

Toxic To-Go Containers Linked to Liver Disease

Analysis by [Dr. Joseph Mercola](#)

✓ Fact Checked

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STORY AT-A-GLANCE

- › Fluorinated chemicals known as polyfluoroalkyl or perfluoroalkyl chemicals (PFAS), which include PFOA and PFOS, are known to accelerate metabolic changes that lead to fatty liver
- › Higher ALT levels – a marker of liver injury – in humans were associated with exposure to PFOA, PFOS and PFNA, another type of PFAS
- › Exposure to PFOA was also linked to higher aspartate aminotransferase and gamma-glutamyl transferase levels – two widely used markers of liver disease – in humans
- › PFAS may damage the liver via promotion of liver inflammation and triglyceride accumulation as well as altered lipid metabolism
- › Grease-resistant to-go containers, papers and wrappers often contain PFAS; this includes fast food containers and wrappers, microwave popcorn bags, pizza boxes and candy wrappers
- › You can also be exposed to PFAS via contaminated drinking water and soil, as well as via exposure to consumer products that contain PFAS, including nonstick cookware, stain resistant clothing and upholstery, cleaning products and personal care products

Fluorinated chemicals known as polyfluoroalkyl or perfluoroalkyl chemicals (PFASs), which include PFOA and PFOS, can be found in most Americans.¹ The widely used chemicals have been added to industry and consumer products since the 1940s, but

while PFOA and PFOS have been phased out in the U.S. due to their toxic properties, other PFAS are still in use.

Because the chemicals break down very slowly in the environment, they've been dubbed "forever chemicals," and there's concern that exposure to these toxins may be a significant contributor to liver disease, including nonalcoholic fatty liver disease (NAFLD).²

Liver Disease Is a Public Health Epidemic

NAFLD is the most common chronic liver disease in developed countries,³ characterized by a buildup of excess fat in your liver that is not related to heavy alcohol use. Lifestyle factors such as diet, exercise, weight and smoking all play important roles in exacerbating (as well as reducing) your chances of developing some form of liver disease.

While alcohol consumption certainly doesn't help liver health, the rise in NAFLD is likely related more so to increased intake of toxic industrially processed seed oils, often referred to as vegetable oils, along with exposure to environmental chemicals, including PFAS.

Globally, about 25% of people are affected by NAFLD. In the U.S., prevalence is expected to rise to 100.9 million, or about one-third of adults, by 2030. Without proper treatment, NAFLD can lead to serious liver problems including nonalcoholic steatohepatitis (NASH), cirrhosis and end-stage liver disease.⁴

Exposure to PFAS Linked to Liver Disease

PFAS are endocrine-disrupting chemicals that accumulate in body tissues, such as the liver, and are known to accelerate metabolic changes that lead to fatty liver. "This bioaccumulation," researchers wrote in *Environmental Health Perspectives*, "coupled with the long half-lives of many PFAS, leads to concern about the potential for PFAS to

disrupt liver homeostasis should they continue to accumulate in human tissue even if industrial use is abated."⁵

The researchers, from the Keck School of Medicine of USC, conducted a systematic review and meta-analysis, yielding 85 rodent studies and 24 epidemiological studies. Four types of PFAS – PFOS, PFOA, perfluorohexanesulfonic acid (PFHxS) and perfluorononanoic acid (PFNA) – accounted for most known human exposure.

The study compared PFAS exposure to indicators of liver injury including serum alanine aminotransferase (ALT), NAFLD, NASH or steatosis, a buildup of fat in the liver. Meta-analysis from the human studies showed that higher ALT levels were associated with exposure to PFOA, PFOS and PFNA.

In addition, exposure to PFOA was also linked to higher aspartate aminotransferase and gamma-glutamyl transferase levels – two widely used markers of liver disease – in humans. Rodents were also affected, with those exposed to PFAS tending to have higher ALT levels and steatosis.⁶ "There is consistent evidence for PFAS hepatotoxicity from rodent studies, supported by associations of PFAS and markers of liver function in observational human studies," the researchers concluded.⁷

While it's unknown exactly how PFAS may be damage the liver, its hepatotoxicity may be due to a combination of the following:⁸

- Promotion of liver inflammation and triglyceride accumulation
- Altered lipid metabolism
- Reduced bioavailability of choline, triggering steatosis due to choline deficiency. Choline, an essential nutrient, supports normal liver function and liver health, helping it to maintain membrane integrity and manage cholesterol metabolism, including low density lipoproteins and very low density lipoproteins (VLDL), helping to move fat out of your liver⁹

They pointed out that newer PFAS, which have been used to replace the "legacy" PFAS that were phased out of use in the early 2000s, have similar chemical structure and

properties, and therefore likely have similarly toxic effects.

Also unknown are what effects these ubiquitous chemicals have after combined exposures, as well as risks of exposure to the most vulnerable populations – infants, including in utero, and children. "This review identifies a need for additional research evaluating next-generation PFAS, mixtures and early life exposures," they explained.¹⁰

"We see that the prevalence of NAFLD in humans is increasing but the explanations are unclear," said study author Sarah Rock in a news release. "Though the human research connecting PFAS to liver disease is limited, there is much evidence in animal research showing hepatotoxicity of PFAS.

A challenge for PFAS researchers is that humans are exposed to mixtures of hundreds if not thousands of these chemicals. Mixture analyses is one potential tool for addressing this complexity in the future."¹¹ Study author Elizabeth Costello added:¹²

"This research clearly shows that PFAS need to be taken seriously as a human health concern because even after they are phased out, they persist in the environment. There is enough evidence, we believe, to demonstrate a need to clean up sources of exposure to PFAS and to prevent future exposures."

PFAS Pose a Significant Risk to Human Health

It's not only the liver that suffers from exposure to PFAS. In May 2015, more than 200 scientists from 40 countries signed the Madrid Statement, which warns about the harms of PFAS chemicals and documents the following potential health effects of exposure:¹³

Liver toxicity	Disruption of lipid metabolism, and the immune and endocrine systems
Adverse neurobehavioral effects	Neonatal toxicity and death
Tumors in multiple organ systems	Testicular and kidney cancers

Liver malfunction	Hypothyroidism
High cholesterol	Ulcerative colitis
Reduced birth weight and size	Obesity
Decreased immune response to vaccines	Reduced hormone levels and delayed puberty

Exposure to high levels of PFAS is also known to affect the immune system, and evidence from both human and animal studies shows that such exposure reduces antibody responses to vaccines and may also reduce your resistance to infectious disease.¹⁴ The U.S. EPA also acknowledges that PFAS exposure is harmful and states that peer-reviewed scientific studies have shown exposure to PFAS may cause:¹⁵

Reproductive effects such as decreased fertility or increased high blood pressure in pregnant women	Developmental effects or delays in children, including low birth weight, accelerated puberty, bone variations or behavioral changes
Increased risk of some cancers, including prostate, kidney and testicular cancers	Reduced ability of the body's immune system to fight infections, including reduced vaccine response
Interference with the body's natural hormones	Increased cholesterol levels and/or risk of obesity

Food Packaging Is an Overlooked Source of Exposure

If you're wondering how you may be exposed to these toxic chemicals, food packaging is a common culprit, particularly for fast food and processed foods. Grease-resistant to-go containers, papers and wrappers often contain PFAS. This includes fast food

containers and wrappers, microwave popcorn bags, pizza boxes and candy wrappers.¹⁶ Even foods from health food stores like Whole Foods may be packaged in containers loaded with PFAS.

In fact, a 2018 study released by consumer watchdog groups Safer Chemicals, Healthy Families and Toxic-Free Future revealed that Whole Foods Market was the biggest offender in their analysis of paper products coming in contact with food. They found high levels of fluorine – a sign that the packaging contains PFAS – in five of the 17 items tested, four of which were containers in the salad and hot food bar.¹⁷

In another study, about one-third of the approximately 400 fast food wrappers and containers tested were found to contain fluorine, which suggests perfluorinated chemicals were used to give the paper a slick surface, making it oil- and grease-resistant. "We found that 46% of food contact papers and 20% of paperboard samples contained detectable fluorine," the researchers explained.¹⁸

Since the chemicals migrate into food and contaminate compost piles and landfills after disposal, the use of PFAS leads to unnecessary long-term exposure to harmful chemicals for humans, wildlife and the environment, especially since PFAS-free packaging options are widely available.

How Else Are You Exposed to PFAS?

PFAS can be found in water, soil, air and food. They are in your home, including in household products like stain- and water-repellant fabrics, cleaning products, nonstick cookware and paint – and likely in your drinking water.

According to a 2016 Harvard study, 16.5 million Americans have detectable levels of at least one kind of PFAS in their drinking water, and about 6 million Americans are drinking water that contains PFAS at or above the EPA safety level.¹⁹ The highest concentration levels of PFAS were found in watersheds near industrial sites, military fire training areas and wastewater treatment plants. Private wells have also been found to be contaminated.

PFAS have no taste or smell, so it's wise for virtually everyone to filter their water with a high-quality carbon filtration system. To be certain you're getting the purest water you can, filter the water both at the point of entry and at the point of use.

You can also be exposed to PFAS by eating seafood caught in water contaminated with the chemicals, by swallowing contaminated soil or dust and by using PFAS-containing personal care products, which include shampoo, dental floss, nail polish, eye makeup and more.²⁰

Given these chemicals' pervasive and persistent use, everyone would be well served by following the Madrid Statement's recommendation to avoid products containing, or manufactured using, PFAS, which include most that are stain-resistant, waterproof or nonstick. To further reduce your exposure, the Environmental Working Group recommends avoiding:²¹

Items that have been pretreated with stain repellants; opt out of such treatments when buying new furniture and carpets.

Water- and/or stain-repellant clothing. One tipoff is when an item made with artificial fibers is described as "breathable." These are typically treated with PTFE.

Items treated with flame retardant chemicals, which includes a wide variety of baby items, padded furniture, mattresses and pillows. Instead, opt for naturally less flammable materials such as leather, wool and cotton.

Fast food and carry out foods, as the wrappers are typically treated with PFAS.

Microwave popcorn. PFAS not only may be present in the inner coating of the bag, it also may migrate to the oil from the packaging during heating. Instead, use "old-fashioned" stovetop popcorn.

Nonstick cookware and other treated kitchen utensils. Healthier options include ceramic and enameled cast iron cookware, both of which are durable, easy to clean

and completely inert, which means they won't release any harmful chemicals into your home. A newer type of nonstick cookware called Duralon uses a nonfluoridated nylon polymer for its nonstick coating. While this appears to be safe, your safest bet is still ceramic and enameled cast iron.

Oral-B Glide floss and any other personal care products containing PTFE or "fluoro" or "perfluoro" ingredients.

Sources and References

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- ⁹ [The Choline Council, Facts About Choline and NAFLD](#)
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- ²¹ [EWG's Guide to Avoiding PFCS \(PDF\)](#)