

# Researchers Find Microplastics in Stool Samples

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✓ Fact Checked

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## STORY AT-A-GLANCE

- › The suspicion that we're consuming our own plastic pollution was recently reconfirmed when researchers discovered microplastic particles in human stool samples
- › The stool samples were tested for the presence of 10 different types of plastics, of which nine were found in the samples. On average, participants had 20 microplastic particles per 10 grams of stool
- › Tests reveal both tap water and bottled water contain microplastics, as does your household dust and many foods, especially seafood and sea salt, but also any food that has been stored in plastic packaging
- › Research suggests microplastic may have an adverse effect on your gut microbiota; polystyrene microplastics affected the gut barrier, microbiota and metabolism of mice
- › By 2050, the world's oceans will contain more plastic than fish, and the annual release of plastics to land is estimated to be four to 23 times greater than that released into oceans

***Editor's Note: This article is a reprint. It was originally published November 7, 2018.***

Tests reveal both tap water and bottled water<sup>1</sup> contain microplastics, as does your many foods, especially seafood<sup>2,3</sup> and sea salt,<sup>4</sup> but also any food that has been stored in plastic packaging.

The suspicion that we're consuming our own plastic pollution was recently reconfirmed when researchers reported the discovery of microplastic particles in human stool

samples. The consequences of ingesting microscopic plastic bits and pieces is still relatively unknown.

But considering the fact that plastic will not degrade within a human lifetime, and that many of the chemicals used in the production of plastic are known endocrine disruptors, chances are the impact on human health may be greater than suspected.

Animal research has also shown microplastics affect the gut barrier and the composition of gut microbiota in mice, and that they have toxic effects on the liver in fish.

## **Microplastic Debris Found in Human Stool Samples**

The study<sup>5,6,7,8</sup> in question was done by researchers from the Medical University of Vienna in collaboration with the Austrian Environment Agency. The findings of this pilot study were presented October 23, 2018, at the annual United European Gastroenterology conference in Vienna. As reported by Salon magazine:<sup>9</sup>

*"Eight people from Finland, Italy, Japan, the Netherlands, Poland, Russia, the United Kingdom and Austria participated in the study. Each person kept a food diary the week before the stool sampling occurred which showed researchers that all participants were exposed to foods that were either wrapped in plastic, or they drank from plastic bottles. Six of the eight ate sea fish, too; none of them were vegetarians."*

The stool samples were tested for the presence of 10 different types of plastics, of which nine were found in the samples. On average, participants had 20 microplastic particles per 10 grams of stool.

The most common types of plastic were polypropylene (found in bottle caps), polyethylene terephthalate or PET (found in water bottles, plastic bags and textile fibers) and polystyrene (found in takeout food containers, cups and plastic utensils). The particles ranged in size from 50 micrometers (about the width of a human hair) to 500

micrometers. According to lead researcher Dr. Philipp Schwabl, who called the results "astonishing":

*"This is the first study of its kind and confirms what we have long suspected, that plastics ultimately reach the human gut. Of particular concern is what this means to us, and especially patients with gastrointestinal diseases<sup>10</sup> ...*

*There are initial indications that microplastics can damage the gastrointestinal tract<sup>11</sup> by promoting inflammatory reactions or absorbing harmful substances<sup>12</sup>*

...

*While the highest plastic concentrations in animal studies have been found in the gut, the smallest microplastic particles are capable of entering the blood stream, lymphatic system and may even reach the liver. Now that we have first evidence for microplastics inside humans, we need further research to understand what this means for human health<sup>13</sup> ...*

*I believe that trying to reduce plastic usage and plastic-packed food might be beneficial for nature and for us. Certainly, plastic is a very useful material and has a lot of clever applications. But maybe we should try to rethink about the necessity of abundant plastic use, and search for and support ecological and sustainable alternatives."<sup>14</sup>*

## **Plastic Pollution Invades Farmland**

Disturbingly, plastic pollution is also accumulating on farmland. According to research<sup>15</sup> published in Science of the Total Environment, the annual release of plastics to land may actually be four to 23 times greater than that released to oceans! The use of sewage sludge (biosolids) as fertilizer is one major source of all this plastic pollution.

When factoring in the range of sludge application rates, and assuming data from certain other countries with similar plastics usage are comparable, the total annual input of microplastics to European and North American farmlands is thought to be 63,000 to 430,000, and 44,000 to 300,000 tons respectively.

## **Are Microplastics Contributing to Bowel Diseases and Cancer?**

Dr. Herbert Tilg, president of the Austrian Society of Gastroenterology and chair of the United European gastroenterology scientific committee (who did not take part in the study), worries that microplastics may be a factor contributing to rising rates of inflammatory bowel syndrome and colon cancer. He told New Hampshire Public Radio:<sup>16</sup>

*"Colon cancer is increasing in young people, and we think that either dietary or environmental components are a factor. Now that we know we can detect microplastics in humans, we can develop larger studies, in both healthy and diseased patients, to find out if they are a contributing factor."*

## **Microplastics Linked to Altered Microbiota and Liver Toxicity**

As noted by Schwabl, recent research suggests microplastic may indeed have an adverse effect on gut microbiota. The study,<sup>17</sup> published in *The Science of the Total Environment*, found that polystyrene microplastics affected the gut barrier, microbiota and metabolism of mice. As reported by the authors:

*"In this study, we exposed male mice to 5 micrometers pristine and fluorescent polystyrene microplastics (MP) for six weeks. The results showed that the polystyrene MP was observed in the guts of mice and could reduce the intestinal mucus secretion and cause damage the intestinal barrier function ...*

*At the phylum level, the content of Actinobacteria decreased significantly in the polystyrene MP-treated group ... [T]he diversity of gut microbiota was altered after polystyrene MP exposure. At the genus level, a total of 15 types of bacteria changed significantly after exposure to polystyrene MP.*

*Furthermore, the predicted KEGG (Kyoto Encyclopedia of Genes and Genomes) metabolic pathway differences indicated that the main metabolic pathways of the functional genes in the microbial community were significantly influenced by the polystyrene MP.*

*In addition, indexes of amino acid metabolism and bile acid metabolism in the serum were analyzed after polystyrene MP exposure. These results indicated that polystyrene MP caused metabolic disorders. In conclusion, the polystyrene MP induced gut microbiota dysbiosis, intestinal barrier dysfunction and metabolic disorders in mice ..."*

Another study<sup>18</sup> published in 2016 found polystyrene microplastics accumulated in zebrafish and stressed the liver. After just seven days of exposure, particles measuring 5 micrometers had accumulated in the gills, liver and gut. Particles measuring 20 micrometers in diameter accumulated the gills and gut only.

Histopathological analysis revealed the particles caused inflammation and the accumulation of lipids in the liver, and "significantly increased activities of superoxide dismutase and catalase, indicating that oxidative stress was induced." Metabolomic analysis also found the microplastics "induced alterations of metabolic profiles in fish liver and disturbed the lipid and energy metabolism."

Earlier research<sup>19</sup> has also proven that microplastics are taken into cells and cause significant effects on the tissue of the blue mussel under laboratory conditions.

## **Most Bottled Water Is Contaminated With Microplastics**

As mentioned earlier, recent tests<sup>20</sup> reveal drinking water is now nearly universally contaminated with microplastics, whether you're getting it from your tap or from bottled water. Just 17 of 259 bottles of water tested were found to be free of microplastic particles, and none of the 11 brands tested consistently free of plastic contaminants.

On average, the bottled water tested contained 325 pieces of microplastic per liter. The worst offender was Nestlé Pure Life, the most contaminated sample of which contained 10,390 particles per liter, while the least contaminated brand, San Pellegrino, contained a high-end density of 74 particles per liter. Here's a summary breakdown of the most and least contaminated brands:<sup>21</sup>

## Most contaminated brands

## Least contaminated brands

Nestlé Pure Life	San Pellegrino
Bisleri	Evian
Gerolsteiner	Dasani
Aqua	Wahaha
Epura	Minalba

As noted by Orb Media, which commissioned the testing:<sup>22</sup>

*"[F]indings suggest that a person who drinks a liter of bottled water a day might be consuming tens of thousands of microplastic particles each year ... For microplastic debris around 100 microns in size ... bottled water samples contained nearly twice as many pieces of microplastics per liter (10.4) than the tap water samples (4.45) ...*

*According to existing scientific research, the plastic particles you consume in food or drinks might interact with your body in a number of different ways ... Some particles might lodge in the intestinal wall. Others might be taken up by intestinal tissue to travel through the body's lymphatic system ...*

*Smaller debris, in the range of 20 microns (0.02 mm) has been shown to enter the bloodstream before it lodges in the kidneys and liver ... Ninety percent of the plastic particles we found ... were ... small enough ... for some to cross the gut into your body."*

## How You Can Be Part of the Solution

Our cultural affection for all things disposable has left a trail of destruction. Now, how can you be part of the solution? In short, by becoming a more conscious consumer.

Really give some thought to the manufacturing of the products you buy, how they may affect you during use, and what will happen to them once you dispose of them.

Few of us are capable of living a zero-waste lifestyle at this point in time, but every single one of us can take small but definitive steps toward the goal of reducing plastic trash in all of its forms. Here are a few suggestions to consider:

**Avoid bottled water** — Instead, invest in a good water filtration system for your home and fill your own reusable bottles with filtered tap water. Previous testing has revealed most bottled water is nothing but tap water anyway, which may or may not have undergone additional filtration. With over 267 toxins found in public tap water, it's worth the investment to install a high-quality filter and bring your own water wherever you go.

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**Reduce your use of all things plastic** — Purchase products that are not made from or packaged in plastic. While the items involved are near-endless, here are a few ideas:

- Use reusable shopping bags for groceries
  - Bring your own mug when indulging in a coffee drink, and skip the lid and the straw
  - Store foods in glass containers or mason jars as opposed to plastic containers or bags
  - Take your own leftover container to restaurants
  - Request no plastic wrap on dry cleaning
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**Avoid microfiber clothing such as fleece, and/or wash them as infrequently as possible** — Stretchy fabrics and fleece items shed copious amounts of microscopic plastic fibers each time they're washed. Due to their tiny size, these microfibers<sup>23</sup> flow straight through the wastewater treatment plant without being caught.

Up to 1.7 million tons of microfibers enter the ocean each and every year,<sup>24</sup> and testing shows synthetic microfibers make up 85 percent of shoreline debris

worldwide.<sup>25</sup> Once in the water column, this plastic microdebris blocks sunlight required for plankton and algae to thrive, and the ramifications of this reverberates throughout the entire food chain.

Not only do the actual fibers pose a health hazard to the sea life that consume them, since they bioaccumulate, these fibers also act like sponges, soaking up and concentrating toxins like PCBs, pesticides and oil, making the animal – which could end up on your plate – even more toxic than it normally would be.

A far "cleaner" option all-around is 100 percent organic clothing – cotton, hemp, silk, wool or bamboo fabrics dyed with natural, nontoxic dyes. The Bluesign System Certification<sup>26</sup> tells you the item has been manufactured with a minimal amount of hazardous chemicals, or none.

Wash synthetic clothing as irregularly as possible using a mild detergent. Line dry instead of putting them in the dryer, as the heat and agitation will break down fibers. Handwashing or using the gentle cycle with cold water will also minimize the shedding of fibers, as will using a front loading washing machine.

You can also install a microfiber filter on your washing machine, but the fibers will still end up in the environment since they'll end up in trash destined for a landfill.

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**Recycle what you can** – Take care to recycle and repurpose products whenever possible, and/or participate in "plastic drives" for local schools, where cash is paid by the pound.

Remember recyclables must never be placed in a plastic bag, as recycling facilities will simply send bagged items to a landfill.<sup>27</sup> So, to ensure your recyclables actually get recycled, make sure you place the items loose in your recycle bin.

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## Sources and References

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