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Beware of Forever Chemicals Causing Cancer to Spread

Analysis by Dr. Joseph Mercola | January 03, 2024

STORY AT-A-GLANCE

- Per- and polyfluoroalkyl chemicals (PFAS) may promote cancer metastasis, according to a study by researchers at the Yale School of Public Health
- Researchers immersed two types of colorectal cancer cells in a PFAS solution for up to seven days; metabolic changes signaling cancer metastasis were observed, along with increased cell motility
- Not only was the cells' migration ability boosted, but they had a tendency to spread and penetrate membranes
- PFAS may lead to altered gene expression and epigenetic changes that in turn cause inflammation, endocrine disruption and changes in metabolism and cell signaling that promote carcinogenesis
- Other research shows exposure to PFAS may worsen the prognosis of patients with colorectal cancer

Per- and polyfluoroalkyl chemicals (PFAS) may accelerate the progression of colorectal cancer, according to a study by researchers at the Yale School of Public Health.[1] The finding could even explain why firefighters, who regularly come into contact with PFAS in firefighting foam, are also more likely to develop and die from cancer, including colorectal cancer.[2]

PFAS are known as "forever chemicals" because of their persistence in the environment and ability to bioaccumulate in people and wildlife. In the human body, PFAS have half-

lives of two to five years.[3] Due to their ability to repel oil, dirt and water, they're widely used in consumer products including nonstick cookware, stain-resistant fabric and firefighting foams.

As endocrine-disrupting chemicals, PFAS are known to affect hormones and metabolism, interfering with fertility, growth and development.[4] However, PFAS may also contribute to cancer, including promoting its spread.[5]

PFAS Could Promote Cancer Metastasis

Perfluorooctanoic acid (PFOA), one type of PFAS, is categorized as carcinogenic to humans by the International Agency for Research on Cancer, while perfluorooctanesulfonic acid (PFOS) is considered possibly carcinogenic to humans.[6]

Due to chemical exposures on the job, firefighters have higher levels of PFAS in their bodies than the general population, and they're also more likely to develop colorectal cancer. About 80% of these cancer cases are believed to be due to environmental exposures.[7]

"We look at patterns that occur within an exposed group of people or a diseased group of people, then try to generate a hypothesis as to why somebody may develop a disease or have progression of disease," study author Caroline Johnson, Ph.D., associate professor of epidemiology, said.[8]

For the study, researchers immersed two types of colorectal cancer cells in a PFAS solution for up to seven days. Metabolic changes signaling cancer metastasis were observed, along with increased cell motility. "It doesn't prove it's metastasis, but they have increased motility, which is a feature of metastasis," Johnson said.[9]

Not only was the cells' migration ability boosted, but they had a tendency to spread and penetrate membranes. According to a news release from Yale School of Public Health:[10]

> *"In another experiment, researchers grew the cells as a flat, two-dimensional layer, then drew a scratch down the middle, separating half of the cells from the*

> *other half. When they added PFAS, the cell lines grew and migrated back together again … Metabolomic analysis revealed the spheroids were producing a variety of fatty acids, amino acids, and signaling proteins in patterns previously linked to metastasis.*
>
> *Small-chain fatty acids, which can protect against tumors and inflammation, were downregulated."*

The study used PFAS exposure levels similar to those in firefighters and others who have increased exposure, such as people living near military bases, landfills, airports and wastewater treatment plants. The researchers intend to conduct additional studies to see if lower levels of PFAS exposure, such as what an average person might be exposed to on a daily basis, have similar effects.

PFAS Exposure May Worsen Colorectal Cancer Prognosis

Other research shows exposure to PFAS may worsen the prognosis of patients with colorectal cancer.[11] Every quantile increase in PFAS mixtures was associated with a 4.67% increase in the numbers of metastatic lymph nodes in colorectal cancer patients.

Further, the number of metastatic lymph nodes in patients with serum PFOA concentrations in the 95th percentile was 27% higher than in those with concentrations at the threshold level.[12] Some evidence also suggests that PFOS exposure leads to gastrointestinal inflammation that contributes to ulcerative colitis, a precursor to colorectal cancer.[13]

PFAS may lead to altered gene expression and epigenetic changes that in turn cause inflammation, endocrine disruption and changes in metabolism and cell signaling that promote carcinogenesis.[14] Writing in Frontiers in Toxicology, researchers explained, "Current literature suggests a link between long-term PFOS exposure, lipid metabolism dysregulation, inflammation, microbiome dysfunction and the etiology of colorectal cancer."[15]

PFAS Exposure Increases Thyroid Cancer Risk

Exposure to PFAS has previously been linked to thyroid cancer. Researchers looked into associations between plasma PFAS levels and thyroid cancer diagnosis. Using data from 88 patients with thyroid cancer and 88 matched controls without thyroid cancer, the team measured levels of eight PFAS, finding a significant association.

"There was a 56% increased rate of thyroid cancer diagnosis per doubling of linear perfluorooctanesulfonic acid (n-PFOS) intensity," according to the study.[16] Another analysis was conducted on a subgroup of 31 patients who were diagnosed with thyroid cancer a year or more after enrolling in the study.

This analysis also found an association between exposure to PFOS and thyroid cancer risk, as well as exposure to several other PFAS, including branched perfluorooctanesulfonic acid, perfluorononanoic acid, perfluorooctylphosphonic acid and linear perfluorohexanesulfonic acid.[17]

PFAS may contribute to cancer via multiple mechanisms, incuding causing changes in epigenetics, immunosuppression, oxidative stress and inflammation or via hormone and metabolomic pathways. An accumulation of epigenetic events induced by PFAS exposure can "synergistically amplify tumorigenicity and cancer progression," the team explained, adding that immune system suppression and chronic inflammation also likely play a role:[18]

> *"PFOS and PFOA have been found to be immunotoxic in epidemiological and animal studies. Suppression of the immune system can affect the body's response to foreign antigens, including those on tumor cells.*
>
> *PFOS exposures are inversely associated with decreased anti-mumps and anti-rubella antibodies and reduced antibody response to tetanus and diphtheria among children, demonstrating the ability of PFOS to cause systemic immunosuppression.*

Chronic inflammation, which can drive cancer development, has been linked with PFOS exposures … Finally, PFOS activates peroxisome proliferator-activated receptors, which contributed to development and regulation of thyroid cancers."

Additional Health Risks of PFAS Exposure

Exposure to high levels of PFAS is known to cause significant health problems, including damage to the immune system, and evidence from both human and animal studies shows that such exposure may reduce your resistance to infectious disease.[19] It may also harm vision health — a concerning finding since PFAS are often found in contact lenses.[20]

A large population-based study conducted in China found exposure to PFAS increased the risk of visual impairment,[21] possibly by inducing oxidative stress. "PFASs are proven pro-oxidants and exposure to these emerging pollutants elicits DNA damage, lipid peroxidation, generation of reactive of species (ROS), and inhibition of anti-oxidant enzymes, as well as triggers signaling cascades like apoptosis," they explained.[22]

Military members who were exposed to PFAS on military bases have also suffered from a number of eye conditions, including myopia, hyperopia, astigmatism and presbyopia.[23] The U.S. Environmental Protection Agency also acknowledges that PFAS exposure is harmful and states that peer-reviewed scientific studies have shown exposure to PFAS may cause:[24]

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

PFAS are also 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."[25]

Further, PFAS exposure may be causing inflammation and oxidative stress in youth, thus contributing to a variety of diseases such as obesity, insulin resistance, increased risk for fatty liver disease and potentially cancer.[26,27]

Where Are PFAS Found?

The ubiquitous nature of PFAS is part of what makes them so toxic. There are more than 9,000 PFAS,[28] and exposure is so widespread that PFAS have been found in 97% of Americans.[29] PFAS is found in water, soil, air and food. It's 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.[30]

Fast food containers and wrappers, microwave popcorn bags, pizza boxes and candy wrappers[31] are common culprits. They're also found in pasta and tomato sauces, sports bras, tampons and dental floss,[32] as well as Thinx period underwear.[33]

PFAS on farmland is another major issue — one that's been called a "slow-motion disaster"[34] — due to the use of toxic human waste sludge as fertilizer. An estimated 20 million acres of U.S. farmland may be contaminated with PFAS as a result.[35]

While foods grown with PFAS-contaminated sewage sludge are not labeled as such, your best bet for avoiding them is to support sustainable agriculture movements in your area. Make it a point to only buy food from a source you know and trust, one using safe,

nontoxic organic or biodynamic farming methods. Eating mostly fresh, whole foods will also help you cut down on exposure to these chemicals in food packaging.

Filtering your drinking water is also important to remove PFAS. The New Jersey Drinking Water Quality Institute recommends using granulated activated carbon "or an equally efficient technology" to remove chemicals such as PFOA and PFOS from your drinking water. Activated carbon has been shown to remove about 90% of these chemicals.[36]

Reverse osmosis can also remove some — but not all — PFAS.[37] You can find additional helpful tips to reduce your exposure to forever chemicals in EWG's "Guide to Avoiding PFAS."[38]

Pretreated or stain-repellent treatments — Opt out of these treatments on clothing, furniture and carpeting. Clothing advertised as "breathable" is typically treated with polytetrafluoroethylene, a synthetic fluoropolymer.

Products treated with flame retardant chemicals — This includes furniture, carpet, mattresses and baby items. Instead, opt for naturally less flammable materials such as leather, wool and cotton.

Fast food and carry-out foods — The containers are typically treated.

Microwave popcorn — PFAS may be present in the inner coating of the bag and may migrate to the oil from the packaging during heating. Instead, use "old-fashioned" stovetop non-GMO 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.

Personal care products containing PTFE, "fluoro" or "perfluoro" ingredients such as Oral B Glide floss — The EWG Skin Deep database is an excellent source to search for healthier personal care options.[39]

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