Are Bisphenol A (BPA) Plastic Products Safe?

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Bisphenol A (BPA) is a chemical used to make plastics. It is frequently used in sports equipment, water bottles, medical devices, as a coating or lining in food and beverage cans, and in credit card receipts. It leaches out of plastic into liquids and foods, and the Centers for Disease Control and Prevention found measurable amounts of BPA in the bodies of 93% of the U.S. population studied.[1]

Infants and children are estimated to have the highest daily intake of BPA because "they eat, drink, and breathe more than adults on a pound for pound basis," according to the U.S. National Toxicology Program.[2] Until recently, most plastic baby bottles contained BPA. The chemical is especially likely to leach out of plastic when it is heated, such as when a baby bottle is warmed in the microwave, thereby allowing the BPA to be ingested and enter the bloodstream.2 On any given day, several times a day, a baby might drink liquid formula that was sold in a can lined with BPA and then warmed in a plastic baby bottle containing BPA.

If BPA is in so many different items that we use every day, it must have been proven safe, right? Unfortunately not. BPA was developed as a synthetic estrogen, and it mimics and interferes with the action of that hormone, which helps regulate development and reproduction.[3] It is called an "endocrine disruptor" because it affects the body's own hormones (its endocrine system) in ways that could be potentially harmful.

It is difficult to determine just how much BPA, or how much of any hormone-disrupting chemical, is unsafe. Toxicologists test chemicals at very high doses in animals to see if they die or if their health is harmed. After establishing the dangerous dose, much lower doses are then allowed in products used or consumed by humans. These products are labeled safe, despite the fact that the chemicals in them have rarely been tested at low doses in animals, and were never tested in humans at all. Furthermore, recent research shows a paradoxical phenomenon with BPA and other chemicals that affect the endocrine system: their impact on health is sometimes greater at low doses than at high doses.[4]

While early concerns about BPA's health effects were based primarily on animal studies and research on cells, there is increasing evidence from studies in humans that BPA can cause serious harm, such as increased risk of heart disease, diabetes, obesity, and sexual dysfunction.[5,6,7,8]

Studying the Effects of BPA in Animals

Before studies were conducted on humans, dozens of studies were conducted and are still being conducted in the lab. The American Chemical Society, the national professional association for chemists, reported that 153 government-funded BPA experiments on lab animals and tissues found harmful effects while only 14 did not.[1]

BPA experiments on rats linked the chemical to precancerous lesions in the prostate and mammary glands, and to early puberty in females at BPA dosages similar to human exposures, according to a 2008 report on BPA by the National Institutes of Health's National Toxicology Program.[2] Another study on rats showed that exposure to BPA, as well as exposure to fungicides and pesticides, appears to cause

ovarian cysts and fewer eggs in offspring—as many as three generations down the line (a rat's great "grandchildren"). [9]

Studies of mice exposed to BPA in the womb found that these mice tended to put on more body fat after birth. [10, 11] However, as adults the BPA-exposed mice were the same size and weight as mice that were not exposed to BPA in the womb. A more recent study, published in 2012, found that adult mice given low doses of BPA twice a day for eight days did not gain weight, but they did develop problems with their metabolism that would lead to type 2 diabetes. [12]

Studies have linked the hormonal effects of BPA from canned cat food to the epidemic of hyperthyroidism in cats, especially females.[13] Studies of rats and mice have linked BPA to hyperactivity and various brain and behavioral changes, including increased anxiety and impaired cognition.[14, 15, 16, 17] In 2008, the first study of nonhuman primates found that BPA levels were associated with cognitive problems that could affect learning and memory.[18]

The National Toxicology Program's 2008 report recommended that more studies be conducted on BPA's health effects on humans, and the report stated: "The possibility that bisphenol A may alter human development cannot be dismissed."[2]

Studying How BPA Affects Humans

Since 2008, studies of humans have added greatly to concerns about the health risks of BPA. A major study published in January 2010, based on a major government data set (the NHANES), found that adults with higher levels of BPA in their urine were more likely to have heart disease, even when other variables were statistically controlled.[5] The NHANES data also showed a separate link between levels of BPA in urine and high blood pressure, a major contributor to heart disease.[19] These findings were similar to a study published in the *Journal of the American Medical Association* in 2008, which found a link between BPA levels and diabetes and heart disease, even when obesity was statistically controlled.[6] A study published in *Circulation* in 2012 based on research in the UK supported these findings.[20] At least two other articles published in 2012 conclude that BPA exposure puts humans at risk for metabolic disorders and obesity. [21,7] One of the articles (a review) focused on in utero exposure to BPA, which Dr. Frederick vom Saal and his co-authors say appears to program the fetus to develop into an overweight adult.

As a weak estrogen, BPA has been shown to cause pre-cancerous growths in the mammary glands of rodents, so an important question is whether it could increase a woman's chances of developing breast cancer, since breast cancer can feed on estrogen. Laboratory studies where scientists look at cells taken from the body suggest that BPA may cause breast cells to change and become cancerous. [22] Not only does regular BPA exposure potentially increase a woman's chances of developing breast cancer, but it appears to also interfere with chemotherapy for breast cancer patients, possibly reducing its efficacy.[23,24]

There is also evidence of harm to fertility and sexual activity. A 2009 research article reported that men who were exposed to very high levels of BPA at work were four times as likely to experience erectile dysfunction and reduced sexual desire compared to men who did not work with BPA.[8] BPA-exposed workers were also seven times as likely to have problems with ejaculation. Although the men in that study had much higher levels of BPA exposure than the average man, this study demonstrates BPA's potential to harm men's sexual and reproductive health at high levels and it raises questions about lower levels of exposure. Research is needed to study the effects of more typical BPA exposures (non-occupational exposures) on men's sexual health.

BPA can also affect a woman's fertility and has been linked to miscarriages.[25] Studies have shown that women undergoing in vitro fertilization (IVF) who have higher levels of BPA have more difficulty becoming pregnant due to the lower quality of their eggs, fewer fertilized eggs, and reduced levels of estrogen. [26,27,28,29]

Reducing BPA in our Homes

After a Food and Drug Administration (FDA) analysis concluded that BPA was safe in 2008,[3] the FDA Science Board, which consists of independent scientists who do not work for the FDA, recommended in October 2008 that the FDA analyze the research literature again, relying less on two industry-funded studies of rats and taking into account the best independent studies. It also recommended that new research be conducted to examine BPA safety concerns.

Meanwhile, Canada announced in 2008 that it intended to reduce infant and newborn exposure to BPA by banning its use in baby bottles, setting stringent standards for the amount of BPA allowed to migrate from the can into infant formula, and working with industry to develop alternative food packaging.[30] In October 2010, Canada became the first government in the world to add BPA to its list of toxic substances, in preparation for regulating its use. [31]

In January 2010, the FDA announced that its National Center for Toxicological Research in cooperation with the National Toxicology Program is "carrying out in-depth studies to answer key questions and clarify uncertainties about the risks of BPA." The FDA said that it "shares the perspective of the National Toxicology Program that recent studies provide reason for some concern about the potential effects of BPA on the brain, behavior, and prostate gland of fetuses, infants and children." The FDA also recognized "substantial uncertainties" with the interpretation of BPA studies and how BPA may affect human health. Despite those uncertainties, the FDA said it supported "a more robust regulatory framework for oversight of BPA to be able to respond quickly, if necessary, to protect the public." However, the agency said at that time that it was "not recommending that families change the use of infant formula for foods, as the benefit of a stable source of good nutrition outweighs the potential risk of BPA exposure."[32]

In March 2012, the FDA finally responded to a 2008 petition from the Natural Resources Defense Council (NRDC). The petition had asked the FDA to ban BPA's use in food and beverage packaging, based on the studies at the time. After ignoring NRDC's petition for years, the FDA—under pressure of a law suit—responded that there was insufficient evidence to remove the chemical from the products in which it is currently being used, and that the Agency would continue to review studies of BPA. [33] It is important to note that the FDA's rejection of the petition was based on the studies that the NRDC had submitted with the petition in 2008, not on the more recent studies.

Legislation to Ban BPA in the U.S.

In March 2009, Suffolk County in New York became the first county in the U.S. to ban BPA in baby bottles and "sippy" cups, and in May of 2009, Chicago and Minnesota followed.[34,35,36] Also in 2009, Connecticut passed a law banning BPA in children's reusable bottles and cups as well as infant formula and baby food containers, which went into effect in October 2012.[37]

Members of the U.S. Congress have introduced BPA-related legislation since 2009 without success. As of spring 2012, there was a bill in the Senate (S. 136) introduced by Senator Dianne Feinstein (D-CA) that would ban BPA in children's products, and a bill in the House (H.R. 432), sponsored by Representative Edward Markey (D-MA), that bans BPA in food containers. [38,39]

BPA in Plastics

BPA is found in polycarbonate (PC) plastics, which are typically clear and hard, marked with the recycle symbol "7" or may contain the letters "PC" near the recycle symbol. To avoid the risks of baby bottles with BPA or other questionable chemicals, look for packages that say “BPA-free” and also consider alternatives such as glass bottles. And to avoid warming up food in plastic containers with these chemicals, use only stoneware, china, or glass dishes and containers in your microwave.

In 2008, manufacturers such as Playtex and Nalgene and retailers such as Wal-Mart pledged to remove BPA from their products and stores by the end of the year.[40] In March 2009, the six major manufacturers of baby bottles in the United States announced that they would no longer sell baby bottles made with BPA in the U.S.[41] A few days later, SUNOCO, a BPA manufacturer, announced that it would require companies using BPA in their products to confirm that none of those products would be used to hold food or water for children under 3 years of age.[42]

These voluntary efforts were a result of negative publicity and consumer concerns about BPA.

BPA in Cans

BPA is still in most canned food and beverages sold to people and pets in the U.S. and other countries. Some companies are not waiting for a ban and are voluntarily removing BPA from their food packaging. Eden Foods began using BPA-free cans in 1999 and now uses BPA-free cans for everything except highly acidic tomato products. [43] According to Eden, it costs the company $300,000 more a year to produce BPA-free cans, which are 14% more expensive than industry standard cans; this translates into about 2 cents more per can. [44] Vital Choice introduced new cans and pouches for its fish products at the end of 2008.[45] It was not until 2012 that a major manufacturer, Campbell’s, announced that it would seek to phase out the use of BPA in its canned foods. The announcement was made after the Breast Cancer Fund publicized the results of its tests on canned foods marketed to kids: the tests found that Campbell’s soups and other popular products had some of the highest levels. [46]

Individual Efforts to Reduce Exposure to BPA

While we wait for more research to be conducted, is it possible to avoid BPA? A recent study suggests that we can significantly lower our levels of BPA by strictly avoiding many packaged foods and beverages and also changing how we prepare and store food.

In 2012, Ruthann Rudel from the Silent Spring Institute and her co-authors published a study showing how BPA levels in the body are affected by consuming foods and beverages that have come into contact with BPA. Twenty participants in 5 families switched from their normal diet, including canned and packaged items, to a diet consisting of only fresh, unprocessed foods for 3 days. Their BPA levels were tested before the switch, during the 3 days of BPA-free eating and drinking, and again after they had returned to their normal diet. The researchers found that BPA levels went down significantly when people ate foods and drank beverages that had never spent time in cans, plastic bottles, or plastic food storage containers made with BPA and had never come into contact with plastic or nonstick pans during preparation or while eating.[47]

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