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Take Control of Your Health

'Forever Chemicals' Linked to Nearly Threefold Higher Odds of Liver Disease in Adolescents

Analysis by Dr. Joseph Mercola | November 27, 2026

STORY AT-A-GLANCE

- Per- and polyfluoroalkyl substances (PFAS), also called "forever chemicals," are found in drinking water, food packaging, cookware, and household products. They persist in the environment and build up in the body
- An Environmental Research study found that higher blood levels of one forever chemical, PFOA, were linked to almost three times higher odds of fatty liver disease among adolescents in high-risk families
- These findings suggest that adolescence may be a sensitive window, as the liver is still adapting to growth and metabolic changes, which may allow chemical exposures to influence liver fat storage and long-term disease risk
- Microplastics can act as carriers for PFAS in the environment and may help transport them into the body. In lab studies of aquatic organisms, combined exposure to microplastics and PFAS caused greater harm than either pollutant alone
- Reducing exposure through water filtration and mindful product choices can help lower long-term chemical burden and protect metabolic health

Nearly every American carries some level of "forever chemicals" in their system.[1] These compounds, formally known as per- and polyfluoroalkyl substances (PFAS), are a large group of synthetic chemicals so resistant to breakdown that once they enter your body,

some can linger for years. They're used to make products slick, stain-proof, grease-resistant, or waterproof — from nonstick pans and fast-food wrappers to carpeting and rain jackets.

The liver is one of the main organs where some forever chemicals, especially perfluorooctanesulfonic acid (PFOS), accumulate.[2] Research in human liver cell models suggests some PFAS may increase fat production and interfere with the liver's ability to export fat, which may promote fat buildup inside liver cells.[3] Now, research suggests this interference may carry greater risk during adolescence, when the liver is still adapting to hormonal shifts, growth signals, and increased metabolic demands.[4]

Adolescent PFAS Exposure Is Linked to Higher Fatty Liver Disease Risk

Fatty liver disease is now estimated to affect 7% to 9% of all children, and up to 41% of children with obesity. A study published in Environmental Research analyzed how exposure to various PFAS compounds may be contributing to this trend, in two groups: Latino adolescents with overweight or obesity and a family history of Type 2 diabetes, and young adults with a history of overweight or obesity.[5]

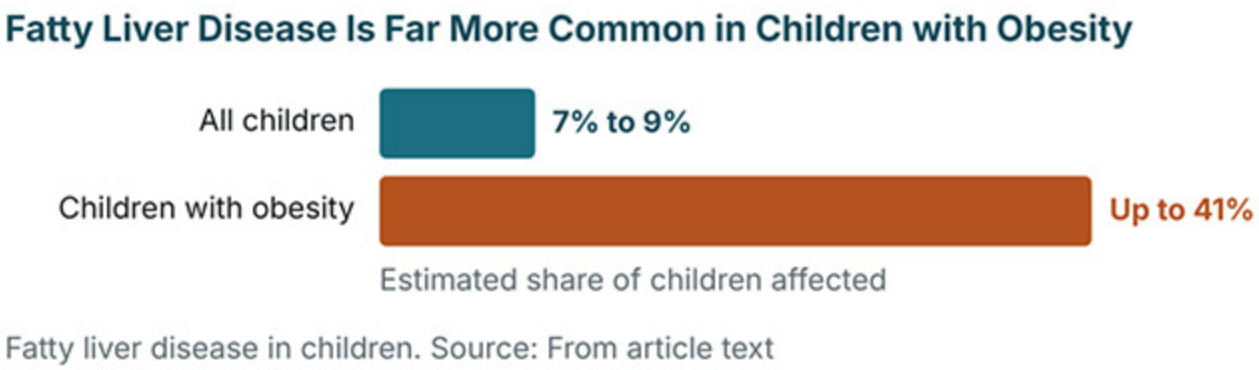

Figure 1. *Fatty liver disease is estimated to affect 7% to 9% of all children and up to 41% of children with obesity.*

- **Two PFAS compounds showed the strongest links to fatty liver disease —** Among the adolescents, each doubling of blood levels of the forever chemical perfluorooctanoic acid (PFOA) was linked to nearly three times higher odds of fatty liver disease, while each doubling of a newer replacement PFAS, perfluoroheptanoic acid (PFHpA), was linked to about 1.7 times the odds in a subset of the adolescents.

  The PFOA link grew stronger with age, and links for two other PFAS (PFOS and PFHxS) were stronger in teens carrying a gene variant (PNPLA3) tied to liver fat. No significant overall links were found in young adults. For families already dealing with metabolic concerns, including overweight or Type 2 diabetes, PFAS exposure may represent an added stressor on the liver that isn't picked up in routine checkups and often goes unnoticed.

- **This study builds on earlier research showing a similar pattern —** An earlier study of adolescents with obesity undergoing weight-loss surgery, published in Communications Medicine in late 2025,[6] found that each doubling of PFHpA concentration in the blood was linked to 80% higher odds of fatty liver disease. Elevated PFHpA was also linked to more advanced liver injury, including inflammation and fibrosis (scarring).

Together, these results highlight adolescence as an important window for identifying environmental contributors like PFAS, when intervention may still prevent long-term metabolic damage. For a deeper look at how PFAS affects your health beyond liver disease, read "**Toxic and Tenacious — How 'Forever Chemicals' Are Damaging Your Health**."

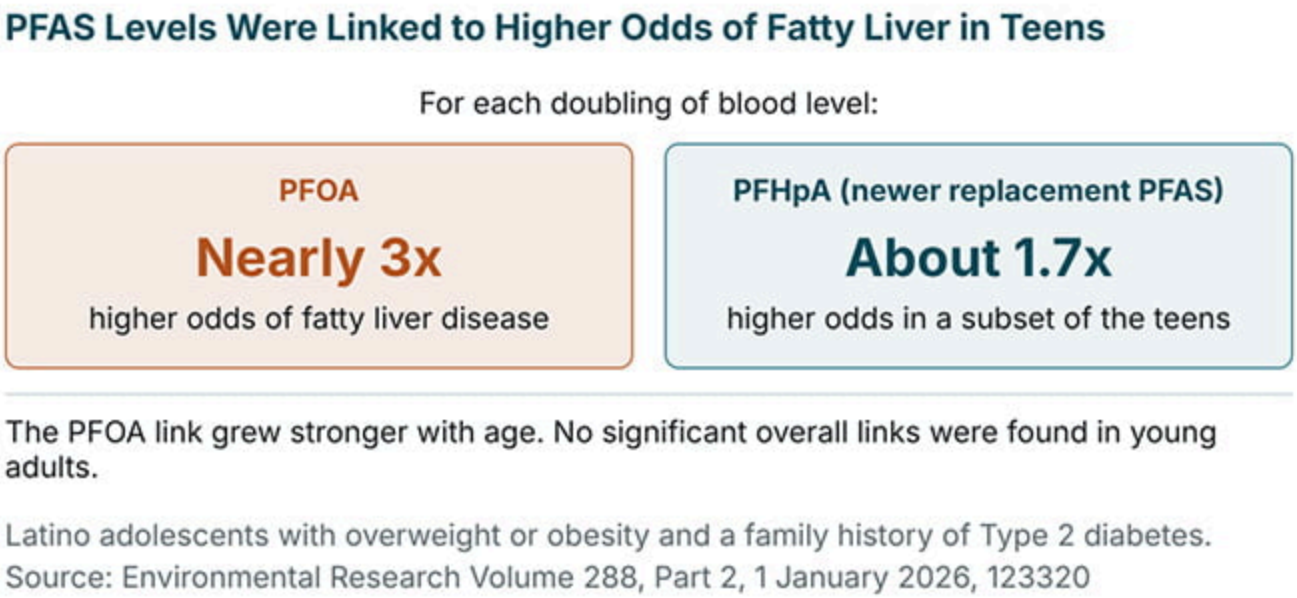

Figure 2. *In high-risk teens, each doubling of blood PFOA was linked to nearly three times the odds of fatty liver disease, and each doubling of PFHpA to about 1.7 times the odds in a subset.*

Microplastics as PFAS Carriers — A Potential Double Threat to Liver Health

PFAS don't always travel alone. Growing evidence shows that microplastics serve as both a reservoir and a transport system for forever chemicals in the environment,[7] and researchers are investigating whether they may also carry these chemicals into your tissues.

- **Microplastics form from the breakdown of larger plastics —** Common items such as packaging, textiles, and household goods degrade into microscopic fragments. Some of these fragments are manufactured with PFAS for durability or chemical resistance, while others absorb PFAS from the surrounding environment. Either way, once inhaled or ingested, the particles may become an ongoing source of internal exposure.

- **Inhalation is a primary route of exposure, along with ingestion —** Microplastics circulate in indoor and outdoor air and are small enough to evade upper airway defenses. Once inhaled, the smallest particles can reach the alveoli (the deepest region of the lungs), where oxygen exchange occurs. From there, they may embed in lung tissue or pass into circulation, potentially carrying their chemical load to the liver, as well as the kidneys, brain, and other organs.

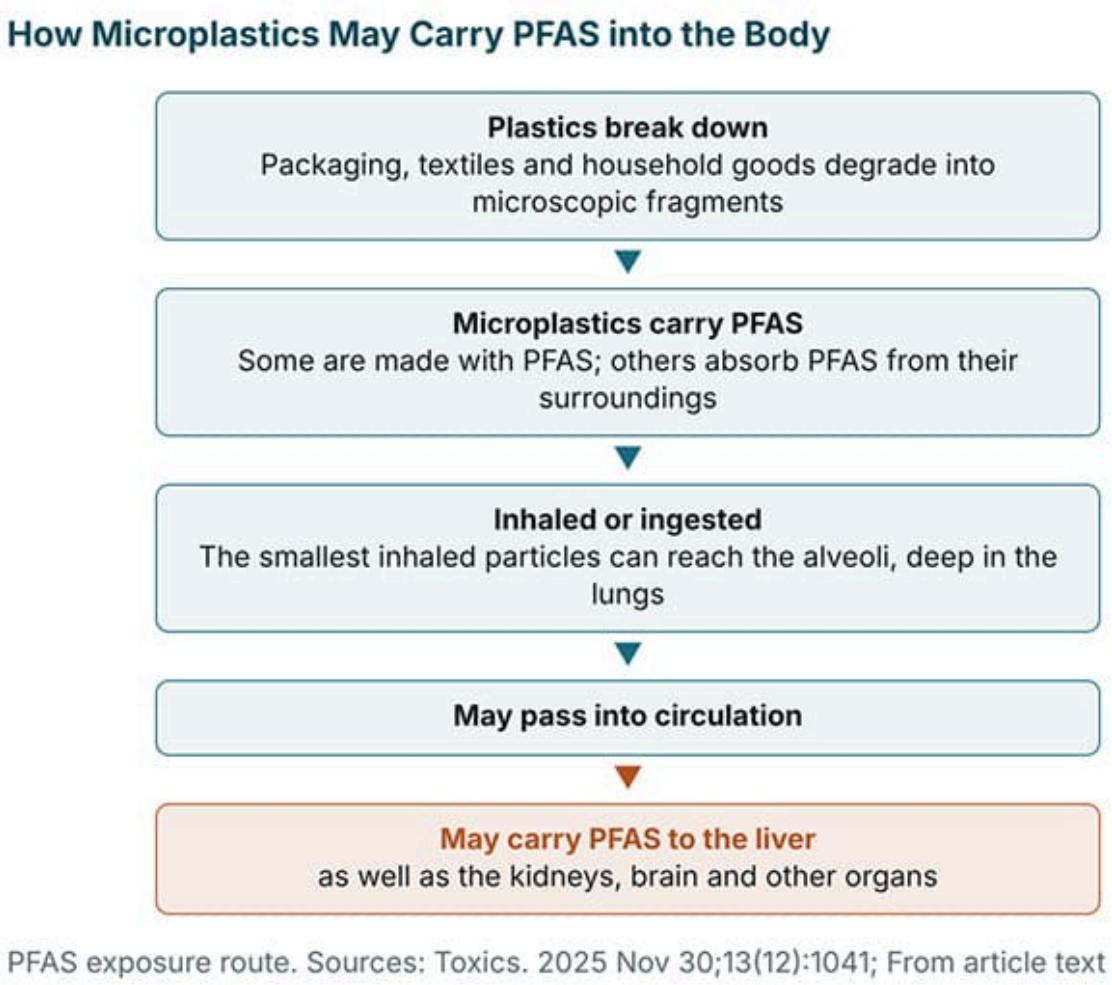

Figure 3. *Microplastics that carry PFAS can be inhaled or ingested and may pass into circulation, potentially carrying PFAS to the liver and other organs.*

- **Microplastics contain a wide range of synthetic chemicals —** In addition to PFAS, these particles can contain endocrine-disrupting chemicals (EDCs) like phthalates, bisphenol A (BPA), flame retardants, and stabilizers. These interfere with hormone

signaling by mimicking or blocking natural hormones and altering how they are produced, transported, or cleared.

The effects span multiple systems, including metabolism, fertility, neurodevelopment, and immune regulation. In lab studies of water fleas (Daphnia), a standard model in toxicology research, combined exposure to PFAS and microplastics produced additive and synergistic toxicity, causing greater harm than either pollutant alone.[8]

The body has no internal mechanism that can break down plastic polymers or reliably remove embedded microplastic particles once they enter tissue. The good news is that researchers are actively investigating strategies to help reduce the body's burden of persistent plastics and chemicals, including PFAS. Some of this emerging research was discussed in my CBS interview, which is featured above.

How to Reduce PFAS Exposure and Manage Its Effects

Because PFAS are widespread and long-lasting, protecting your health as well as your family's means taking steps on two fronts — limiting new exposures and helping your body eliminate what's already built up. Here are some practical strategies to help you get started:

1. **Filter your drinking water with a system designed to remove PFAS —** If PFAS are in your household tap water, you're being exposed every time you drink, cook, or shower. Check your local water quality report or test your water using a PFAS-specific kit.

   If contamination is confirmed, install a water filtration system with a PFOA/PFOS or Total PFAS reduction claim certified to NSF/ANSI Standard 53 (for activated carbon) — these claims verify that the filter reduces those specific chemicals, which marketing claims alone do not guarantee.[9]

2. **Limit PFAS-containing products in your home —** Avoid nonstick cookware, stain-resistant carpets and upholstery, and water-repellent clothing. If you have children, pay special attention to school uniforms, outdoor gear, and athletic wear that may be treated with water- or stain-repellent chemicals. Choose materials like cotton, wool, leather, or cast iron instead of synthetic, chemically treated options.

   Food packaging is another major source of exposure. Microwave popcorn bags, fast-food wrappers, pizza boxes, and takeout containers are among the worst offenders, as they're often coated with PFAS to prevent grease and moisture from soaking through. Plastic packaging can also break down into microplastics. Whenever possible, cook at home, and transfer takeout food to glass or stainless steel containers rather than eating directly from the packaging.

   Personal care products can also be hidden sources, so check labels for ingredients like polytetrafluoroethylene (PTFE) or anything containing "fluoro." Look for fluorine-free certifications or use databases like the Environmental Working Group's (EWG) Skin Deep to help guide safer choices for your household.[10]

3. **Consider blood or plasma donation if you are eligible —** If you meet donation criteria, this is one of the few approaches shown in a randomized trial to lower PFAS levels in the blood.

   In a 12-month trial of 285 Australian firefighters with PFOS levels of at least 5 ng/mL, donating plasma every six weeks lowered blood levels of PFOS, a common forever chemical, by an average of 2.9 nanograms per milliliter (ng/mL), and donating blood every 12 weeks lowered them by 1.1 ng/mL, while levels were unchanged in those who didn't donate.[11]

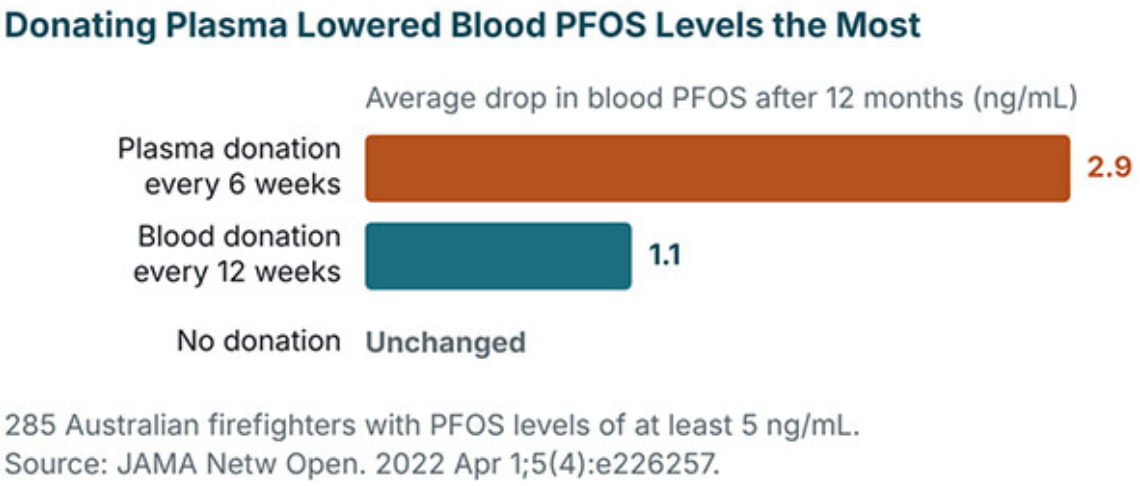

Figure 4. *Over 12 months, plasma donation lowered blood PFOS by 2.9 ng/mL and blood donation by 1.1 ng/mL, while levels were unchanged in firefighters who didn't donate.*

4. **Support liver and kidney function through daily habits —** Eat sulfur-rich foods such as garlic, onions, broccoli, and Brussels sprouts to support the production of glutathione, the body's master detoxification compound, which binds to toxins so they can be eliminated. Pair this with adequate hydration using filtered water, which supports normal kidney function.

   Because PFAS clearance may depend partly on healthy mitochondrial function, reducing factors that impair mitochondria, including excess linoleic acid from seed oils like soybean, corn, and sunflower oil, may support your body's ability to process these chemicals. Avoiding alcohol further reduces strain on the liver and supports more efficient detoxification.

5. **Support broader efforts to reduce environmental exposure —** The widespread presence of PFAS in people's blood and environments is the result of decades of unregulated chemical use. While personal steps matter, broader policy changes are needed to protect communities.

Support efforts to ban PFAS in consumer products, push for full ingredient transparency, and demand government-led testing and cleanup in contaminated areas. Each reduction in exposure — whether personal or collective — lowers the toxic burden on future generations.

5 Strategies to Support Liver Health

Reducing exposure to PFAS is only part of protecting your liver. You also need to supply it with the nutrients and inputs it needs to function well, repair cellular damage, and export stored fat. These five strategies focus on practical, foundational ways to support liver recovery and resilience over time:

1. **Prioritize choline-rich foods —** Choline is one of the most important nutrients for liver health because it helps move fat out of the liver and supports cell membrane repair. A single hard-boiled egg can contain anywhere from 113 milligrams (mg) to 147 mg of choline,[12,13] or about 20% to 27% of the daily value,[14] making it one of the best choline sources in the American diet.[15]

   Muscle meats and fish also provide moderate amounts and fit easily into most diets.[16] Some plant foods, including soybeans and cruciferous vegetables like broccoli, cauliflower, and Brussels sprouts, contain smaller amounts but can still contribute to your overall intake.[17]

2. **Consider choline supplements if your diet falls short —** If you struggle to get enough choline from food, supplementation may help, but the form matters. I recommend citicoline (also known as CDP-choline) because it is well absorbed and supplies choline and cytidine, which your body uses to make phospholipids, key building blocks of liver cell and mitochondrial membranes.[18]

   Citicoline is also a precursor for acetylcholine, a neurotransmitter involved in memory. In a 12-week clinical trial of healthy adults aged 50 to 85 with age-associated memory impairment, 500 mg a day improved episodic memory and overall memory scores compared with placebo.*[19]

Researchers have also hypothesized that the choline in citicoline may be less prone than some other choline forms to conversion into trimethylamine N-oxide (TMAO), a metabolite linked to cardiovascular risk, though this hasn't been confirmed in human trials.[20]

3. **Increase your intake of other liver-supportive nutrients —** Your liver needs certain nutrients called methyl donors — folate (B9), vitamin B12, and methionine — to run a vital repair process called methylation. This process helps regulate gene activity, manage inflammation, and carry out essential detox and fat metabolism tasks.

   Without enough methyl donors, fat can start to accumulate, and liver function can slow down. Getting these nutrients through food helps keep your liver resilient and metabolically active. Key dietary sources include:

   - **Folate (B9) —** Beef liver and dark leafy greens such as spinach and kale, and asparagus[21]
   - **Vitamin B12 —** Animal sources like wild-caught Alaskan salmon, pastured eggs, grass fed dairy, and beef; for vegetarians or vegans, consider taking a B12 supplement[22]
   - **Methionine —** High-protein foods like eggs, chicken, turkey, beef, and lamb[23]

4. **Support liver health with regular movement —** Physical activity helps regulate blood sugar, increase insulin sensitivity, and stimulate fat transport out of the liver. You don't need a demanding workout routine. Aim to walk one hour a day, including **brisk 10- to 20-minute walks** after meals. Along with that, daily stretching and two to three sessions of resistance training totaling 40 to 60 minutes each week go a long way.

   Waist circumference matters, too. More than 40 inches for men or 35 inches for women signals excess **visceral fat**,[24] which has been linked to liver scarring. Shifting your focus toward losing inches around the waist, rather than just the number on the scale, gives you a more accurate measure of progress.

5. **Get restorative sleep nightly —** Your liver depends on quality sleep for repair and detoxification. Chronic sleep loss or disrupted sleep patterns interfere with glucose regulation, raise inflammation, and may impair mitochondrial function in liver cells.

   Aim for consistent sleep in a dark room, ideally at a temperature between 60 and 68 degrees Fahrenheit (15 to 20 degrees Celsius). Teenagers need eight to 10 hours of sleep per night, while adults need at least seven.[25] Additionally, avoid late-night meals, as they can spike blood sugar and keep your liver metabolically active when it should be resting.

**These findings are from research conducted in clinical settings. Results may not apply to all individuals.*

Frequently Asked Questions (FAQs) About Forever Chemicals and Liver Disease

Q: How do I know if I've been exposed to PFAS?

A: You have almost certainly been exposed. PFAS are found in drinking water, food packaging, cookware, clothing, and household products, and studies consistently show detectable levels in the blood of nearly all Americans. Exposure often happens gradually over years, so you usually won't notice symptoms tied to a single source.

Q: What does PFAS do to liver health?

A: PFAS may disrupt how your liver handles fat, responds to insulin, and clears toxins. These disruptions may raise your risk of developing fatty liver disease. Over time, this can lead to more serious issues like inflammation, fibrosis, or insulin resistance.

Q: Why does PFAS exposure matter more during adolescence?

A: The adolescent liver is still adapting to growth hormones and metabolic changes, which can make it more susceptible to chemical interferences like PFAS. Early research suggests genetic differences and age may also influence the risk, meaning two teens with similar PFAS exposure could have different outcomes depending on inherited susceptibility and their stage of adolescence.

Q: How are microplastics linked to PFAS exposure?

A: Microplastics can carry PFAS on their surface and may transport them into the body through inhalation or ingestion. Once inside, these particles may carry the chemicals to organs such as the liver, potentially increasing overall internal exposure to PFAS.

Q: What can I do to reduce exposure to PFAS in our home?

A: You can lower PFAS exposure in your home by focusing on the most common sources. Use a water filtration system certified to reduce PFAS, especially for drinking and cooking. Avoid nonstick cookware and products treated to resist stains, water, or grease, including some carpets, furniture, and clothing.

Store and prepare food using glass, stainless steel, or cast iron, and check personal care products for ingredients that include “PTFE” or anything containing “fluoro.” These steps reduce the amount of PFAS entering your home on a daily basis.

This article is for informational purposes only and does not constitute medical advice. Consult a qualified healthcare provider before making changes to your health regimen.

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