Recent studies show bottled water containing **excessive levels of microplastics** - small pieces of plastic debris less than five millimeters in size. According to research conducted by Orb Media, 93% of the 11 bottled water brands sampled, all showed traces of microplastics.

What Contaminants Are In Bottled Water?

Bottled water that is not purified, such as spring or mineral water, can contain bacteria, parasites, and viruses. Several brands of bottled water have tested positive for the parasite *cryptosporidium* and the bacteria *E. coli* in recent years. However, microplastics is the most prevalent contaminant in bottled water.

In fact, a recent study of 259 bottles of water found 93% contained microplastics(Ref 1).

However, unlike municipal water facilities, bottled water companies do not have to notify the public if their water contains contaminants. Even if the contaminant is dangerous, or in excessive concentrations.

REF 1 Tyree & Morrison. Plus Plastic: Microplastics found in global bottled water. Orb Media.

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Microplastics found in human blood for first time...

Exclusive: The discovery shows the particles can travel around the body and may lodge in organs

Microplastic pollution has been detected in human blood for the first time, with scientists finding the tiny particles in almost 80% of the people tested.

The discovery shows the particles can travel around the body and may lodge in organs. The impact on health is as yet unknown. But researchers are concerned as microplastics cause damage to human cells in the laboratory and air pollution particles are already known to enter the body and cause millions of early deaths a year.

Huge amounts of plastic waste are dumped in the environment and microplastics now contaminate the entire planet, from the summit of Mount Everest to the deepest oceans. People were already known to consume the tiny particles via food

and water as well as breathing them in, and they have been found in the fetus of babies and adults.

The scientists analyzed blood samples from 22 anonymous donors, all healthy adults and found plastic particles in 17. Half the samples contained PET plastic, which is commonly used in drinks bottles, while a third contained polystyrene, used for packaging food and other products. A quarter of the blood samples contained polyethylene, from which plastic carrier bags are made.

“Our study is the first indication that we have polymer particles in our blood – it’s a breakthrough result,” said Prof Dick Vethaak, an ecotoxicologist at Vrije Universiteit Amsterdam in the Netherlands. “But we have to extend the research and increase the sample sizes, the number of polymers assessed, etc.” Further studies by a number of groups are already under way, he said.

“It is certainly reasonable to be concerned,” Vethaak told the Guardian. “The particles are there and are transported throughout the body.” He said previous work had shown that microplastics were 10 times higher in the faeces of babies compared with adults and that babies fed with plastic bottles are swallowing millions of microplastic particles a day.

“We also know in general that babies and young children are more vulnerable to chemical and particle exposure,” he said. “That worries me a lot.”

The new research is published in the journal Environment International and adapted existing techniques to detect and analyze particles as small as 0.0007mm. Some of the blood samples contained two or three types of plastic. The team used steel syringe needles and glass tubes to avoid contamination, and tested for background levels of microplastics using blank samples.

Vethaak acknowledged that the amount and type of plastic varied considerably between the blood samples. “But this is a pioneering study,” he said, with more

work now needed. He said the differences might reflect short-term exposure before the blood samples were taken, such as drinking from a plastic-lined coffee cup, or wearing a plastic face mask.

“The big question is what is happening in our body?” Vethaak said. “Are the particles retained in the body? Are they transported to certain organs, such as getting past the blood-brain barrier?” And are these levels sufficiently high to trigger disease? We urgently need to fund further research so we can find out.”

The new research was funded by the Dutch National Organization for Health Research and Development and Common Seas, a social enterprise working to reduce plastic pollution.

“Plastic production is set to double by 2040,” said Jo Royle, founder of the charity Common Seas. “We have a right to know what all this plastic is doing to our bodies.” Common Seas, along with more than 80 NGOs, scientists and MPs, are asking the UK government to allocate £15m to research on the human health impacts of plastic. The EU is already funding research on the impact of microplastic on fetuses and babies, and on the immune system.

A recent study found that microplastics can latch on to the outer membranes of red blood cells and may limit their ability to transport oxygen. The particles have also been found in the placentas of pregnant women, and in pregnant rats they pass rapidly through the lungs into the hearts, brains and other organs of the fetuses.

A new review paper published on Tuesday, co-authored by Vethaak, assessed cancer risk and concluded: “More detailed research on how micro- and nano-plastics affect the structures and processes of the human body, and whether and how they can transform cells and induce carcinogenesis, is urgently needed, particularly in light of the exponential increase in plastic production. The problem is becoming more urgent with each day.”

Over the past decade, concerns about the health effects of bisphenol A (BPA) have forced food and beverage companies to largely abandon the use of the common plastic in many household items. In its place, they've turned to more than 50 "BPA-free" alternatives. Now, researchers report that some of these substitutes may cause the same ill effects in mice, particularly in

reproductive cells. If the new results hold in further animal and human studies, they could upend efforts to mollify consumers' health concerns over the plastics in food and beverage containers.

"It suggests these replacement bisphenols are not safe," says Patrick Allard, a molecular biologist at the University of California (UC), Los Angeles, who was not involved with the study.

Concerns about BPA have been swirling since the 1970s. In the decade after, it became ubiquitous in water bottles, toys, canned food linings, and even cash register receipts, as its clarity and toughness made it an essential component of polycarbonates and other common plastics. A 2003–04 study by the U.S. Centers for Disease Control and Prevention found that 93% of Americans have at least trace levels of BPA in their blood. Nevertheless, extensive studies by the U.S. Food and Drug Administration have not shown that BPA is dangerous to human health at normal exposure levels, though the conclusion remains controversial.

In 2003, while carrying out mouse studies unrelated to BPA, Patricia Hunt, a reproductive biologist at Washington State University in Pullman, and her colleagues found that the compound was leaching out of plastic cages housing female mice. The result was an increase in chromosomal abnormalities in the lab animals and their offspring. That finding, along with others in animals that suggested BPA "disrupts" estrogen hormone receptors, triggered an avalanche of studies that fingered the compound as interfering with meiosis, the process by which the number of chromosomes is cut in half and chromosomal segments are shuffled during the production of sperm and egg cells. The finding also led to new mouse cages, made of a more durable plastic called polysulfone.

But in recent studies, Hunt and her colleagues again noticed odd results in their mice. It was "a strange déjà vu experience," Hunt says. "Our control studies started going wacko." After months of work, Hunt and her colleagues traced the problem to contamination from cages damaged by washing and other normal wear and tear.

Hunt sent samples from damaged and undamaged cages to Roy Gerona, a chemist at UC San Francisco. Gerona and colleagues determined that the damaged cages were leaching out compounds manufacturers often use to replace BPA, such as bisphenol S (BPS) and diphenyl sulfone.

Gerona puzzled over an additional oddity: Polysulfone doesn't contain BPS. After evaluating the starting material and leachates, Gerona says he believes the polysulfone degraded to produce BPS and other BPA-like compounds.

After getting the contamination under control, Hunt and her colleagues decided to test the effects of BPA alternatives directly. They fed pregnant female mice low doses of BPA, BPS, diphenyl sulfone, or a placebo. Compared with unexposed females, those exposed to BPA or its

alternatives produced more protein markers of genetic damage during meiosis, they report today in *Current Biology*.

In previous studies, that kind of genetic damage has gone on to cause aneuploidy, an abnormal number of chromosomes that can trigger miscarriage in females and reduced sperm count in males. What's more, in the current study Hunt and her colleagues showed that the effect lasts beyond the mothers and fetuses directly exposed to BPA and its alternatives. Genetic abnormalities persisted for two generations of male mice unexposed to BPA and its substitutes.

Just what this means for people is hard to say. "Nobody has ever proven it causes harm at the levels to which people are normally exposed to it," says Oliver Jones, a chemist at RMIT University in Melbourne, Australia. However, Hunt and others suggest that the strong similarities in chemical structure between BPA and some of its alternatives mean that consumers may be wise to be wary of labels that tout "BPA-free" products.

The study also raises concerns about the reliability of widespread studies of BPA, says Monica Colaiacovo, a geneticist at Harvard Medical School in Boston. Ongoing studies of BPA's effects commonly house animals in plastic cages previously thought not to expose them to bisphenollike compounds. Yet, Hunt's cages were inadvertently subjecting animals to contamination.

"If you are already producing an effect in your control [animals], you might fail to see a significant difference" in your experimental animals, Colaiacovo says. This could make it even harder for scientists in the future to sort out any real dangers of BPA and its family of replacements.

***Correction, 13 September, 3:35 p.m.:** This story has been updated to reflect that the first carcinogenesis study of BPA was launched by the National Cancer Institute in 1977.*