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Medical studies say what chemicals in food containers harm human reproduction

Medical studies have identified several chemicals, including **bisphenols, phthalates, and per- and polyfluoroalkyl substances (PFAS)**, that can leach from food containers and packaging to harm human reproduction. These substances are considered endocrine disruptors, meaning they interfere with the body's hormonal systems, leading to reproductive and developmental issues. [↗](#)

Bisphenols (BPA, BPS, BPF)

Bisphenol A (BPA) is an industrial chemical used to make hard, clear plastics (polycarbonate) and epoxy resins that line food and beverage cans. Due to consumer concerns, many "BPA-free" products emerged, but manufacturers often replaced BPA with similar bisphenols, such as BPS and BPF, that can also disrupt hormones. [↗](#)

Effects on fertility

- **In men:** BPA is linked to reduced sperm quality, including lower counts and motility.
- **In women:** It has been associated with poor in vitro fertilization (IVF) outcomes, conditions like polycystic ovary syndrome (PCOS) and endometriosis, and an increased risk of miscarriage.
- **Alternatives:** BPS and BPF have been shown to have similar hormone-disrupting effects as BPA, affecting testosterone secretion and fertility. [↗](#)

Phthalates

Phthalates are chemicals used as plasticizers to make plastic products more flexible and durable, including certain food packaging, tubing, and sealants. They can leach into food, especially fatty and heated foods, and are also known endocrine disruptors. [↗](#)

Effects on fertility

- **In men:** Studies link higher phthalate exposure to lower sperm counts, reduced motility, and decreased testosterone levels.
- **In women:** Phthalates are associated with increased rates of miscarriage, preterm birth, and endometriosis.
- **In children:** Maternal exposure to phthalates has been linked to developmental disorders in offspring. [↗](#)

Per- and polyfluoroalkyl substances (PFAS)

PFAS are a class of "forever chemicals" used for their grease- and water-resistant properties in fast-food wrappers, microwave popcorn bags, and some takeout containers. While the FDA has phased out some PFAS in food packaging, legacy contamination and older products remain a concern. [↗](#)

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and the chemicals they carry are linked to reproductive harm. [↗](#)

Effects on fertility

- **In men:** Recent studies have found microplastics in human semen and testes, with exposure linked to reduced sperm count, concentration, and motility.
- **In women:** Animal and cell studies show that microplastics can cause ovarian atrophy and fibrosis, damage eggs, and lead to reduced embryo formation.
- **Developmental harm:** Studies suggest microplastics may cross the placental barrier and can be detected in fetal meconium. [↗](#)

How to reduce your exposure

To minimize exposure to these chemicals, medical studies and health organizations recommend several steps: [↗](#)

- **Limit plastic contact with hot food:** Avoid microwaving food in plastic containers or wrapping hot food in plastic wrap, as heat increases leaching. Use glass, ceramic, or stainless steel instead.
- **Choose fresh or frozen:** Reduce your consumption of canned and highly processed foods, opting for fresh or frozen alternatives that do not come in chemical-lined containers.
- **Handle plastics gently:** Avoid washing plastics with harsh detergents or using the dishwasher, which can break down the material.
- **Look for PFAS-free packaging:** In some states, such as California and New York, certain PFAS-containing food packaging is banned. Look for "PFAS-free" labels, and choose uncoated paper products when possible.
- **Check recycling codes:** While not foolproof, plastics with recycling codes 3 (PVC) and 7 (which includes polycarbonate) are more likely to contain harmful plasticizers. [↗](#)

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How do BPA alternatives like BPS and BPF affect hormone receptors?

Based on medical and laboratory studies, bisphenol S (BPS) and bisphenol F (BPF) act as endocrine-disrupting chemicals (EDCs) by interfering with the function of hormone receptors in ways that can be comparable to or even distinct from bisphenol A (BPA). This interference can include mimicking natural hormones or blocking their effects. [↗](#)

Estrogen receptors (ERs)

Like BPA, BPS and BPF have estrogenic effects, meaning they can bind to and activate

27 sites

BPA and Your Fertility: What You Need to Know Now

Nov 10, 2017 — BPA and Your Fertility: What You Need to Know Now. ... BPA...

Dr. Lora Shahine

bisphenol S and bisphenol F are not safe alternatives to this ...

Jan 15, 2015 — Bisphenol S (BPS) and bisphenol F (BPF) are already or are...

ScienceDirect.com

Bisphenol-A and Female Fertility: An l Existing ...

Dec 5, 2022 — Humans interfere with a endocrine disruptors on a daily basis, v

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on the slower nuclear estrogen receptors.

- **Differential effects:** Studies using human breast tissue organoids showed that BPS treatment caused different architectural and proteomic changes compared to BPA, with BPS causing stronger effects in terms of increased branching. [↗](#)

Androgen receptors (ARs)

Unlike their estrogen-mimicking activity, BPS and BPF generally act as antagonists toward androgen receptors.

- **Antagonist activity:** Studies have confirmed that BPS and BPF have anti-androgenic properties, which means they can block the action of androgens like testosterone.
- **Altered expression:** Research in gerbils found that BPS exposure led to an upregulation of both androgen (AR) and estrogen (ER α) receptors in prostate tissue, potentially contributing to glandular hyperplasia.
- **Inhibiting testosterone:** BPF has been shown to block Leydig cell maturation in male rats, reducing androgen receptor levels and testosterone production. BPS has been found to inhibit testosterone production in rat cells by interfering with specific signaling pathways. [↗](#)

Other receptor effects

Beyond estrogen and androgen receptors, BPS and BPF have been shown to interfere with other hormonal pathways.

- **G-protein coupled estrogen receptor 1 (GPER1):** In rat studies, BPF was found to increase GPER1 levels in Leydig cells, suggesting that non-genomic estrogen pathways play a role in its endocrine-disrupting effects.
- **Thyroid hormone receptors (TRs):** Both BPS and BPF can disrupt thyroid hormone signaling by interfering with the thyroid hormone receptor (TR) pathway.
- **Mixed effects on other receptors:** The impact of BPS and BPF can extend to other systems, including the Aryl Hydrocarbon Receptor (AhR) and various steroidogenic enzymes, which can influence hormonal balance and reproductive function. [↗](#)

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Are there human studies about exposure to BPS or BPF?

While most research on bisphenol exposure focuses on bisphenol A (BPA), human studies confirm widespread exposure to bisphenol S (BPS) and bisphenol F (BPF) and have found associations with adverse health outcomes. These effects may be linked to

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The mixture effects of bisphenol derivatives on estrogen ...

Abstract. Bisphenol A (BPA) is a well-known for endocrine-disrupting...

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Bisphenol A Analogues Suppress Sphe Attachment on Human ...

Recently, several countries have restrict of BPA and replaced them with bispher

 National Institutes of Health (NIH) ... [↗](#)

Bisphenol A replacement chemicals, BPF and BPS, induce ...

Significance. Bisphenol A (BPA), found in many plastic products, has...

 PNAS [↗](#)

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- **Ubiquitous exposure:** A study using data from the 2013–2014 National Health and Nutrition Examination Survey (NHANES) detected BPS in nearly 90% of U.S. adults and children and BPF in over 66%.
- **Increasing concentrations:** With the phaseout of BPA, studies show that human urinary concentrations of BPS and BPF have been increasing.
- **Exposure sources:** Humans are exposed to BPS and BPF through multiple routes, including ingestion from food and beverages, inhalation of household dust, and dermal contact with products like thermal receipt paper. [↗](#)

Human studies on health effects

Neurodevelopmental effects

- **Prenatal BPF exposure:** A Swedish longitudinal study on children found that higher prenatal exposure to BPF was associated with decreased full-scale IQ at age seven. Stronger associations were observed in boys.
- **BPF and IQ:** An interquartile-range increase in prenatal BPF exposure was associated with a 1.6-point lower IQ score in children.
- **Other bisphenols:** In this same study, no significant associations were found between prenatal BPA or BPS exposure and cognitive function at age seven. However, other studies have found links between BPS and lower psychomotor development in younger children. [↗](#)

Metabolic health and obesity

- **Weight gain:** Multiple human studies, mostly cross-sectional, have explored the link between BPS/BPF exposure and obesity, often with mixed or conflicting results. Some studies report an association with increased body mass index (BMI), waist circumference, and higher body fat percentages.
- **Sex differences:** Similar to findings for BPA, some studies on BPS have found associations with weight gain that differ between men and women. For BPF, one study found a link to general obesity risk in boys but not girls.
- **Diabetes risk:** Studies in Chinese, French, and Korean populations have shown positive associations between BPS exposure and an increased risk of type 2 diabetes. A prospective study in China also found that BPS exposure in pregnant women was associated with increased blood glucose levels and a potentially higher risk of gestational diabetes. [↗](#)

Cardiovascular disease

- **BPS exposure:** A study using data from the 2013–2016 NHANES found that higher concentrations of BPS were significantly associated with an increased risk of total cardiovascular disease (CVD) and coronary heart disease in the U.S. population. This association was particularly strong in older adults.
- **BPF exposure:** The same study did not find a significant association between BPF exposure and CVD. [↗](#)

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exposure and an increased risk of miscarriage and early delivery. [↗](#)

Challenges and future research

While a growing body of human research links BPS and BPF exposure to adverse health outcomes, more work is needed to draw definitive conclusions.

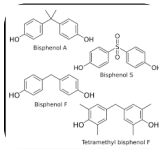
- **Establishing causality:** Many human studies are cross-sectional, meaning they cannot definitively prove that bisphenol exposure *causes* the observed health effects.
- **Varied potency:** The effects of BPS and BPF in humans may vary depending on the concentration, timing of exposure, and individual sex, as seen in lab studies.
- **Research gaps:** The specific mechanisms of action and long-term health implications of BPS and BPF exposure in humans are still not fully understood. Continued biomonitoring is needed to track population exposure levels and inform future risk assessments. [↗](#)

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Where are BPS and BPF found in daily life?

Bisphenol S (BPS) and bisphenol F (BPF) are found in many of the same products as bisphenol A (BPA) because they are often used as "BPA-free" alternatives. Exposure occurs primarily through diet and skin contact. [↗](#)



Food and beverage packaging

Dietary intake is considered the primary exposure route for bisphenols in most people. [↗](#)

- **Can linings:** BPS and BPF are used in the epoxy resins that line the inside of some metal food and beverage cans.
- **Plastic containers:** Rigid, clear plastic products, including reusable water bottles and some takeaway food containers, are sources of bisphenols.
- **"BPA-free" products:** Many products labeled as "BPA-free" use BPS or BPF as substitutes, which can leach into food, especially when heated.
- **Other sources:** Exposure can also occur from plastic-containing tea bags and some cardboard packaging for foods and beverages. [↗](#)

Thermal paper

Cash register and ATM receipts, labels, and tickets printed on glossy, heat-sensitive paper are a major source of bisphenol exposure. [↗](#)

- **Absorption:** The bisphenols in thermal paper are unbound and can be easily absorbed

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Bisphenol S: A potential toxicant in daily use (Review)

May 25, 2023 — In the present short review, the toxic effects of BPS are...

Spandidos Publications [⋮](#)

Exposure to Bisphenol A Substitutes, and Bisphenol F, ...

Nov 29, 2022 — However, most of the studies only assessed BPS exposure le...

National Institutes of Health (NIH) ... [⋮](#)

Prenatal exposure to bisphenols and cognitive function in children at ...

Abstract * Background. Experimental evidence demonstrates that exposu...

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Minnesota Pollution Control Agency [⋮](#)

BPA and BPS: How Your Genes Influence Bisphenol ...

Jan 4, 2025 — BPA and BPS: How Your Genes Influence Bisphenol...

Genetic Lifehacks [⋮](#)

Bisphenol A and Related Compounds: Food Exposure and ...

May 30, 2025 — Health Concerns and Scientific Background. BPA has bee...

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contribute to the bisphenol load in household dust.

- **Higher levels indoors:** Studies show higher concentrations of bisphenols in indoor dust compared to outdoor dust. [↗](#)

Consumer products and personal care items

Bisphenols are used in the manufacture of various products, leading to dermal and other forms of exposure.

- **Clothing:** Synthetic fabrics, including polyester in athletic wear, socks, and infant clothing, have been found to contain BPS.
- **Personal care:** BPS has been detected in personal care products like shampoos, toothpaste, and lotions.
- **Dental materials:** Dental sealants and composites contain bisphenols, which can leach into the body.
- **Electronics and appliances:** BPS and BPF are used in the manufacture of hard plastic parts in electronics and household appliances. [↗](#)

Other exposure sources

- **Medical devices:** Some medical equipment and supplies, including those used in neonatal intensive care units, contain bisphenols.
- **Mustard:** BPF can form naturally in some varieties of yellow mustard from mustard seeds during the production process. [↗](#)

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-  What are the trends in BPS/BPF levels in human biomonitoring studies?
-  What chemicals are used instead of bisphenols in thermal paper and can linings?
-  How can I reduce my exposure to bisphenols from receipts?