sample 1 at 100 ppb gave 107% recovery and sample 2 at 25 ppb gave 126% recovery.

As a negative control, blanks of de-ionized water prepared and extracted with samples were run only once to verify that there was no contamination in the process. No BPA was detected.

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