Scientists Discover Plastic Nanoparticles in Men's Testicles

BRIEF OVERVIEW

- Scientists discovered microplastics in men's testicles, raising concerns about their potential impact on reproductive health
- Researchers were surprised to find microplastics in the testicles, given the tight blood-tissue barrier in the male reproductive system, known as the blood-testis barrier
- The study found microplastics in all the testes examined, with polyethylene (PE) being the most common type of plastic
- A 2023 study similarly found microplastics in the male reproductive system, including the testis and semen
- Plastics are loaded with chemicals that are xenoestrogens that can mimic the effects of estrogen in your body; much of their danger is related to their stimulation of estrogen receptors

The average person eats about 5 grams of plastic per week — about the amount found in one credit card. So it's no wonder that tiny pieces of plastic are turning up throughout the human body, including in places you might not expect. Following research that found plastic particles in the human bloodstream,[2] and another study that found them in the human heart, scientists have now discovered microplastics in men's testicles.

The study's lead author, Dr. John Yu, a toxicologist in the College of Nursing at the University of New Mexico, wasn't expecting microplastics to have infiltrated the

testicles, given the tight blood-tissue barrier in the male reproductive system, known as the blood-testis barrier.

As noted in Pharmacological Reviews, "The blood-testis barrier (BTB) is one of the tightest blood-tissue barriers in the mammalian body." The presence of microplastics in the testes suggests that microplastics can bypass or penetrate the BTB, raising concerns about their ability to infiltrate other protected and sensitive tissues in the body, as well as their potential impact on reproductive health.

Microplastics Found in Human and Dog Testicles

For the study, researchers from the University of New Mexico measured 12 types of microplastics in 47 canine and 23 human testes. Microplastics are small plastic particles that are less than 5 millimeters in size. They may be intentionally manufactured for use in products like cosmetics, personal care items (such as exfoliating beads in face scrubs) and industrial applications. They also include microfibers shed from synthetic clothing during washing.

Microplastics also include small plastic fragments that result from the breakdown of larger plastic items, such as bottles, bags and other plastic debris. This breakdown can occur due to environmental exposure, such as sunlight (photodegradation), ocean waves and weathering.

The study involved both human and dog testicles, as dogs share many physiological and anatomical similarities with humans, making them a valuable model for studying human diseases and conditions.

Further, because dogs share the same living environment as humans, they are exposed to similar pollutants, chemicals and other potential hazards. As such, they're often considered sentinel animals, meaning they can serve as early warning indicators of potential health risks and environmental hazards that might also affect humans.

The study found microplastics in all the canine and human testes examined, with significant differences between individuals. On average, total microplastic levels were

122.63 µg (micrograms) per gram (g) in dogs and 328.44 µg/g in humans. Both humans and canines had similar proportions of the main types of microplastics, with polyethylene (PE) being the most common.

Polyvinyl chloride (PVC) was also detected and linked with lower sperm count in dog testicles. Higher levels of PVC were also associated with decreased weight of the testicles, as was polyethylene terephthalate (PET). A 2023 study similarly found microplastics in the male reproductive system, including the testis and semen.

Are Microplastics Involved in Male Infertility?

It's estimated that 11 million tons of plastic waste enter the world's oceans annually -- an amount that could nearly triple by 2040. What's the end result of a plastic world? An impending fertility crisis is upon us. Men experienced a 50% to 60% decline in sperm counts from 1973 to 2011, according to a 2017 study published in Human Reproduction Update.

An update to the study, which includes data from 53 countries and an additional seven years — 2011 to 2018 — found sperm concentration declined "appreciably" by 51.6% from 1973 to 2018. The percent decline per year doubled, increasing from 1.16% after 1972 to 2.64% after 2000.

Total sperm count also declined at an alarming level — 62.3% from 1973 to 2018. A class of plastic chemicals called phthalates, which are so ubiquitous that the U.S. Centers for Disease Control and Prevention has stated "phthalate exposure is widespread in the U.S. population," may be particularly to blame.

An estimated 8.4 million metric tons of plasticizers, including phthalates, are used worldwide each year, with phthalate production amounting to about 4.9 million metric tons annually. Microplastics often contain phthalates, which can leach out of the material causing endocrine-disrupting effects.

Exposure to Plastic Chemicals in Utero May Affect Male Fertility as an Adult

Women's exposure to phthalates during pregnancy is linked to male babies' anogenital distance (AGD) — the distance from the anus to the base of the penis — with higher exposure associated with shortened AGD.[19] Later in life, shorter AGD is linked with a smaller penis and poorer semen quality, such that AGD at birth may be predictive of adult reproductive function.

Phthalate syndrome refers to a number of disturbances to male reproductive development that have been observed after exposure to phthalates in utero. In studies on rats, it's been found that when a rat that's been gestating in a mother rat fed phthalates during the sensitive periods of reproduction, his genitals end up smaller and less developed, his testicles might not be fully descended, his penis may be smaller, and the whole size of the genital area is smaller.

What's more, phthalates represent only one class of endocrine-disrupting chemicals. There are many more, including bisphenol-A (BPA), flame retardants, pesticides and per-and polyfluoroalkyl chemicals (PFAS) chemicals. Since microplastics often contain harmful endocrine-disrupting chemicals, this is one way they may affect fertility.

It's also likely that they affect fertility via other mechanisms as well, including inflammation, oxidative stress and even direct disruption of reproductive functions if they accumulate in the testes and other sensitive areas.

An evidence review conducted for California State Legislature in 2023 revealed, in fact, that "exposure to microplastics is suspected to adversely impact sperm quality and testicular health in humans based on … high quality of the body of evidence."[26]

Plastic's Estrogenic Effects

Plastics are xenoestrogens that can mimic the effects of estrogen in the body.[27] Much of their danger is related to their stimulation of estrogen receptors. Phthalates, for

instance, have estrogenic properties, and some endocrine-disrupting chemicals are also considered estrogenic carcinogens.

This is because the abnormal stimulation of estrogen receptors promotes cell proliferation and potentially contributes to the development and progression of estrogen-sensitive cancers, such as breast cancer and endometrial cancer.

Due to their estrogenic effects, plastics exposure contributes to estrogen dominance, which may affect men's reproductive health. Exposure to certain endocrine disruptors is associated with reduced semen quality and impaired fertility in men, for instance, while endocrine disruptors — particularly xenoestrogens — are also "etiologic factors in the global decrease of sperm counts and other problems of the male reproductive tract."

Additional Strategies to Decrease Your Estrogen Load

Considering that estrogenic microplastics are ubiquitous in the environment, including in food and drinking water, taking steps to avoid them is important both for reproductive and overall health - and may help lower your estrogen burden.

You can help reduce your exposure by becoming conscious of the plastic you're using daily - and cut back where you can. Some steps are easy, like swapping plastic bags, bottles, straws, utensils and food containers for more durable, reusable options. You'll also want to choose fresh foods as much as possible. Avoid fast foods and ultraprocessed foods, and choose those with minimal natural packaging or glass packaging instead.

You should also filter your drinking water and be mindful of the materials you use in your home. Avoid flooring, shower curtains and furniture made with phthalates, and vacuum often to pick up household dust, which is often contaminated. Some additional commonsense strategies that can help you limit your exposure and lower your estrogen load include:

Avoid synthetic estrogens — Minimize exposure to synthetic estrogens, such as those found in hormone replacement therapy and oral contraceptives. Consult with a qualified health care professional about alternative treatments and/or contraceptive methods with lower estrogen content.

Avoid linoleic acid (LA) — Omega-6 PUFA like LA functions very similarly to estrogen as they both increase your risk for cancer and decrease metabolic function by suppressing your thyroid.

Choose natural products — Opt for natural and organic personal care products, including makeup, skin care, and hair care items, to reduce exposure to synthetic chemicals like parabens and phthalates, which have estrogenic properties.

Limit pesticide exposure — Choose organic produce whenever possible to reduce exposure to pesticides, many of which have estrogenic effects. Washing fruits and vegetables thoroughly can also help remove pesticide residues.

Rethink your household products — Many household cleaning products, laundry detergents and air fresheners contain chemicals with estrogenic properties. Swap them out for natural, nontoxic alternatives or make your own cleaning solutions using vinegar, baking soda and essential oils instead.

Avoid plastic containers — Minimize the use of plastic containers and food packaging, which can leach estrogenic compounds into food and beverages. Instead,

opt for glass or stainless steel containers for food storage and water bottles.

Maintain a healthy weight — Aim for a healthy weight and body composition through a balanced diet and regular exercise. Excess body fat, particularly around the thighs, hips, and buttocks, can contribute to higher estrogen levels.

Support liver health — Support liver function, as your liver plays a crucial role in metabolizing and eliminating excess estrogen from your body. Eat a nutrient-rich diet, limit alcohol consumption and consider incorporating liver-supporting herbs and supplements, such as milk thistle or dandelion root.

Promote hormonal balance — Explore natural approaches to promote hormonal balance, such as consuming foods rich in cruciferous vegetables (such as broccoli, cauli**fl**ower and kale), which contain compounds that help support estrogen metabolism and detoxi**fi**cation.

Reduce stress — Manage stress through relaxation techniques like meditation, deep breathing exercises, yoga or spending time in nature. Chronic stress can disrupt hormone balance, including estrogen levels, so prioritizing stress reduction is essential.