## Microplastics now causing problems in most life forms - many studies

Note: "Microplastics" = 100 nm to 5 mm in size  Nanoplastics 1 to 100 nm in size
but many groups seem to now consider "Microplastics" = 1 nm to 5 mm

As of June 2024, Vitamin D has been proven to reduce microplastic problems only in Zebrafish,
Perhaps during 2024, there will be evidence of Vitamin D fighting microplastics in mice,
and perhaps in 2025 vitamin D will be found to fight microplastics in humans.

**The founder of VitaminDWiki has taken many steps to reduce microplastics at home**

1. Filter tap water that is consumed (Zero Filter)
2. Eliminated all plastic food containers
3. Use HEPA air filters that capture even nanoplastics - as well as COVID and other viruses
4. Stop using plastic-covered paper plates in the microwave
5. Transfer frozen dinners to non-plastic containers before putting the food into the microwave

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- What changes can I make to avoid microplastics (from water, air, food, etc) - Perplexity AI July 2024
- VitaminDWiki - Microplastics change the gut microbiome - Jan 2025
- Microplastics caused Parkinson's-like symptoms (In mice so far) - Dec 2024
  - Microplastics might be a cause of Parkinson's - Nov 2023
- Microplastics and Human Health: Unveiling the Gut Microbiome Disruption and Chronic Disease Risks - Dec 2024?
- Fate of Microplastics in Wastewater Treatment Plants - book Nov 2024
- Polystyrene microplastics found in Prostate cancers, but not elsewhere in Prostate (small study) - Oct 2024
- Microplastics in the Olfactory Bulb of the brain in 8 out of 15 people - Sept 2024
- Microplastics in ecological system: Their prevalence, health effects, and remediation - Sept 2024
- What Microplastics Are Doing to the Brain, Body, and Reproductive Systems - Dr. Patrick Sept 2024
- A sea fugus has learned how to slowly eat polyethylene that has been exposed to UV (at the surface) - July 2024
- Microplastics found in 8 human organ systems - scoping review Aug 2024
- Increased vascular blockage associated with increased microplastics – Aug 2024
- Microplastics especially found in pancreatic, lung, gastric and colorectal tumors – Sept 2024
- Breastmilk proteins altered by microplastics - July 2024
- Surprise: Biodegradable microplastics may actually be worse for soil and plants - July 2024
- Microplastics in many people with calcified blood vessels (24% of adults have vascular calcification) - Dec 2023
- Microplastics found in ALL 16 patients with bone marrow diseases (leukaemia, etc.) - July 2024
- Microplastics in milk for infants (both breast and formula) change proteins that may affect health - July 2024
- Women with Cervical Cancers have high levels of microplastics in both cervix and blood - June 2024
- How microplastics and nanoplastics affect systems of the human body - review June 2024
- Human Toxicity of Nano- and Microplastics - book chapter behind paywall - June 2024
- Microplastics and Fertility
  - Microplastics increase miscarriage in humans (and mice) - March 2024
    - 40% increase in recent summer miscarriage rates in the US - Perplexity AI July 2024
  - Exposure to microplastics and human reproductive outcomes: A systematic review - Jan 2024
  - Toxicity of microplastics and nanoplastics: invisible killers of female fertility and offspring health - Aug 2023
  - Microplastics found to affect rat semen etc. (no data on humans yet) - June 2024
- Plastic takeaway food containers may cause human intestinal damage (200,000 particles per cm2 when heated) – June

2024

- Good news: clear, black, shiny plastics degrade into microplastics far more slowly (not adsorb UV) - May 2024
- Microplastics and Their Implications for Human Health: A Scientific Exploration – May 2024
- Micro and nanoplastics in plaque: 4.5 X higher risk of cardiovascular events and death - May 2024
- Fish ingesting microplastics have gut, reproduction, brain injury etc, problems – May 2024
- Probiotics should fight microplastics problems in the gut: A Comprehensive Review - May 2024
- Impact of microplastics on human health and aquatic species - May 2024
- 150 plastic plants and chemical industries = Cancer Alley: cancer rates 50 X higher - May 2024
- Chart of studies of microplastics in humans - 2020
- Review of many microplastic medical studies - substack March 2024
- Health risk of human exposure to microplastics: a review - March 2024
- Microplastics appear to impact human organs ($65 paywall) - March 2024
- Microplastics Linked to Heart Attack, Stroke and Death - Scientific American March 2024
- Plaques were removed: those having microplastics had a 4.5 X increased risk of stroke, heart attack, etc. - March 2024
  - Study was described in a 8 minute video March 2024 - 2 charts from PDF
- Effects of Microplastics and Nanoplastics in Agro-ecosystems and Human Health: A review - Jan 2024
- Detection of Various Microplastics in Patients Undergoing Cardiac Surgery - July 2023
- Microplastics reduced bio-avalability of Zinc and Magnesium essential for vitamin D metabolism (in mice) - July 2023
- Microplastics and human health: Integrating pharmacokinetics - April 2023
- Microplastics as an Emerging Threat to the Global Environment and Human Health - July 2023
- Microplastics and human health: Integrating pharmacokinetics - April 2023
- The Plastic Within: Microplastics Invading Human Organs and Bodily Fluids Systems - Nov 2023
- Microplastics contamination in food products: Occurrence, analytical techniques and potential impacts on human health - Feb 2024
- The potential impacts of micro-and-nano plastics on various organ systems in humans - Lancet Jan 2024
- VitaminDWiki - Autism risk if toxins, heavy metals, microplastics, etc during pregnancy (unless add Vitamin D) – Feb 2024
- Microplastics causing problems in Zebra fish - reduced by 40% if Vitamin D was added - Nov 2023
- People are now INHALING a credit card's worth of plastics each week - Sept 2023
- Study: people could be EATING a credit card's worth of microplastics per week- 2019
- Microplastics may increase snow melt, and thus increase climate warming
- 8 Types of Plastic Discovered in People Who Had Heart Surgery - Sept 2023
- Microplastics in fruit and vegetables
- 100K-400K NANOplastic particles in a liter of bottled water - Jan 2024
- Microplastics perturb macrophages in the lab - May 2023
- 94% of US water contains microplastics
- 500 tons of RF chaff into the US annually, vs 878 tons of microplastics into the ocean from all washing machines US and Canada - Feb 2024
- Web- seabirds, humans, baby formula, breast cancer
- Rainfall in the Rocky Mountains contains microplastics - 2019
- Microplastics in Mosquitoes - Sept 2018

- Zero Water countertop filter eliminates microplastic (nanoplastic too?)
- Chart of the size of nano and microplastics removed by type of water filter - Jan 2024?
- Visualizing the amount of microplastic we eat - Dec 2019
- 5+ VitaminDWiki pages with BPA in title
- Your clothes can shed 700,000 microplastic fibers in a single wash - Feb 2023
- A Detailed Review Study on Potential Effects of Microplastics and Additives of Concern on Human Health - Feb 2020
- Microplastics Pollution as an Invisible Potential Threat to Food Safety and Security, Policy Challenges and the Way Forward - Dec 2020
- VitaminDWiki – PFAS (forever chemicals) reduce Vitamin D and VDR, cause health problems - many studies
- VitaminDWiki – Interactions with Vitamin D contains

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**What changes can I make to avoid microplastics (from water, air, food, etc) - Perplexity AI July 2024**

Microplastics are pervasive in our environment, found in water, air, and food. While completely avoiding them is challenging, there are several practical steps you can take to minimize your exposure:

**Water**

- **Use a Water Filter:** Invest in a high-quality water filter that can remove microplastics. Look for filters with a fine mesh or activated carbon.
- **Avoid Bottled Water:** Bottled water often contains microplastics. Opt for filtered tap water instead.

**Air**

- **Ventilation:** Ensure good ventilation in your home to reduce indoor air pollution.
- **Air Purifiers:** Use air purifiers with HEPA filters to capture microplastic particles.
- **Avoid Synthetic Fabrics:** Reduce the use of synthetic textiles like polyester, which shed microfibers into the air. Choose natural fibers like cotton or wool instead.

**Food**

- **Avoid Processed and Packaged Foods:** Processed and packaged foods often contain microplastics. Choose fresh, whole foods whenever possible.
- **Reduce Seafood Consumption:** Seafood, especially shellfish, can contain high levels of microplastics. Limit your intake of these foods.
- **Organic Produce:** Buy organic fruits and vegetables to avoid pesticides that may contain microplastics.

**Cooking and Storage**

- **Avoid Heating Food in Plastic:** Do not microwave food in plastic containers, as heat can cause plastics to release harmful chemicals. Use glass or ceramic containers instead.
- **Use Glass or Stainless Steel:** Store food and drinks in glass or stainless steel containers rather than plastic ones.

**Personal Care Products**

- **Check Ingredients:** Avoid personal care products that contain microbeads or other plastic ingredients. Look for natural alternatives.

**Household Tips**

- **Non-Plastic Cleaning Tools:** Use natural sponges or cloths instead of plastic sponges and brushes, which can release microplastics during use.
- **Natural Cleaning Products:** Use natural cleaning products like vinegar and baking soda instead of chemical cleaners that may contain microplastics.

**Clothing Care**

- **Wash Less Frequently:** Reduce the frequency of washing synthetic clothes to minimize microfiber shedding.
- **Use a Guppyfriend Bag:** When washing synthetic fabrics, use a Guppyfriend bag or similar product to catch microfibers.

**General Lifestyle Changes**

- **Eat Lower on the Food Chain:** A plant-based diet can reduce exposure to microplastics, as these particles tend to accumulate in higher concentrations in animals higher up the food chain.

- **Stay Hydrated:** Drinking plenty of water helps your body flush out toxins, including microplastics.

By incorporating these strategies into your daily routine, you can significantly reduce your exposure to microplastics and contribute to a healthier lifestyle.

### VitaminDWiki - Microplastics change the gut microbiome - Jan 2025

### Microplastics caused Parkinson's-like symptoms (In mice so far) - Dec 2024

**PD-like pathogenesis induced by intestinal exposure to microplastics: An in vivo study of animal models to a public health survey**

https://doi.org/10.1016/j.jhazmat.2024.136974

"With the increasing incidence of non-hereditary Parkinson's disease (PD), research into the involvement of specific environmental factors, in addition to aging, has become more prominent. The effects of microplastic exposure on public health have gained increased attention as it is known to cause a range of neurotoxic changes, some of which are similar to the pathological features of PD. We carried out low-dose microplastic exposure experiments on mice and Caenorhabditis elegans models and implemented a survey regarding the utilization of plastic products in the population. We found that low-dose microplastic exposure accelerated dopamine neuron degeneration and the onset of movement disorders in vivo, inducing a PD-like neuronal pathology through its effects on the intestinal mucosal barrier, immune barrier, and microbial barrier. Notably, non-penetrating microplastics facilitated neuroinflammation by triggering excessive reactive oxygen species production and a sustained UPRmt. Furthermore, our population survey demonstrated that inappropriate use was a major source of microplastics in the gastrointestinal tract. The high use of disposable plastic tableware, especially in those with definite microplastic exposure, was also associated with intestinal inflammatory symptoms. As a novel pollutant, microplastic exposure in vivo undoubtedly executes an important role in the degeneration of dopamine neurons, regardless of barrier penetration, which is a non-independent risk factor that cannot be ignored in the athogenesis of PD."

Study mentioned age-adjusted PD incidence increased by 115% in 30 years (from 1990)

The sample of the PDF showed that the study looked at increased fecal microplastics, but did not indicate the amount of increase.

**Microplastics might be a cause of Parkinson's - Nov 2023**

**Nanoplastics Linked to Changes in Brain Proteins Associated With Parkinson's, Study Finds Science Alert**

**Reporting on**

**Anionic nanoplastic contaminants promote Parkinson's disease–associated α-synuclein aggregation Science Advances, FREE PDF**

### Microplastics and Human Health: Unveiling the Gut Microbiome Disruption and Chronic Disease Risks - Dec 2024?

**Abstract only (as of Oct 2024)**

they expect to have the full PDF "soon" - I guess Dec 2024

### Fate of Microplastics in Wastewater Treatment Plants - book Nov 2024

**Occurrence, Identification, Potential Factors, and Future Perspectives**

CRC $37 to rent for 6 months

**Preview PDF with Table of Contents of 14 chapters**

### Polystyrene microplastics found in Prostate cancers, but not elsewhere in Prostate (small study) - Oct 2024

**MedicalNewsNet**

Reporting on Identification and analysis of microplastics in para-tumor and tumor of human prostate FREE PDF

### Microplastics in the Olfactory Bulb of the brain in 8 out of 15 people - Sept 2024

**Microplastics in the Olfactory Bulb of the Human Brain**

JAMA Netw Open. 2024;7(9):e2440018. FREE PDF

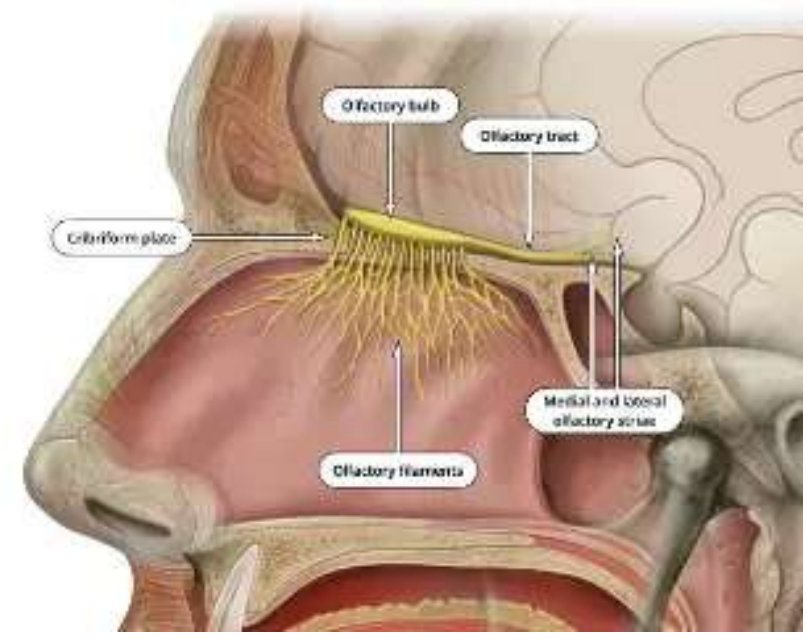
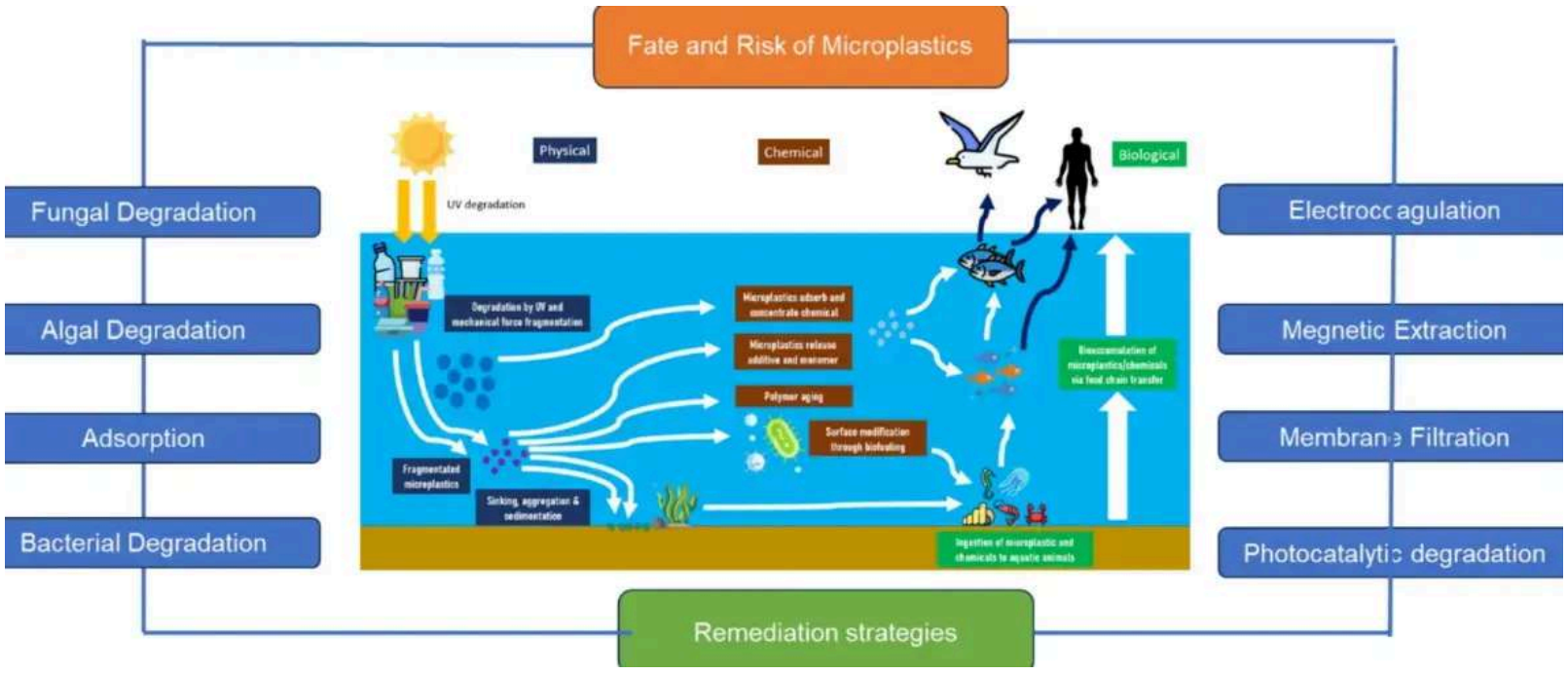


image is from the web, not the study

## Microplastics in ecological system: Their prevalence, health effects, and remediation - Sept 2024

Environmental Nanotechnology, Monitoring & Management - Sept 2024, https://doi.org/10.1016/j.enmm.2024.101007

**Note: Appears to focus on microplastics, and ignores nanoplastics, a much bigger problem**




**Zoomed in view of above chart**

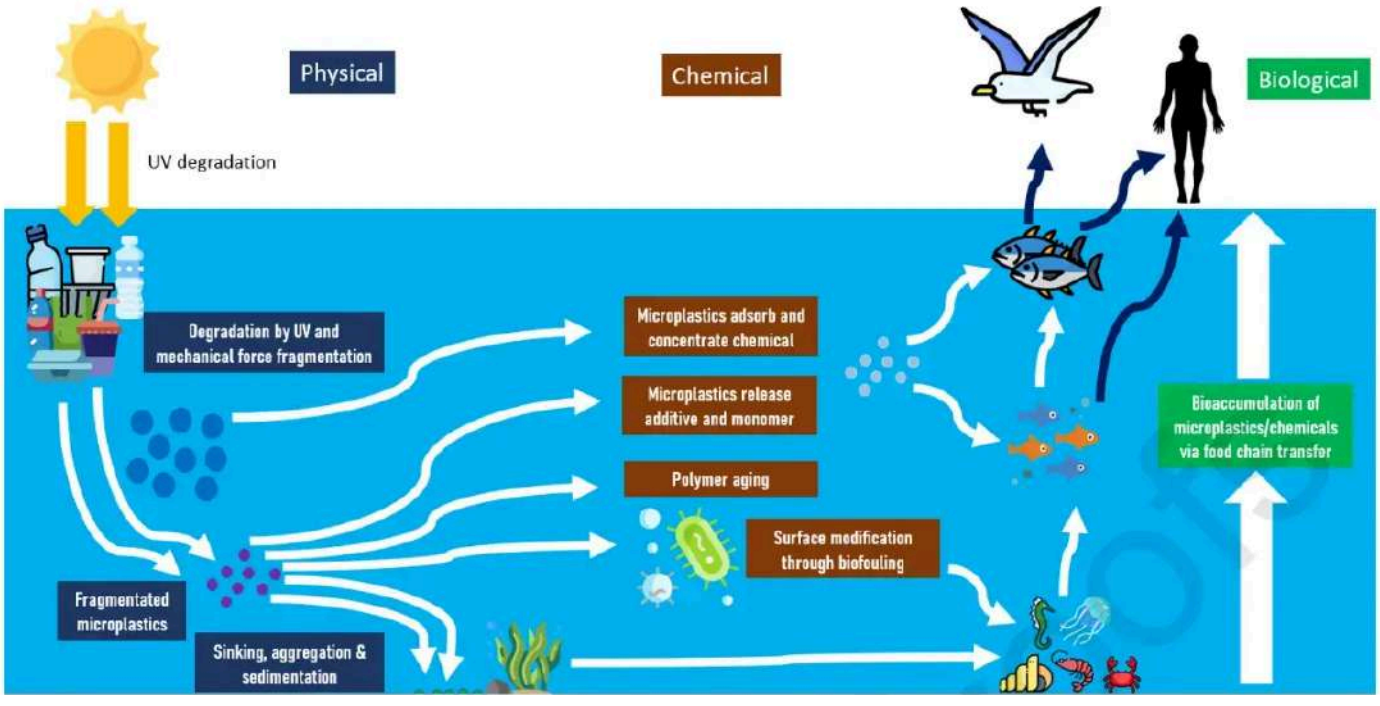


**Table 6.** Remediation methods with their pros and cons.

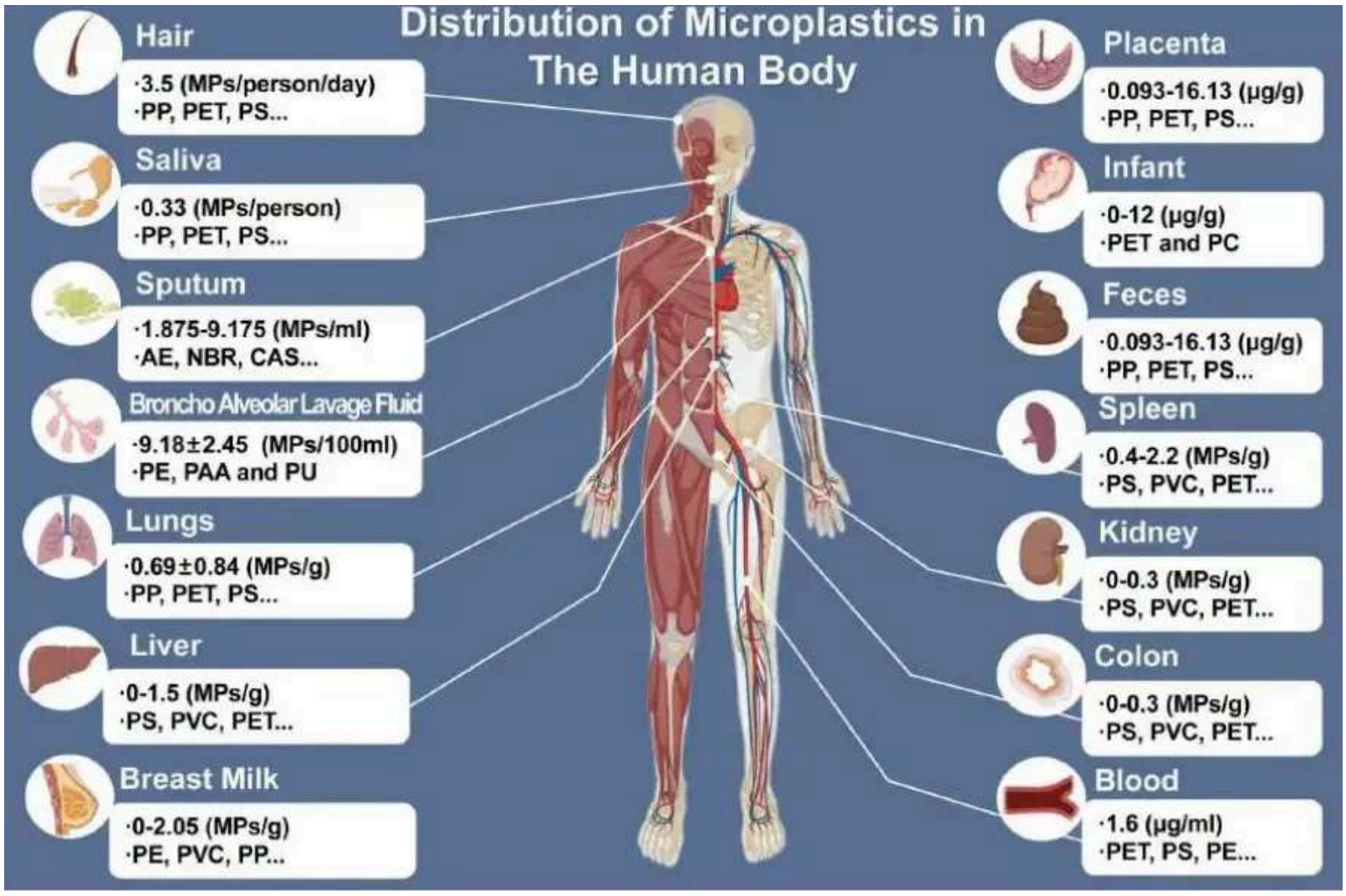
| Methods | Roles | Advantages | Disadvantages | References |
|---|---|---|---|---|
| Electrocoagulation | Coagulants are formed utilising metal electrodes and an electrical source | • High efficiency<br>• Low operating costs<br>• Automated systems<br>• Able to remove tiny particles | • High chemicals consumption<br>• High consumption of electrodes replacement<br>• Electricity reliant | Padervan et al. (2020); Dey et al. (2021) |
| Magnetic extraction | MPs are separated by using magnetic particles, acid, and magnetism | • Low operation cost<br>• Able to remove tiny-sized MP | • Secondary MP generated that cause pollution | Dey et al. (2021) |
| Membrane filtration | MPs are trapped by allowing the contaminated water to pass through the film | • Simple operation<br>• Low operating cost<br>• No chemical is required | • Membrane clogging<br>• Regular maintenance needed | Padervan et al. (2020); Dey et al. (2021) |
| Photocatalytic degradation | Decompose MPs into water and carbon dioxide | • No chemicals are needed<br>• Ecologically sustainable<br>• Less energy required | • Low removal efficiency<br>• Secondary MP generated that cause contamination | Kaewkam et al. (2022); Ouyang et al. (2021); Tofa et al. (2019); Han et al. (2017) |
| Adsorption | Adsorption occurs due to the Van der Waals forces between the adsorption material and the microplastics. These forces are weak and are affected by the size, shape, and polarity of the microplastics. The microplastics come in contact with the adsorption material and are attracted to its surface through these forces | Effective removal<br>Cost-effective<br>does not require the use of chemicals | Limited capacity<br>Secondary pollution<br>Not a complete solution | Yu et al. (2016); Rani et al. (2019); Shang et al. (2019); Wang et al. (2021) |
| Bacterial degradation | Break down plastics through enzymatic activities | • Low operating cost<br>• Environmental-friendly<br>• Complete degradation<br>• Potential for upcycling | • Long period of time needed<br>• Low efficiency<br>• Environmental conditions are unpredictable<br>• Risk of contamination | Roohi et al. (2017) |
| Fungal degradation | lipases, proteases, and cellulases can break down various types of plastics) | • Low operating cost<br>• Environmental-friendly<br>• Low energy required | • Limited effectiveness<br>• Slow process | Lacerda et al. (2020); Tournier et al. (2020); Devi et al. (2015) |
| Algae degradation | MPs are degraded into other chemical compounds ($CH_4$, $H_2S$, $CO_2$, $H_2O$) | • High efficiency<br>• Natural process<br>• $CO_2$ sequestration | • Nutrient requirements<br>• Difficulty on implementation on a large scale<br>• Breakdown products | Kim et al. (2020); Moog et al. (2019) |

Water is a fundamental component of human physiological processes, playing a crucial role in functions such as nutrient assimilation and metabolic activities. Furthermore, it plays a crucial role in guaranteeing a plentiful food supply for all organisms. In addition to its duty in providing nutrition, water serves as a home for many life forms and plays a vital part in establishing a conducive living environment. However, the introduction of plastic materials has led to the occurrence of microplastics (MPs) in aquatic environments, which has become a global issue that has attracted significant interest from both the scientific community and the general public. The increasing worldwide demand for plastics can be ascribed to its multifunctionality in commercial and industrial contexts, combined with its cost-effectiveness. Members of Parliament have been identified through multiple sources, including but not limited to cosmetic products, industrial wastes, and fishing operations. The primary aim of this research is to conduct a thorough examination of the consequences resulting from the widespread presence of MPs on both terrestrial and marine ecosystems, as well as the impact on human welfare. Therefore, it is crucial to develop efficient mitigation measures in order to remove MPs from water reservoirs, protect ecological integrity, and provide a safer environment for future generations. Furthermore, this work evaluates the benefits and limitations of utilized methodologies, elucidating the inherent difficulties in MPs research that require resolution in order to achieve a thorough comprehension of these particles. International collaboration plays a crucial role in efficiently resolving concerns related to marine pollutants, as they have the ability to disperse by wind and sea currents, leading to possible repercussions that are difficult to predict.



**What Microplastics Are Doing to the Brain, Body, and Reproductive Systems - Dr. Patrick Sept 2024**

[YouTube 74 minutes]




(00:03:59) Why exclusively drinking bottled water could increase your microplastic intake by up to 90,000 particles per year

(00:07:07) Why consuming food or drinks heated in plastic increases BPA exposure up to 55x

(00:08:07) How microwaving food in plastic containers can release over 4 million microplastic particles into a meal in just 3 minutes

(00:08:18) Why microwavable popcorn is a major source of PFAS (AKA, forever chemicals)

(00:21:15) How consuming canned soup daily for 5 days affects urinary BPA levels

(00:26:38) The likely link between BPA & autism spectrum disorder

(00:33:46) Why the brain may bioaccumulate plastic at 10-20x the rate of other organs

(00:34:17) The strong correlation between brain microplastic levels & neurodegenerative disease

(00:34:50) Why the growing amount of microplastic in human brains (50% more from 2016 to 2024) is cause for concern

(00:43:56) How drinking from an aluminum can lined with BPA can increase blood pressure in just a few hours

(00:50:31) Why you should never drink Topo Chico sparkling water

(00:53:02) The only water filtration method that removes up to 99% of microplastic particles

(00:57:14) Why disposable coffee cups are a major source of BPA exposure

(00:58:14) How salt adds 7,000 microplastic particles to your diet every year

(00:59:18) How to reduce microplastics in indoor air

(01:00:52) How to alter your wardrobe to reduce microplastic exposure

(01:02:32) Why handling receipts is a major source of BPA exposure — especially after using hand sanitizer

(01:06:28) Why sulforaphane could increase BPA, BPS, & phthalate excretion

(01:10:15) Are microplastic-associated chemicals excreted through sweat?

Excellent detailed show notes includes many charts **PDF**

## A sea fugus has learned how to slowly eat polyethylene that has been exposed to UV (at the surface) - July 2024

**Biodegradation of polyethylene by the marine fungus Parengyodontium album**

portions of the study are available online

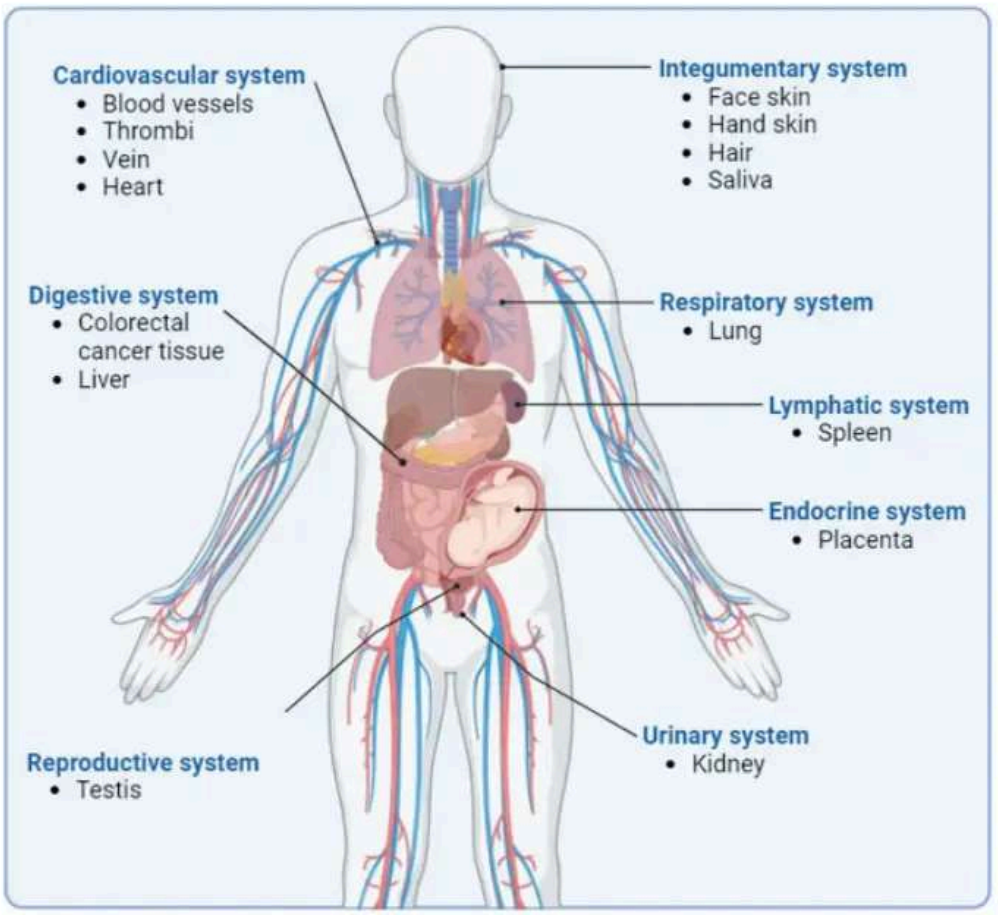
YouTube video describes the study and mentions land-based microbes consuming plastic as well

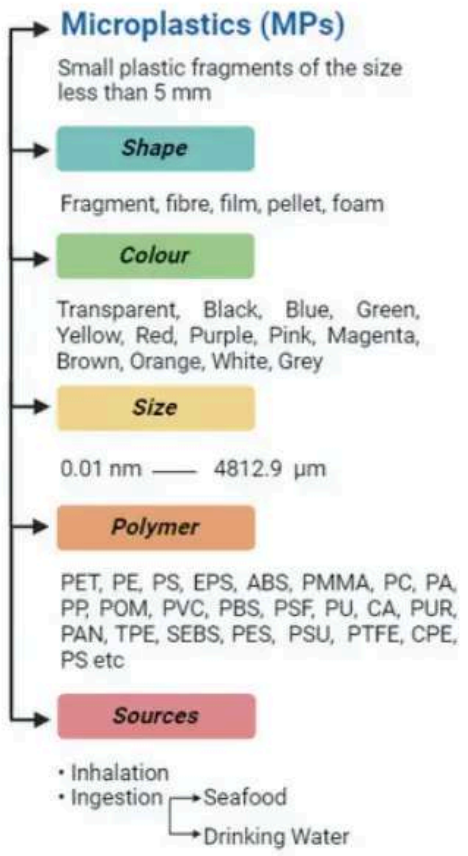
## Microplastics found in 8 human organ systems - scoping review Aug 2024

**Detection of microplastics in human tissues and organs: A scoping review**

J Glob Health 2024 Aug 23:14:04179. doi: 10.7189/jogh.14.04179

Nur Sakinah Roslan 1, Yeong Yeh Lee 2, Yusof Shuaib Ibrahim 3, Sabiqah Tuan Anuar 3, Ku Mohd Kalkausar Ku Yusof 3, Lisa Ann Lai 4, Teresa Brentnall 4




Background: Research on microplastics has largely focused on the environment and marine organisms until recently. A growing body of evidence has detected microplastics in human organs and tissues, with their exact entry routes being unclear and their potential health effects remain unknown. This scoping review aimed to characterise microplastics in human tissues and organs, examine their entry routes and addressing gaps in research analytical techniques.

Methods: Eligibility criteria included English language full text articles, in-vivo human studies only, and searching the databases using pre-defined terms. We based our analysis and reporting on the PRISMA guideline and examined the quality of evidence using the risk of bias assessment tool.

Results: Of 3616 articles screened, 223 evaluated and 26 were eventually included in this review. Nine were high risk for bias, three were unclear risk and the rest low risk for bias.
Microplastics were detected in 8/12 human organ systems including

- cardiovascular,
- digestive,
- endocrine,
- integumentary,
- lymphatic,
- respiratory,
- reproductive and
- urinary.

Microplastics were also observed in other human biological samples such as

- breastmilk,
- meconium,
- semen,
- stool,
- sputum and
- urine.

Microplastics can be characterised based on shape, colours, and polymer type. Potential entry routes into human included atmospheric inhalation and ingestion through food and water. The extraction techniques for analysis of microplastics in human tissues vary significantly, each offering distinct advantages and limitations.

Conclusions: Microplastics are commonly detected in human tissues and organs, with distinct characteristics and entry routes, and variable analytical techniques exist.

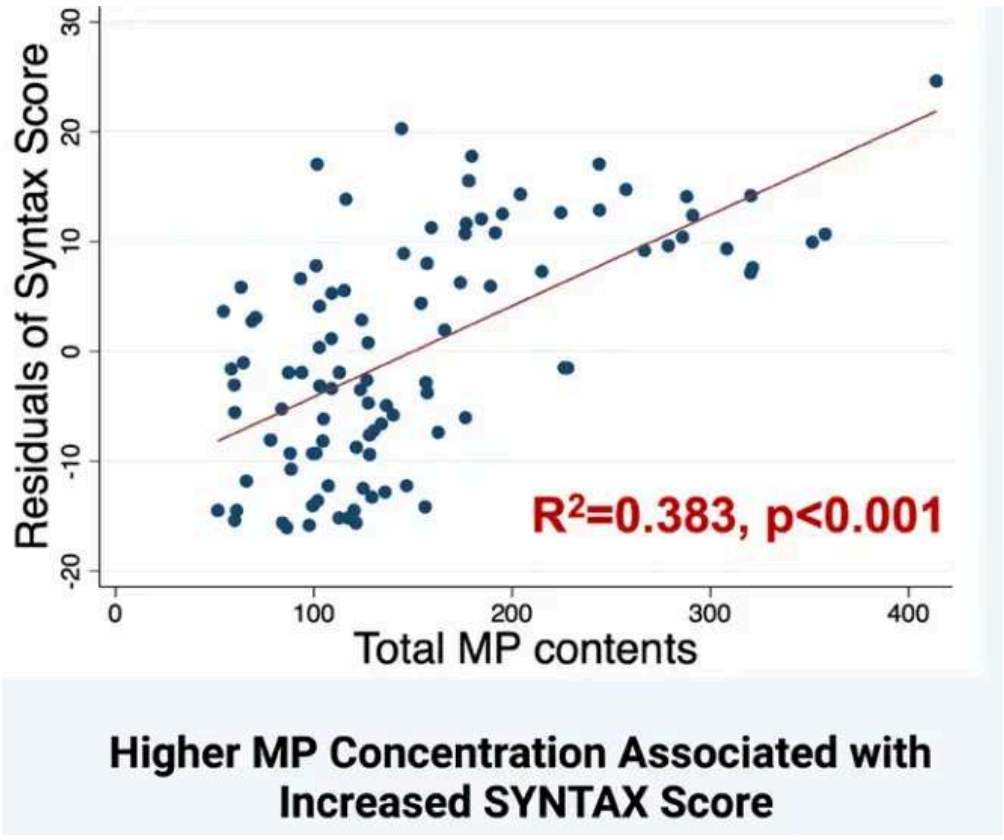
**Download the PDF from VitaminDWiki**

### Increased vascular blockage associated with increased microplastics – Aug 2024

**Microplastics are associated with elevated atherosclerotic risk and increased vascular complexity in acute coronary syndrome patients**

Yunxiao Yang, Feng Zhang, Zhili Jiang, Zhiyong Du, Sheng Liu, Ming Zhang, Yanyan Jin, Yanwen Qin, Xiubin Yang, Chenggang Wang & Hai Gao

Particle and Fibre Toxicology volume 21, Article number: 34 (2024) Cite this article




**Highlights**

1. Blood microplastic levels escalate from angiographic patency, to angina patients, peaking in myocardial infarction patients.
2. Microplastics in acute coronary syndrome patients are predominantly PE, followed by PVC, PS, and PP.
3. Microplastics may induce immune cell-associated inflammatory responses in acute coronary syndrome patients.

Background

Microplastics, widely present in the environment, are implicated in disease pathogenesis through oxidative stress and immune modulation. Prevailing research, primarily based on animal and cell studies, falls short in elucidating microplastics' impact on human cardiovascular health. This cross-sectional study detected blood microplastic concentrations in patients presenting with chest pain using pyrolysis–gas chromatography/mass spectrometry and evaluating inflammatory and immune markers through flow cytometry, to explore the potential effects of microplastic on acute coronary syndrome.

Results

The study included 101 participants, comprising 19 controls and 82 acute coronary syndrome cases. Notably, acute coronary syndrome patients exhibited elevated microplastic concentrations, with those suffering from acute myocardial infarction presenting higher loads compared to those with unstable angina. Furthermore, patients at intermediate to high risk of coronary artery disease displayed significantly higher microplastic accumulations than their low-risk counterparts. A significant relationship was observed between increased microplastic levels and enhanced IL-6 and IL-12p70 contents, alongside elevated B lymphocyte and natural killer cell counts.

Conclusion

These results suggest an association between microplastics and both vascular pathology complexity and immunoinflammatory response in acute coronary syndrome, underscoring the critical need for targeted research to delineate the mechanisms of this association.

**Download the PDF from VitaminDWiki**

## Microplastics especially found in pancreatic, lung, gastric and colorectal tumors – Sept 2024

**Detection and quantification of microplastics in various types of human tumor tissues**

Ecotoxicology and Environmental Safety. 15 Sept 2024, https://doi.org/10.1016/j.ecoenv.2024.116818

Microplastics (MPs) have been detected in various human tissues. However, whether MPs can accumulate within tumors and how they affect the tumor immune microenvironment (TIME) and therapeutic responses remains unclear. This study aimed to determine the presence of MPs in tumors and their potential effects on the TIME. Sixty-one tumor samples were collected for analysis. The presence of MPs in tumors was qualitatively and quantitatively assessed using pyrolysis-gas chromatography-mass spectrometry. MPs were detected in 26 of the samples examined. Three types of MPs were identified: polystyrene, polyvinyl chloride, and polyethylene.

In lung, gastric, colorectal, and cervical tumors, the MP detection rates were 80 %, 40 %, 50 %, and 17 % (7.1–545.9 ng/g), respectively.

MPs were detected in 70 % of pancreatic tumors (18.4–427.1 ng/g) but not detected in esophageal tumors.

In pancreatic cancer, the MP-infiltrated TIME exhibited a reduction in CD8+ T, natural killer, and dendritic cell counts, accompanied by substantial neutrophil

infiltration. This study illustrates the potential presence of MPs in diverse tumors; varying adhesive affinities were observed among different tumor types. MPs may lead to a more adverse TIME in pancreatic tumors. Further investigations are warranted to assess whether MPs promote tumor progression and affect the efficacy of immunotherapy

**Download the PDF from VitaminDWiki**

## Breastmilk proteins altered by microplastics - July 2024

**Univ of Texas El Paso**

- "The UTEP research team focused on the compounds' impact on three proteins critical to human development and function: beta-lactoglobulin, alpha-lactalbumin and myoglobin."
- "Narayan said that, most importantly, their research revealed that nanoplastics and PFAS completely "dissolved" a region of proteins known as the alpha helix, converting them into structures called beta sheets."

has links to 2 of their publications

## Surprise: Biodegradable microplastics may actually be worse for soil and plants - July 2024

**New Scientist**

Tried growing in soil contaminated with biodegradable OR standard microplastics

"Just 10 days later, the bio-microplastics had significantly reduced key minerals such as nitrogen in the soil, lowered its microbial diversity and stunted plant growth. The polyethylene microplastics had much less of an effect."

Reference: DOI: 10.1016/j.scitotenv.2024.172949

**Highlights of the study (which has abstract and snippets of the PDF**

- PLA-MPs induced a labile C-rich but mineral Nitrogen-deficient soil environment.
- PLA-MPs inhibited plant growth and Nitrogen uptake.
- PLA-MPs had more adverse effects on ecosystems than PE-MPs.
- Flooding conditions inhibited the mineralization of PLA-MPs.

## Microplastics in many people with calcified blood vessels (24% of adults have vascular calcification) - Dec 2023

**Toxic vascular effects of polystyrene microplastic exposure**

Science of The Total Environment Vol 905 20 Dec 2023, 167215 https://doi.org/10.1016/j.scitotenv.2023.167215 PDF behind paywall

**Highlights**

- Fecal samples from patients with VC contain higher levels of microplastics.
- PSMP exposure induces mild VC in normal rats.
- PSMP exposure aggravates VDN-induced VC in VDN-treated rats.

Polystyrene microplastics (PSMPs) are some of the most common microplastic components, and the resulting pollution has become a global problem. Extensive studies have been conducted on the toxic effects of PSMPs on the heart, lungs, liver, kidneys, nerves, intestines and other tissues. However, the impact of PSMPs on vascular toxicity is poorly understood at present. The aim of this study was to reveal the vascular toxicity of microplastics (MPs).
Patients were assigned to a calcification group (25 patients) or a non-calcification group (22 patients) based on the presence or absence of calcification in the thoracic aorta wall. We detected 7 polymer types in human feces. Patients with vascular calcification (VC) had higher levels of total MPs, polypropylene (PP) and polystyrene (PS) in feces than patients without VC. The thoracic aortic calcification score was significantly positively correlated with the total MP abundance (Spearman r = 0.8109, $p < 0.0001$), PP (Spearman r = 0.7211, p = 0.0160) and PS (Spearman r = 0.6523, p = 0.0471) in feces. We then explored the effects of PSMP exposure on normal and vitamin D3 + nicotine (VDN)-treated rats. PSMP exposure induced mild VC in normal rats and aggravated VC in VDN-treated rats. PSMP exposure disturbed the gut microbiota, causing Proteobacteria and Escherichia_Shigella to be the dominant phylum and genus, respectively. It also induced intestinal inflammatory responses in normal rats, aggravated intestinal inflammation in VDN-treated rats, impaired the intestinal mucosal barrier, and increased intestinal permeability. This study provides a theoretical basis for the risk assessment of MP-induced cardiovascular disease.

## Microplastics found in ALL 16 patients with bone marrow diseases (leukaemia, etc.) - July 2024

**Discovery and Analysis of Microplastics in Human Bone Marrow**

Journal of Hazardous Materials July 2024, Behind paywall

- " Our study shows that MPs were present in all 16 bone marrow samples, with an average concentration of 51.29 μg/g . . . ."
- "...bone marrow represents 3.5-5.9% of adult body weight. As the largest haematopoietic organ, it is pivotal for hematopoiesis and immune defense..."

***Note: The study did not test the amount of microplastics in bone marrows of healthy people***

## Microplastics in milk for infants (both breast and formula) change proteins that may affect health - July 2024

**SciTechDaily** 2 studies

- "Myoglobin, found in the blood and muscle tissue of most mammals, is crucial for storing oxygen. The UTEP research team found that nanoplastics and PFAS compromise the functionality of the myoglobin protein, disrupting its ability to store oxygen. This disruption could lead to health issues such as breathlessness and anemia."

## Women with Cervical Cancers have high levels of microplastics in both cervix and blood - June 2024

**Detection and analysis of microplastics in tissues and blood of human cervical cancer patients**

Environmental Research https://doi.org/10.1016/j.envres.2024.119498 PDF behind paywall - online includes PDF snippets and references

Hongwen Xu a b c, Chunlin Dong d e, Zhilong Yu a b c, Yukihiro Ozaki f, Zhenyang Hu a b c, Bing Zhang g, Weirong Yao a b c, Jinjin Yu d, Yunfei Xie a b c

Microplastics (MPs) can enter the reproductive system and can be potentially harmful to human reproductive health. In this study, 13 types of microplastics (MPs) were identified in patient blood, cancer samples, and paracarcinoma samples using Raman spectroscopy, with polyethylene, polypropylene and polyethylene-co-polypropylene being the most abundant polymer types. Futher, cotton was also found in our study. The diversity and abundance of MPs were higher in blood samples than in cancerous tissues, and there was a significant positive correlation between diversity ($p < 0.05$). Furthermore, the diversity and abundance of MPs in cancerous tissues were higher than in paracancerous tissues. The dimensional sizes of MPs in these samples were also very similar, with the majority of detected MPs being smaller in size. Correlation analysis showed that patient's age correlated with the abundance of MPs in blood samples, body mass index (BMI) correlated with the abundance of MPs in cancerous tissues. Notably, the frequency with which patients consume bottled water and beverages may also increase the abundance of MPs. This study identifies for the first time the presence of MPs and cotton in cancerous and paracancerous tissues of human cervical cancer patients. This provides new ideas and basic data to study the risk relationship between MP exposure and human health.

## How microplastics and nanoplastics affect systems of the human body - review June 2024

**Health effects of microplastics and nanoplastics: review of published case reports**

Environmental Analysis Health and Toxicology Vol: 39(2), Article ID: e2024020, 7 pages https://doi.org/10.5620/eaht.2024020

Oche Joseph Otorkpa , and Chinenye Oche Otorkpa 2

Department of Public Health, School of Public Health, Texila American University, Georgetown, Guyana

Department of Physiology, College of Health Sciences, Federal University, Lokoja, Nigeria Correspondence: drocheioseph@gmail.com

Microplastics and nanoplastics (MNPs) represent a pervasive environmental pollutant, raising significant concerns about potential health effects on humans. These tiny plastic particles have been detected across various environmental matrices, including air, water, soil, and food sources. While the adverse impacts of MNPs on wildlife and ecosystems are well-documented, understanding their effects on human health is still in its infancy. This study aims to comprehensively review existing case reports documenting adverse health outcomes associated with MNPs exposure. Through an extensive literature search, relevant articles were identified and analyzed. MNPs exposure primarily occurs through ingestion and inhalation routes. Health effects on the digestive system include oxidative stress, inflammation, dysbiosis, and metabolic disorders, with cases linking MNPs exposure to gastrointestinal injury and liver dysfunction. Respiratory system impacts include asthma exacerbation and hypersensitivity pneumonitis, particularly in industries involving plastic production. MNPs exposure has also been associated with nervous system conditions, reproductive toxicity, skeletal system interference, excretory system disruption, and cardiovascular morbidity and mortality. Despite limited case reports, the widespread presence of MNPs warrants further investigation into their potential health risks. This study underscores the urgency of understanding and mitigating the adverse health effects posed by MNPs exposure. Further research is imperative in order to comprehensively assess and address the dangers associated with MNPs contamination in the environment.

### Topics: Health Effects on the:

Digestive System

Respiratory System

Nervous System
Reproductive system
Skeletal System
Cardiovascular System
Excretory System

**Download the PDF from VitaminDWiki**

### Human Toxicity of Nano- and Microplastics - book chapter behind paywall - June 2024

Arely A. Cruz Salas, Maribel Velasco Perez, Ana Laura Tecorralco Bobadilla, Alethia Vázquez Morillas, Rosa María Espinosa Valdemar
https://doi.org/10.1002/9781394238163.ch15 $10 to rent the chapter

The toxicity of microplastics to human beings has raised global concern because of the ubiquity of these emergent pollutants in the environment and their entrance into trophic chains. This chapter reviews the advances and challenges in assessing toxicity in humans based on the analysis of basic concepts of toxicology and recent research results. The challenges and scope of applying animal studies, cell- and tissue-based toxicology assays, in silico or computational models, tissue engineering, organ-in-chip engineering, and human dosing studies are discussed. The analysis of the results of toxicity studies with nano- and microplastics, based on the revision of **85 research articles**, showed that toxicity tests were mainly performed with mice and human cells, while polystyrene, polyethylene, polyethylene terephthalate, and polyvinyl chloride were the most common plastics tested.
The main results regarding

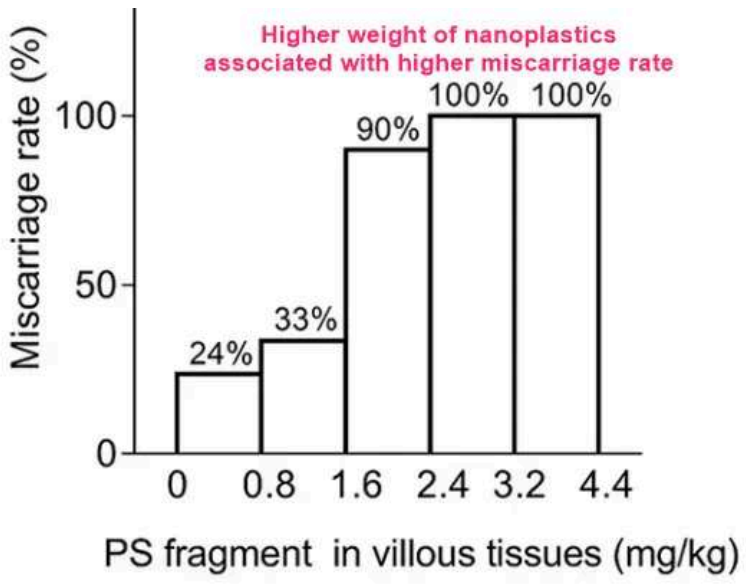
- particle uptake,
- cell viability,
- stress response,
- cancer,
- genomic effects, and
- toxicity in the reproductive system are described.

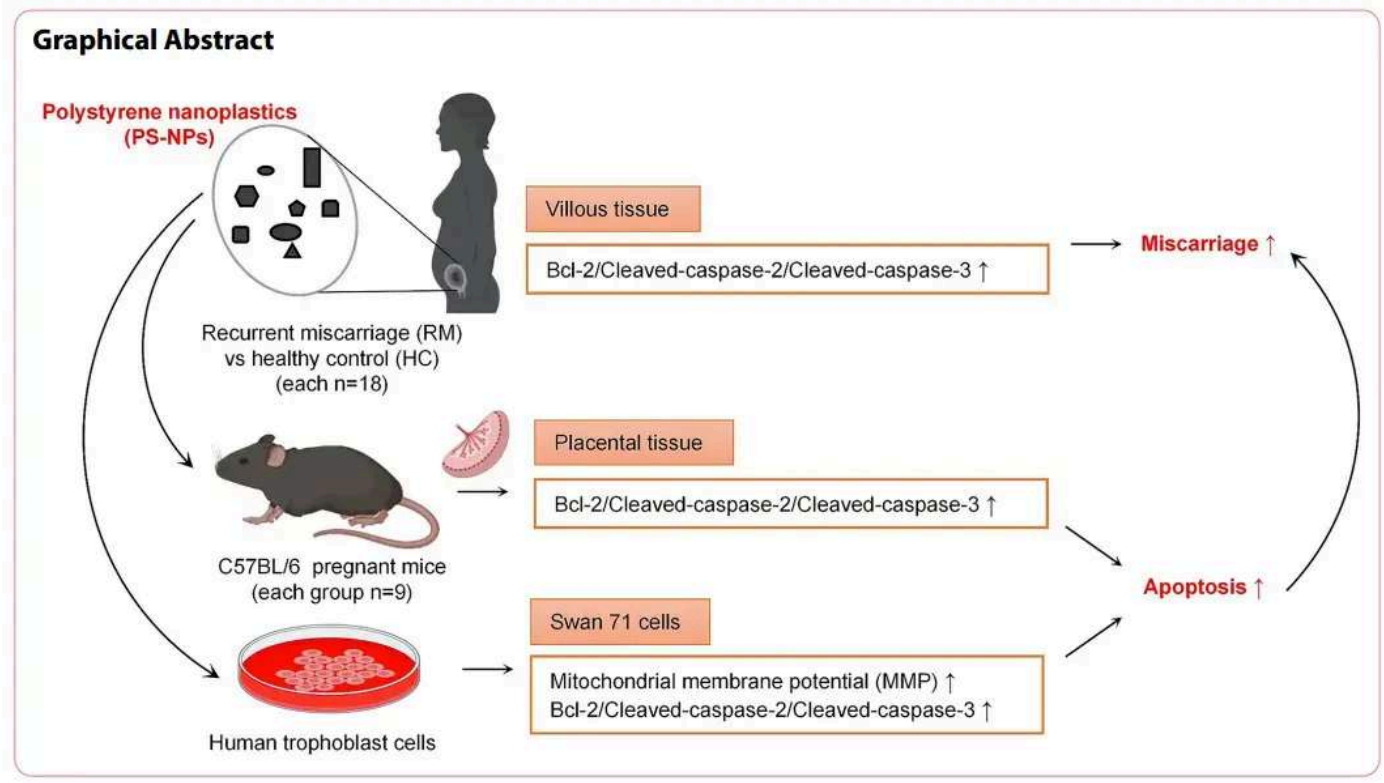
While the results show, in most cases, a negative effect associated with the presence of micro- and nanoplastics, differences in methodologies and research approaches make it difficult to establish clear cause-effect relationships.

## Microplastics and Fertility

### Microplastics increase miscarriage in humans (and mice) - March 2024

**Exposure to high dose of polystyrene nanoplastics causes trophoblast cell apoptosis and induces miscarriage**
Particle and Fibre Toxicology https://doi.org/10.1186/s12989-024-00574-w
Shukun Wan, Xiaoqing Wang, Weina Chen, Manli Wang, Jingsong Zhao, Zhongyan Xu, Rong Wang, Chenyang Mi, Zhaodian Zheng & Huidong Zhang






Background

With rapid increase in the global use of various plastics, microplastics (MPs) and nanoplastics (NPs) pollution and their adverse health effects have attracted global attention. MPs have been detected out in human body and both MPs and NPs showed female reproductive toxicological effects in animal models. Miscarriage (abnormal early embryo loss), accounting for 15-25% pregnant women worldwide, greatly harms human reproduction. However, the adverse effects of NPs on miscarriage have never been explored.

Results

In this study, we identified that polystyrene (PS) plastics particles were present in women villous tissues. Their levels were higher in villous tissues of unexplained recurrent miscarriage (RM) patients vs. healthy control (HC) group. Furthermore, mouse assays further confirmed that exposure to polystyrene nanoplastics (PS-NPs, 50 nm in diameter, 50 or 100 mg/kg) indeed induced miscarriage. In mechanism, PS-NPs exposure (50, 100, 150, or 200 μg/mL) increased oxidative stress, decreased mitochondrial membrane potential, and increased apoptosis in human trophoblast cells by activating Bcl-2/Cleaved-caspase-2/Cleaved-caspase-3 signaling through mitochondrial pathway. The alteration in this signaling was consistent in placental tissues of PS-NPs-exposed mouse model and in villous tissues of unexplained RM patients. Supplement with Bcl-2 could efficiently suppress apoptosis in PS-NPs-exposed trophoblast cells and reduce apoptosis and alleviate miscarriage in PS-NPs-exposed pregnant mouse model.

Conclusions

Exposure to PS-NPs activated Bcl-2/Cleaved-caspase-2/Cleaved-caspase-3, leading to excessive apoptosis in human trophoblast cells and in mice placental tissues, further inducing miscarriage.

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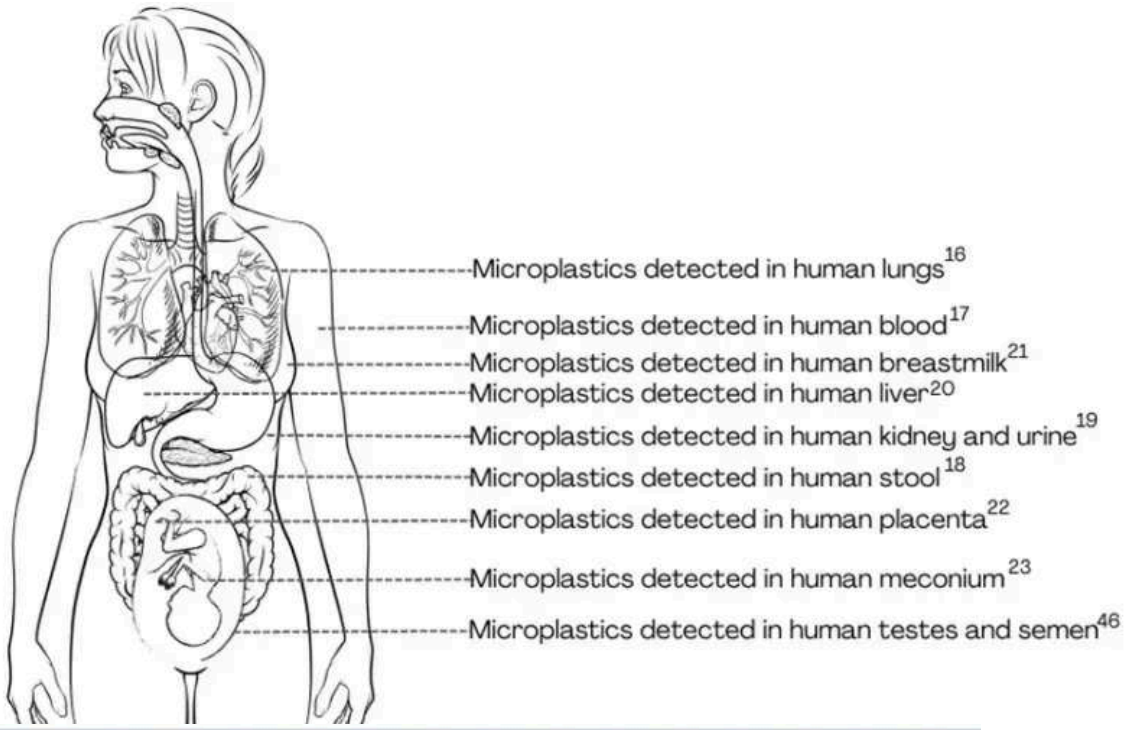
**40% increase in recent summer miscarriage rates in the US - Perplexity AI July 2024**

**Suspected to be due to increased temperatures**

**Exposure to microplastics and human reproductive outcomes: A systematic review - Jan 2024**




**Key findings**

- We identified seven studies examining the presence of microplastics in human reproductive tissue, all with very small sample sizes. These studies included exclusively female participants, and were carried out in Italy, Germany, China and Iran.
- Microplastics composed of 16 different polymer types were detected in placentas and fetal meconium.
- All studies used plastic-free protocols for specimen collection and processing.
- Studies varied in methods used to detect microplastics.
- Environmental plastic exposure, e.g. through drinking water, hygiene products and food packaging, may influence levels of placental microplastics.
- Higher loads of placental microplastics may be linked to fetal growth restriction.

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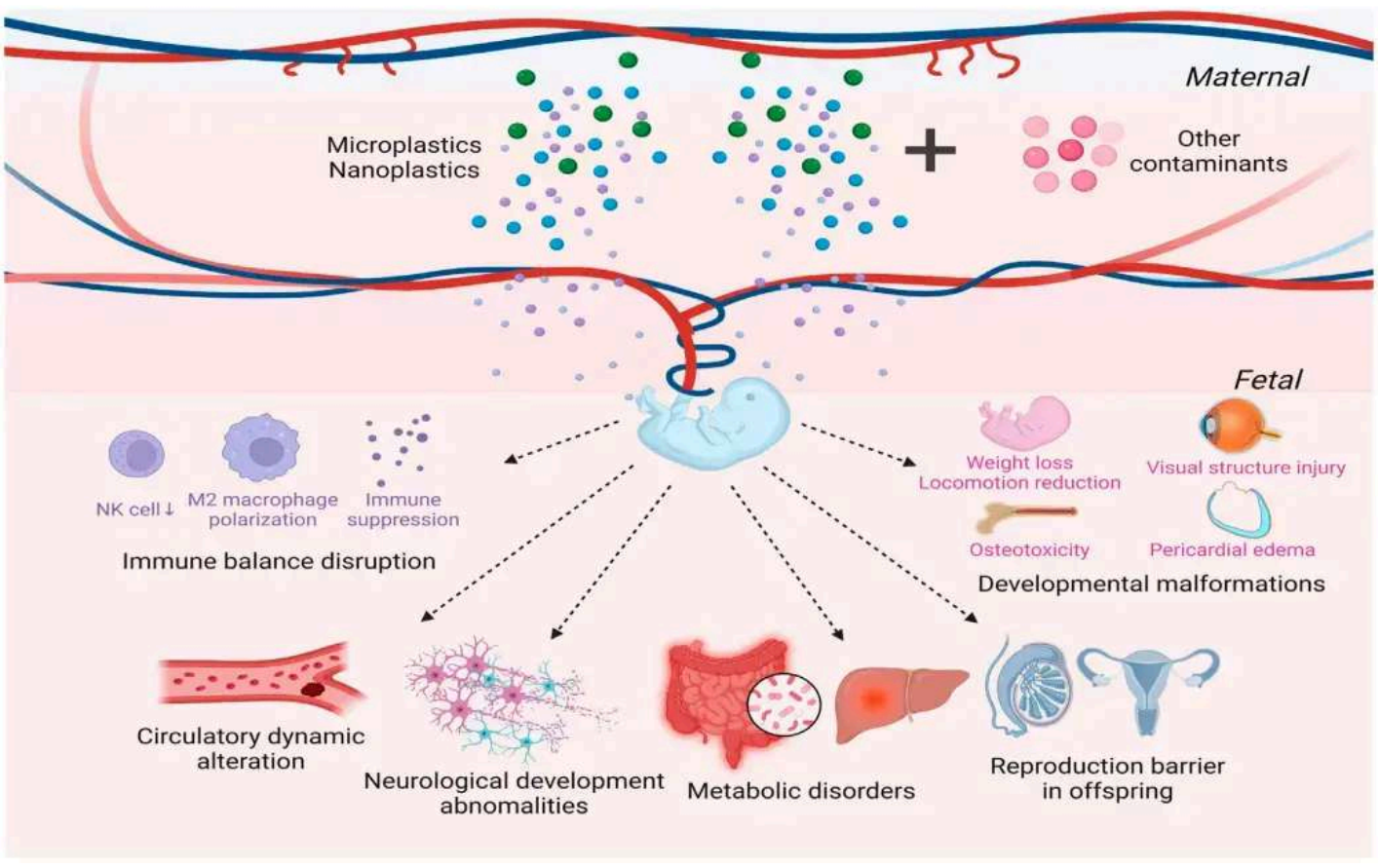
**Toxicity of microplastics and nanoplastics: invisible killers of female fertility and offspring health - Aug 2023**

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**Microplastics found to affect rat semen etc. (no data on humans yet) - June 2024**

**Blood, Sweat and Tears: The Struggle for Human Rights in the Age of Microplastics**

Batchelor thesis: Ballentine, Maya

**Table of contents includes**

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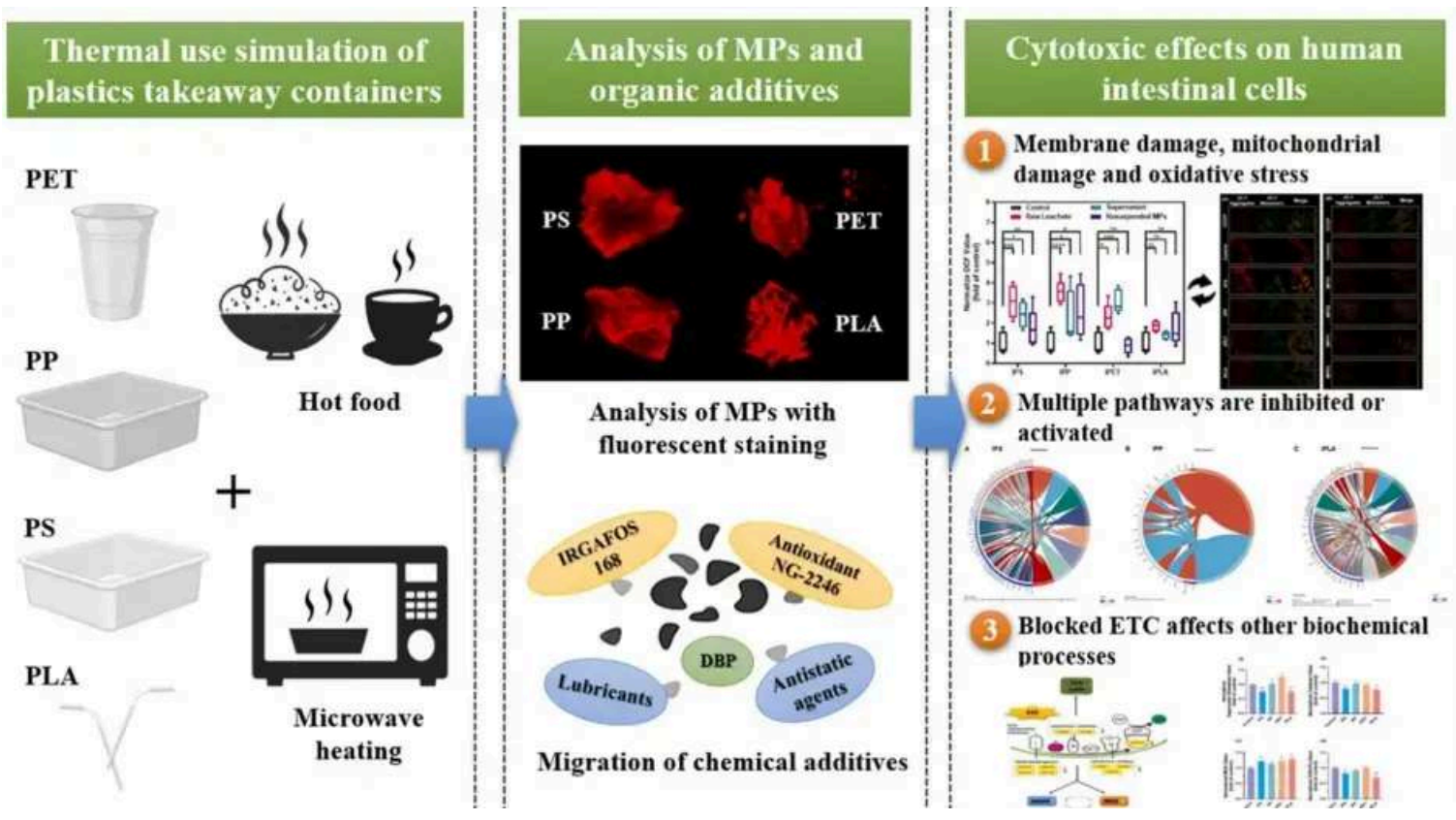
## Plastic takeaway food containers may cause human intestinal damage (200,000 particles per cm2 when heated) – June 2024

Journal of Hazardous Materials https://doi.org/10.1016/j.jhazmat.2024.134866 PDF behind paywall

Tianyue Jin a, Yaxuan Liu a, Honghong Lyu b, Yuhe He c, Hongwen Sun a, Jingchun Tang a, Baoshan Xing d




The microplastics and organic additives formed in the routine use of plastic takeaway food containers may pose significant health risks. Thus, we collected plastic containers made of

- polystyrene,
- polypropylene,
- polyethylene terephthalate,
- olylactic acid and simulated two thermal usages, including hot water (I) and microwave treatments (M).

Nile Red fluorescence staining was developed to improve accurate counting of microplastics with the aid of TEM and DLS analysis. The quantity of MPs released from thermal treatments was determined ranging from 285.7 thousand items/cm2 to 681.5 thousand items/cm2 in containers loaded with hot water **with the following order: IPS>IPP>IPET>IPLA,** while microwave treatment showed lower values ranging from 171.9 thousand items/cm2 to 301.6 thousand items/cm2. In vitro toxicity test using human intestinal epithelial Caco-2 cells indicated **decrease of cell viability** in raw leachate, resuspended MPs and supernatants, which might further lead to cell membrane rupture, ROS production, and decreased mitochondrial membrane potential. Moreover, the leachate inhibited the expression of key genes in the electron transport chain (ETC) process, disrupted energy metabolism. For the first time, we isolate the actually released microplastics and organic substances for in vitro toxicity testing, and demonstrate their potential impacts to human intestine.

Environmental Implication

As a new type of contaminant, microplastics are becoming a great concern in the environment. However, microplastics released from plastic food containers and its impact on human health is not clearly understood. This study investigated the formation and characteristics of microplastics from different types of plastic takeaway food containers after loading hot food and microwave heating. Microplastics and dissolved contaminants were separated and their respective toxic effects on Caco-2 cells were examined. Our research highlights new route of environmental risk of microplastics, and is useful for environmental management on plastic takeaway containers that may have been ignored before.

Synopsis

Plastic take-out containers may release microplastics and organic substances during daily usage, both of which can cause individual and combined cytotoxic effects on human colon adenocarcinoma cells Caco-2.

online includes section snippets and references

## Good news: clear, black, shiny plastics degrade into microplastics far more slowly (not adsorb UV) - May 2024

**Why blue and red packaging turns into microplastic so much faster - Fast Company**

The study: https://doi.org/10.1016/j.envpol.2024.123701

- Colourants in plastics effect the rate of environmental degradation and microplastic evolution.
- Red, blue and green samples degraded but black, white and silver were largely unaffected.
- Remote sampling showed long-lived samples were black/white and most microplastics were coloured.
- looking at a beach - "Most items were black or white and samples up to 45 years old were found with relatively little environmental degradation other than mild abrasion. It appears that carbon and titanium dioxide colourants protect the HDPE polymer from photolytic degradation. While anthraquinone, phthalocyanine and diketopyrrolopyrrole pigments were found to enable UV light to degrade the polymer leading to brittle plastics, promoting the formation of microplastics, it is likely that other pigments that do not strongly absorb in the UV will result in similar degradation."

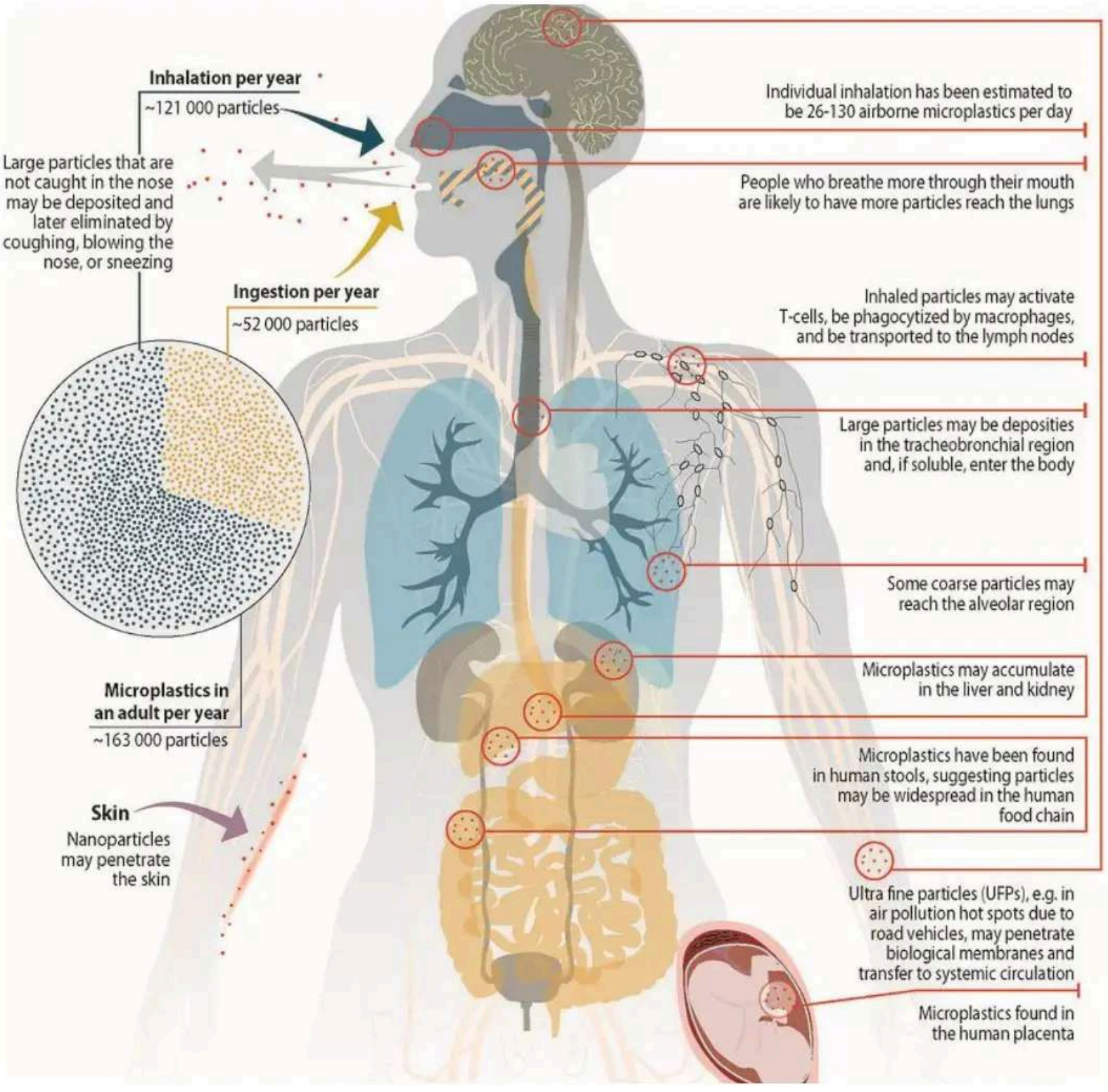
## Microplastics and Their Implications for Human Health: A Scientific Exploration – May 2024

African Journal of Biological Sciences Jharna Maiti /Afr.J.Bio.Sc. 6(9) (2024) doi: 10.33472/AFJBS.6.9.2024.2681-2695

Jharna Maiti1, Amit Joshi1, Sanyogita Shahi1*

1. Kalinga University, Raipur, Chhattisgarh, India, 492101

Corresponding author e-mail: drsanyogitashahi@gmail.com




As they are so common in the environment, microplastics pose serious health risks to people. This scientific investigation explores their origins, movements, and effects. Synthetic fibres, microbeads, and plastic manufacture are examples of primary sources; the fragmentation of bigger polymers is a secondary source. Nurdles are released during the plastic manufacturing process, wastewater from personal care items contains microbeads that infiltrate aquatic bodies, and contamination is caused by synthetic fibers shed from textiles. Larger polymers break apart as a result of external stresses like sunshine and mechanical forces. Microplastics find their way into ecosystems via soil, streams, atmospheric deposition, and the food chain. Deposition occurs on both terrestrial and aquatic surfaces as a result of atmospheric transport caused by wind and precipitation. Surface runoff and wastewater discharge contribute to accumulation in rivers,

which affects aquatic life and may make its way into the food chain. Runoff and atmospheric deposition cause soil to accumulate, which has an impact on soil quality and agricultural output. Microplastics biomagnified in the food chain, putting human health at risk from eating polluted seafood. Determining human exposure and related health hazards requires an understanding of the origins and pathways of microplastics. Thorough risk assessments and mitigation tactics are necessary to reduce negative impacts on the environment and public health. To reduce pollution and protect public health, it is imperative to address the manufacture of plastics, regulate the presence of microplastics in consumer products, and support sustainable alternatives. This investigation emphasizes the necessity of multidisciplinary study and teamwork to address the intricate problems brought on by microplastics and safeguard environmental integrity and public health.

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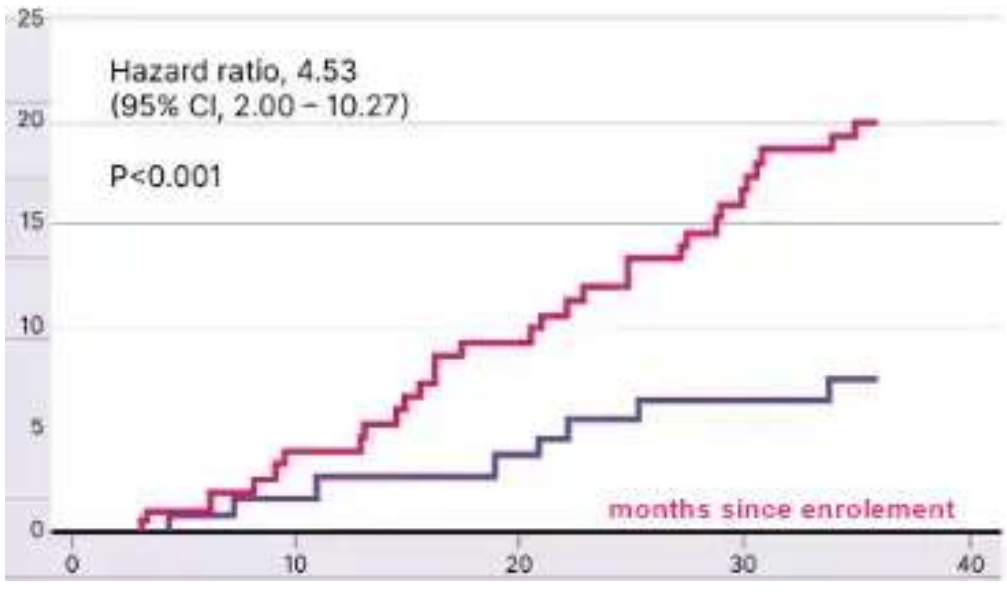
### Micro and nanoplastics in plaque: 4.5 X higher risk of cardiovascular events and death - May 2024

Examine.com New England Journal of Medicine behind paywall until Sept 2024




### Fish ingesting microplastics have gut, reproduction, brain injury etc, problems – May 2024

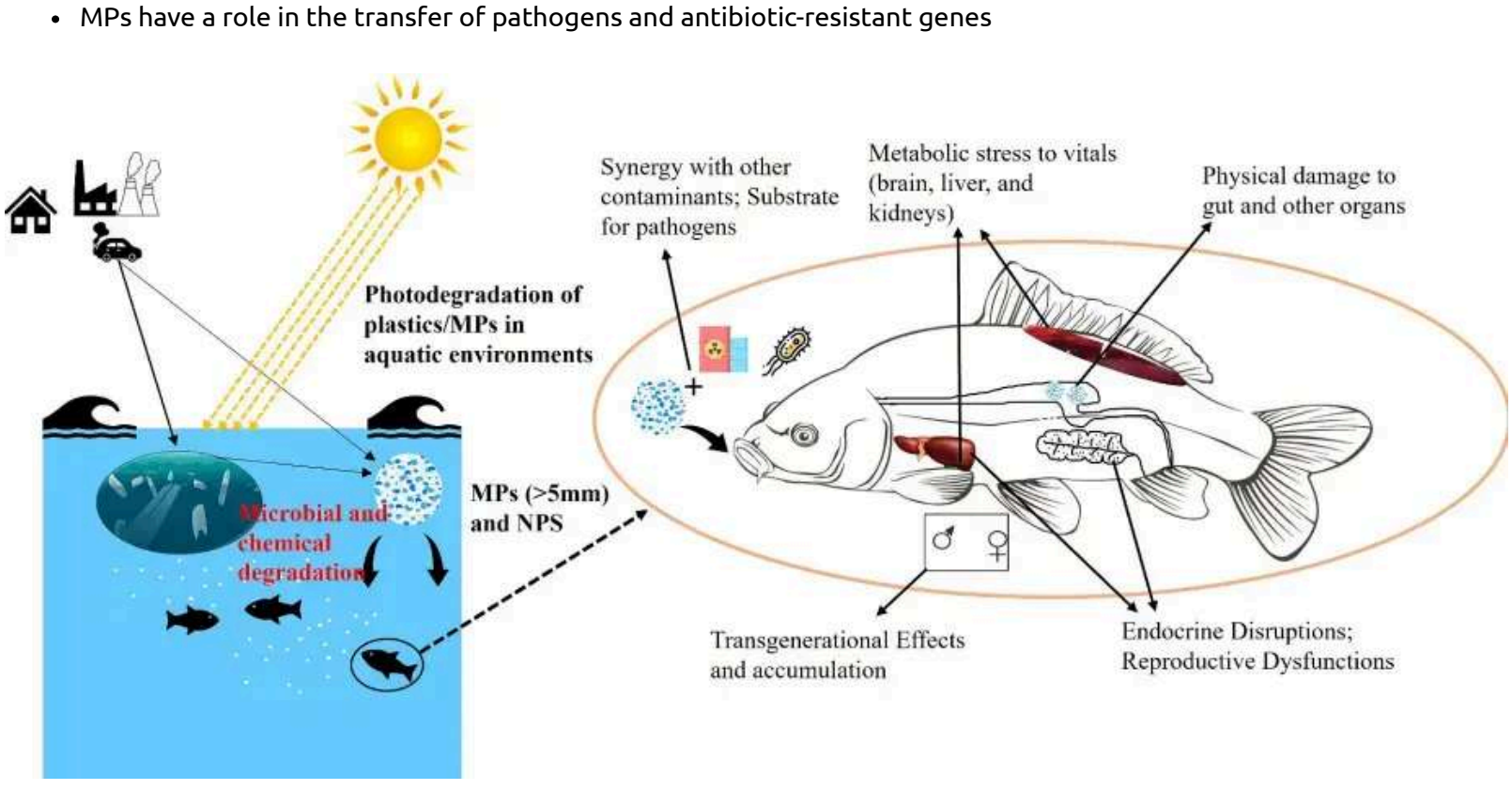
**Impact of microplastics and nanoplastics on fish health and reproduction**

Aquaculture https://doi.org/10.1016/j.aquaculture.2024.741037 PDF is behind a paywall

lRaja Aadil Hussain Bhat a b, M. Junaid Sidiq c, Ilhan Altinok b d e

**Highlights**

- Naturally occurring MPs and NPs may not be toxic to fish*
- Virgin MPs and NPs are toxic to aquatic organisms
- Virgin MPs and NPs have an impact on fish health and reproductive potential*
- Intestinal dysbiosis is common after exposure to virgin MP
- MPs have a role in the transfer of pathogens and antibiotic-resistant genes




Microplastic (MP) contamination is a worldwide threat to aquatic organisms and human health. Aquatic environments are ideal and ultimate sinks for the MPs. They are negatively impacting the physical and physiological fitness of various fish species. Virgin MPs and nanoparticles (NPs) compromise immune, digestive, and reproductive systems, induce intestinal dysbiosis, and may have transgenerational effects. Even prolonged exposure to small ambient levels of MPs in aquatic environments has been found to be associated with such hazards. Moreover, plastisphere formation in aquatic habitats provides an excellent source and

carrier for transporting contaminants, antimicrobial-resistant genes, and pathogens. Numerous studies utilize artificially produced virgin MPs and NPs containing toxic chemicals. When these plastics interact with water and organisms, they release harmful compounds, leading to the promulgation of toxic effects. However, macroplastics undergo chemical degradation in nature, producing micro- and nano-sized particles that appear to have varying degrees of adverse impact on aquatic organisms, due to their presence in substantial diluting environments. The work done so far suggests that evaluations of MP impact in aquatic habitats should be performed at a mass scale and in diverse fish species to get a clear picture of this hazard. This article reviews the most recent literature available on the influence of virgin MPs and NPs on fish welfare, with a particular focus on their health and reproductive functions.

## Introduction

Plastic pollution, particularly in the form of MPs, has emerged as an urgent and significant global environmental concern (Li et al., 2021b; MacLeod et al., 2021; Williams and Rangel-Buitrago, 2022). Since the 1950s, the production of plastics has increased exponentially. Global plastic production reached a staggering 460 million metric tons (Mt) in 2019 and is projected to reach 1231 Mt. by 2060 (Forum, 2022). In 2018, China produced 107.7 Mt. of plastics, accounting for approximately 30% of global plastic production (Plastic Europe, 2019). It is estimated that approximately 11 million tons of plastic enter the oceans annually (UNEP, 2021). Plastic emission levels into aquatic habitats are predicted to range from 20 to 53 million tons annually by 2030, highlighting the alarming scale of this issue (Borrelle et al., 2020). Reports indicate that >170 trillion plastic particles are currently floating in the oceans, causing significant damage to livelihoods and ecosystem and this number is projected to triple in the next two decades (UNEP, 2021). The widespread adoption of plastic usage can be credited to its affordability, long-lasting quality, lightweight characteristics, and adaptability across diverse sectors such as food packaging, construction, automotive, electronics, sports, agriculture, healthcare, and furniture production (An et al., 2020; Europe Plastics, 2019; Osman et al., 2023).

Microplastics are smaller than 5 mm in diameter and pose notable ecological risks due to their widespread distribution throughout aquatic and terrestrial ecosystems (Lusher et al., 2017b). These MPs can be categorized as either primary (originally manufactured to be <5 mm) or secondary (resulting from the decomposition of larger plastic objects) (Kershaw and Rochman, 2015). The significant growth in plastic manufacturing has resulted in massive amounts of plastic waste, a substantial portion of which eventually breaks down into MPs (Sharma and Chatterjee, 2017). On the other hand, NPs are formed from the degradation of MPs and are characterized by colloidal behavior, with a size range of 1 to 1000 nm (Gigault et al., 2018). These microscopic plastic particles can contaminate water bodies, soil, and air, leading to ecological imbalances and potential consequences for human well-being (Basri et al., 2021).

Microplastics, which originate from terrestrial activities such as plastic production, tire wear, agriculture, and plastic litter, enter aquatic environments through routes such as atmospheric deposition, coastal interactions, and runoff. Comprehensive solutions are crucial to tackling the complexity of MP pollution in aquatic ecosystems (Gesamp, 2016; Klein et al., 2015). Microplastics are present in all habitats of the open ocean and enclosed seas, including beaches, water columns surface waters, and the deep seafloor (Lusher, 2015). Wind-induced vertical movement within the water column, plays a crucial role in determining the dispersion of MPs within marine environments (Kukulka et al., 2012). Once released, MPs can remain in the environment for prolonged periods, causing detrimental effects on wildlife, ecosystems, and potentially human health (MacLeod et al., 2021; Ritchie and Roser, 2018). Microplastics can be ingested by a variety of organisms, including plankton (Carbery et al., 2018; Gunaalan et al., 2023; Rakib et al., 2023), fish (Abbasi et al., 2018; Bhuyan, 2022; Collard et al., 2017; Gao et al., 2023; Renzi et al., 2019), bivalves (Abidli et al., 2023; Khanjani et al., 2023), birds (Bilal et al., 2023; Brookson et al., 2019; Lu et al., 2023; Navarro et al., 2023), and mammals (Liu et al., 2023; Zantis et al., 2021), resulting in numerous adverse effects such as reduced reproductive success, impaired growth, and disruption of physiological processes Fish may consume MPs through two main pathways: direct ingestion (primary ingestion), in which they unintentionally perceive the MPs as food and ingest them, or accidental consumption (Worm et al., 2017), or indirectly (secondary digestion) by consuming prey that has already consumed these particles (Watts et al., 2014). The latter process, known as trophic transfer, may result in the accumulation of MPs in predators occupying higher trophic levels (Farrell and Nelson, 2013; Provencher et al., 2019; Zhang et al., 2019). On the other hand, the amount of increased MP accumulation in predators at higher trophic levels is still unknown (Carbery et al., 2018; Miller et al., 2020). Furthermore, MPs contain additives from the manufacturing process that have a prominent capacity to absorb detrimental pollutants, such as persistent, bioaccumulative, and toxic substances, from the surrounding environment. The ingestion of MPs and subsequent accumulation of these contaminants within aquatic organisms has raised concern about the potential hazards and risks associated with MPs in marine ecosystems (Lusher et al., 2017a).

Wootton et al. (2021) demonstrated that 49% of the worldwide fish samples examined for MP consumption exhibited the presence of plastic particles (average of 3.5 pieces per fish), and the prevalence of plastic ingestion was higher in North American fish as compared to fish from other geographic regions. A comprehensive literature review conducted by Galafassi et al. (2021) emphasized the widespread and concerning problem of MP pollution in freshwater environments. The review documented instances of 199 species from 29 countries ingesting plastic, with over 60 research articles specifically dedicated to studying MP ingestion by wild freshwater fish. Interestingly, MPs have been found not only in the digestive tracts of fish but also in their gills, suggesting that the particles can translocate to different tissues within the organisms. Ingestion of MPs by fish poses a multifaceted threat to their health, including structural intestinal damage. It also introduces toxic substances that disrupt physiological processes (Montero et al., 2022). As a result, ingesting MPs introduces these toxicants into the fish's body, where they may cause extensive physiological disruptions such as endocrine disruption and oxidative stress. Furthermore, MPs are capable of accumulating in the digestive system, which may result in physical damage such as obstructions, inflammation, and hindrances in nutrient absorption. Thus, it is imperative to comprehensively examine the effects of MPs on fish health. Fig. 1 depicts the number of articles present in the public domain that explore the impact and presence of MPs in aquatic organisms. With escalating concerns about MP pollution and its potential effects on aquatic ecosystems, particularly fish populations, there is an urgent need for a consolidated and structured evaluation of the current state of knowledge in this area. This review article seeks to consolidate the current insights and knowledge available regarding the effects of MP on fish health. Moreover, we have provided detailed information about the role of MPs in the transfer of pathogens and antibiotic-resistant genes.

**Section snippets**

Methodology

A literature search was conducted using various databases, including Web of Science, PubMed, and ScienceDirect, employing different keywords such as: “fate of microplastics and nanoplastics in the environment”, “microplastics and nanoplastics in water”, “microplastics and nanoplastics in aquaculture”, “effect of microplastics in fish”, impact of microplastic on fish and “effect of plastic in fish”. The articles related to our study were screened, and finally, 210 articles, including research…

Entry and fate of MPs in fish and water

When MP trash ends up in the ocean, it undergoes photo- and biodegradation as well as physical aging (Ter Halle et al., 2017), leading to micro- and nano-scale plastic pollution (Gigault et al., 2016). Due to the slowness of these degradation processes, the flow of MPs and NPs from terrestrial settings is assumed to be the primary cause of marine pollution (Cózar et al., 2014). Chemicals are frequently added to plastic during the manufacturing process in order to impart certain desirable…

Impact of MPs and NPs on fish welfare

There is compelling evidence that consumption of MPs and NPs can have adverse effects on fish health (Table 1, Fig. 4). The majority of the research to determine the impacts of artificially produced MPs on fish has been conducted under controlled laboratory settings. The fish species used in these experiments were obtained from diverse habitats, primarily from marine environments (Ding et al., 2018; Hao et al., 2023; Hasan et al., 2023; Li et al., 2021a; Lusher et al., 2013). On the other hand, …

Synergistic effects of MPs and pathogens in fish

Virgin MPs could increase disease susceptibility in fish by impairing their immune systems (Masud and Cable, 2023). A study was done to evaluate the effect of MPs on rainbow trout exposed to Yersinia ruckeri. This study revealed how the combined impact of virgin MPs triggered the severe clinical manifestations in fish infected with Y. ruckeri (Banihashemi et al., 2022). Furthermore, the study indicates that the toxic effects of foreign substances such as virgin MPs might increase the ability of …

Synergistic effects of temperature and MPs or NPs

The intricate relationship between elevated temperatures and exposure to virgin NPs in environmental contexts has garnered considerable attention. A combination of incremental temperature rise (28, 29, 30 °C) and exposure to virgin polystyrene NPs disrupted the circadian rhythm, induced brain injury, and led to notable alterations in the levels of 18 metabolites across various pathways in zebrafish (Sulukan et al., 2022).This result implies that a one-degree temperature increase can exacerbate…

Microplastics and antibiotic resistance gene (ARG) transfer

As previously mentioned, MPs are widely dispersed in marine environments and pose a variety of negative effects. In comparison to other natural materials, plastic debris poses a greater threat to the aquatic environment due to its longer physical half-life. This extended persistence makes plastics hazardous. Furthermore, since organic pollutants can adhere to plastic surfaces, plastic debris can serve as a carrier (Fig. 5) for many organic pollutants, such as polycyclic aromatic hydrocarbons (…

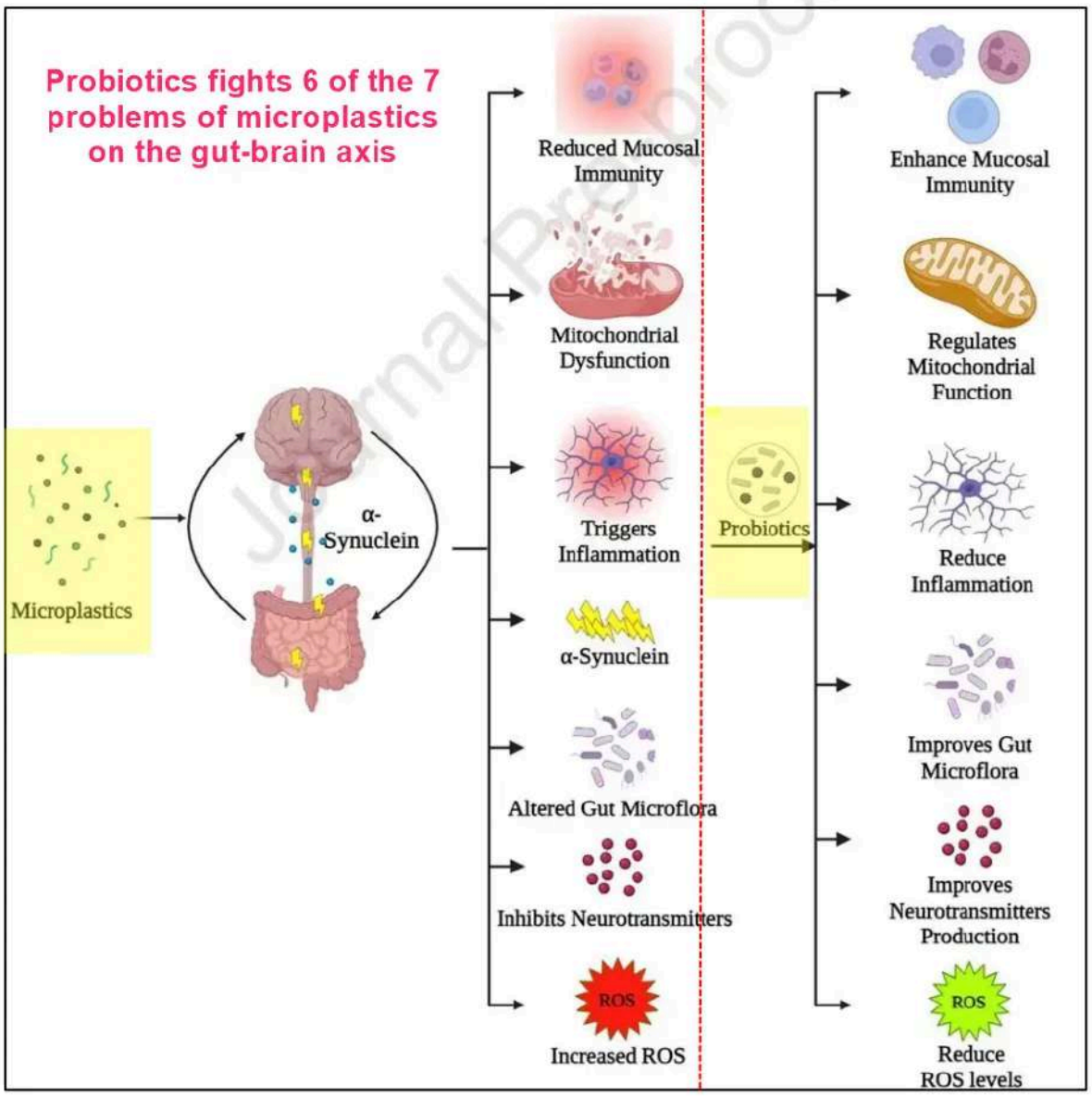
Microplastics cause reproductive dysfunction in fish

The majority of aquatic organisms are found to be invariably affected by virgin MPs at some stage in their lives. Low trophic-level communities such as zooplankton, filter-feeding invertebrates and echinoderms, and fish larvae are found to have higher pathological and physiological sensitivities towards virgin MPs (do Sul and Costa, 2014). Virgin MPs have also gained importance for being one of the most potent anthropogenic factors that are reprotoxic to fish. It has been found that the…

Conclusion

Plastic, a remarkably versatile and utilitarian material, has become integral to modern daily life. However, excessive utilization and inadequate disposal practices result in the pervasive menace of MP pollution in aquatic ecosystems, spanning from the upper pelagic zones to the seafloor sediments. Commercially produced plastics often contain toxic materials that are incorporated during their manufacturing process. The degradation of plastics into MPs and NPs in aquatic environments, which…

## Probiotics should fight microplastics problems in the gut: A Comprehensive Review - May 2024




**PROBIOTICS AN EMERGING THERAPEUTIC APPROACH TOWARDS GUT- BRAIN-AXIS ORIENTED CHRONIC HEALTH ISSUES INDUCED BY MICROPLASTICS: A COMPREHENSIVE REVIEW**

Ieshita Pan. Suganiya Umapathy

https://doi.org/10.1016/j.heliyon.2024.e32004

Applications for plastic polymers can be found all around the world, often discarded without any prior care, exacerbating the environmental issue. When large waste materials are released into the environment, they undergo physical, biological, and photo-degradation processes that break them down into smaller polymer fragments known as microplastics (MPs). The time it takes for residual plastic to degrade depends on the type of polymer and environmental factors, with some taking as long as 600 years or more. Due to their small size, microplastics can contaminate food and enter the human body through food chains and webs, causing gastrointestinal (GI) tract pain that can range from local to systemic. Microplastics can also acquire hydrophobic organic pollutants and heavy metals on their surface, due to their large surface area and surface hydrophobicity. The levels of contamination on the microplastic surface are significantly higher than in the natural environment. The gut-brain axis (GB axis), through which organisms interact with their environment, regulate nutritional digestion and absorption, intestinal motility and secretion, complex polysaccharide breakdown, and maintain intestinal integrity, can be altered by microplastics acting alone or in combination with pollutants. Probiotics have shown significant therapeutic potential in managing various illnesses mediated by the gut-brain axis. They connect hormonal and biochemical pathways to promote gut and brain health, making them a promising therapy option for a variety of GB axis-mediated illnesses. Additionally, taking probiotics with or without food can reduce the production of pro-inflammatory cytokines, reactive oxygen species (ROS), neuro-inflammation, neurodegeneration, protein folding, and both motor and non-motor symptoms in individuals with Parkinson's disease. This study provides new insight into microplastic-induced gut dysbiosis, its associated health risks, and the benefits of using both traditional and next-generation probiotics to maintain gut homeostasis

**CONCLUSION (clipped from PDF)**

At present, the main reason humans are exposed to MPs is the increasing consumption of plastic. MPs have the ability to absorb, release, and act as reservoirs for various toxic chemicals and heavy metals, allowing these toxins to enter the human body and cause serious health issues. As the concentration of MPs increases in the body, they begin to modulate several biochemical and physiological pathways by altering the gut-brain axis.

This can lead to

- inflammatory lesions,
- tissue degradation,
- ROS,
- metal imbalance,
- changes in gut phenotype,
- gut barrier function,
- endocrine secretion, and
- neurodegeneration.

While there is limited information on the stages of plastic in the human diet, it is evident that regardless of degradation, MPs contaminate the environment, enter the body through contaminated foods, and disrupt intestinal homeostasis.
Recent studies have shown that nano- and microplastics have various effects on the intestines, including

- disrupting intestinal homeostasis,
- altering gut permeability, and
- affecting levels of cytokine secretion.

Since the human diet plays a significant role in disrupting gut microbes and causing disorders, probiotics are a suitable and compassionate therapeutic target to manage gut dysbiosis and
protect bi-directional axes such as the

- gut-brain axis,
- gut-liver axis,
- gut-lung axis, and
- gut-skin axis.

The altered gut induced by MP consumption also leads to oxidative stress, inflammation, and reproductive issues. Probiotics can effectively control ROS, inflammation, and reproductive problems.
In conclusion, probiotics play a crucial role in managing MP-induced gut dysbiosis. With the assistance of gene editing techniques, both conventional and next-generation probiotics may address many health-related concerns in the future. Given the increasing use of synthetic materials, further research is necessary to fully understand the harm that microplastics pose to human health and the environment, as well as to facilitate their complete eradication through cutting-edge gene editing technologies.

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## Impact of microplastics on human health and aquatic species - May 2024

Iliass Achoukhi1*, Yahya El Hammoudani1, Khadija Haboubi1, Lahcen Benaabidate2, Abdelhak Bourjila1, Mustapha El Boudammoussi1, Mohamed Moudou1, Hatim Faiz1, Abdelaziz Touzani1 and Fouad Dimane1

**Table 1.** Potential harmful impacts of micro- and nano-sized plastics on human health.

| Toxicity | Characteristics of Plastic Particles | Particle Size | Details | Refs |
|---|---|---|---|---|
| Inflammation | Polystyrene nanoparticles<br>Unaltered/Carboxylated polystyrene/nanoparticles<br>Carboxylated and amino-modified polystyrene particles<br>Unaltered polyethylene particles<br>Polyethylene particles from plastic prosthetic implants<br>Polystyrene MPs particles | • 202 and 535 nm<br>• 20, 44, 500,<br>• and 1000 nm<br>• 120 nm<br>• 0–3 μm,10 μm<br>• 0.2 and 10 μm<br>• 5 and 20 μm | Expression of IL-8 is increased<br>Inflammation was induced in human A549 lung cells<br>Expression of IL-6 and IL-8 is increased<br>Multiple human cancers have increased inflammation<br>Scavenger receptor expression is altered<br>Periprosthetic bone resorption occurred as a result<br>Induced inflammatory reaction around the implant<br>The liver is inflamed as a result of the inflammation | [74, 81, 92-94] |
| Oxidative Stress and Apoptosis | Amine-modified polystyrene nanoparticles<br>Cationic polystyrene nanoparticles<br>Unaltered or functionalized polystyrene polyvinyl chloride (PVC) and poly (methyl methacrylate) (PMMA) | • 60 nm<br>• 60 nm<br>• 20, 40, 50, and 100 nm | Mucin has strong interaction and aggregation<br>Apoptosis was induced in all intestinal epithelial cells<br>ROS production and ER stress are both induced<br>Autophagic cell death in mice macrophages and lung epithelial cells has<br>Been induced<br>Apoptosis was induced in a variety of human cell types | [95-97] |
| Metabolic Homeostasis | Pristine and fluorescent polystyrene MPs<br>Anionic carboxylated polystyrene nanoparticles<br>Polystyrene nanoparticles<br>Cationic polystyrene nanoparticles<br>Pristine polystyrene microparticles<br>MPs | • 5 μm<br>• 20 nm<br>• 30 nm<br>• 50 and 200 nm<br>• 5 and 20 μm<br>• and 5 μm | Amino-addition and bile-addition metabolism changes<br>Induced dysbiosis of the gut microbiota and intestinal barrier failure<br>Ionic homeostasis and altered ion channel function<br>Basolateral K+ channels that have been activated<br>Cl− and HCO3− ion outflow is induced | [98-100] |

Microplastics (MPs) have emerged as a pervasive environmental challenge, with significant implications for both marine ecosystems and human health. This study delves into the adverse effects of MPs, highlighting their physical, chemical, and biological impacts on marine life, particularly fish.
These impacts include physical injury, oxidative stress, and altered immune responses, which can have cascading effects on marine biodiversity and ecosystem functionality.
The review also underscores the risk MPs pose to humans through

- direct exposure,
- via consumption of contaminated seafood,

- inhalation, or dermal contact,

potentially leading to

- oxidative stress,
- cytotoxic effects, and
- disturbances in immune function.

By comprehensively examining existing research and identifying knowledge gaps, this study aims to underline the urgent need for targeted research strategies. These strategies should focus on elucidating the complex interactions between MPs and biological systems, assessing long-term health implications, and developing effective mitigation measures. Through detailed analysis of methodologies, results, and existing literature, this review aims to contribute to a deeper understanding of the multifaceted impact of microplastics, thereby guiding future research directions and informing policy decisions for the protection of marine ecosystems and human health.

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### 150 plastic plants and chemical industries = Cancer Alley: cancer rates 50 X higher - May 2024

"150 plastic plants and chemical industries. The cancer rates in this area are 50 times higher than the national average."

**'We're All Plastic People Now': A Groundbreaking Documentary = Mercola**

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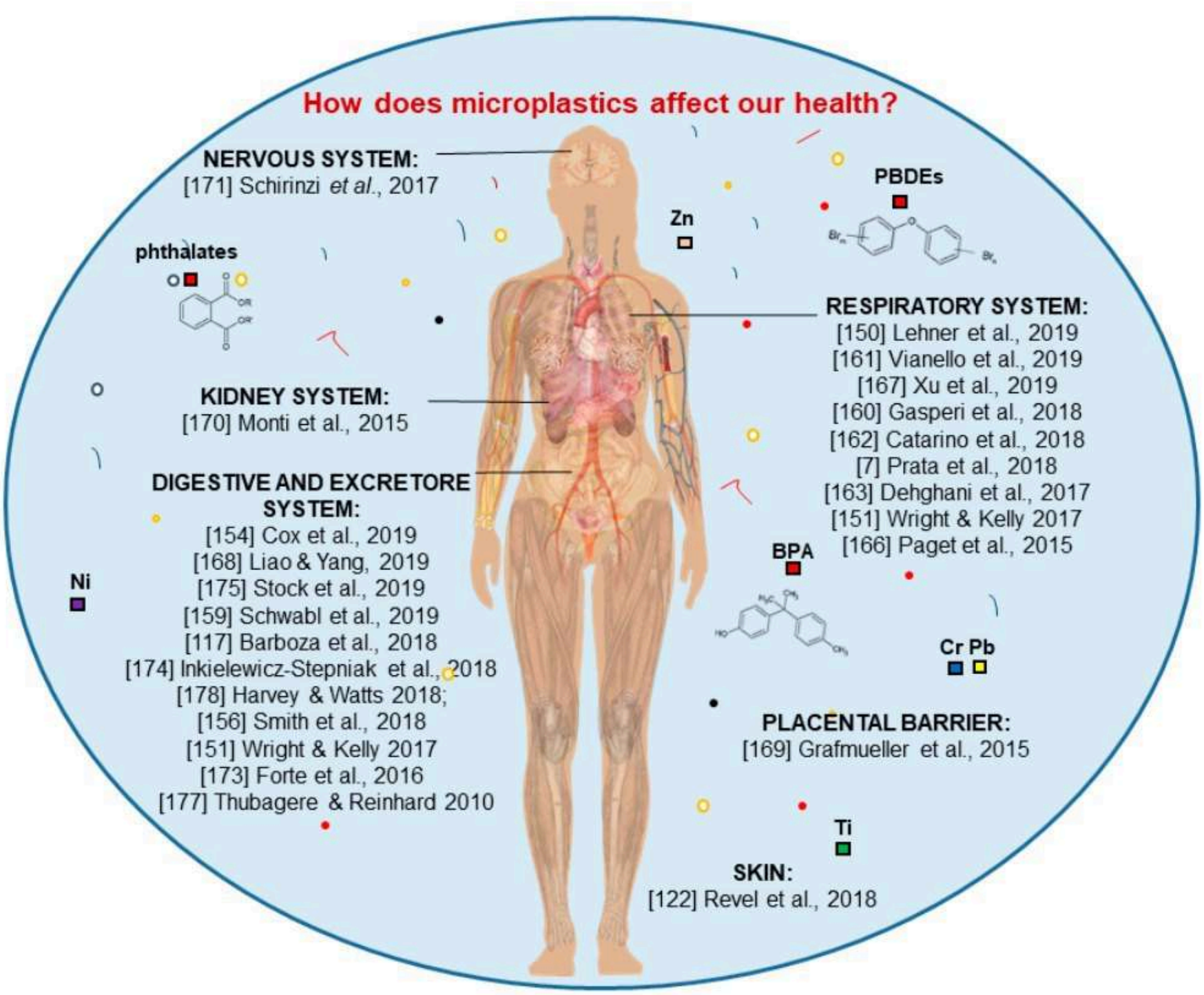
**56 minute video**

### Chart of studies of microplastics in humans - 2020




Details further down this page

## Review of many microplastic medical studies - substack March 2024

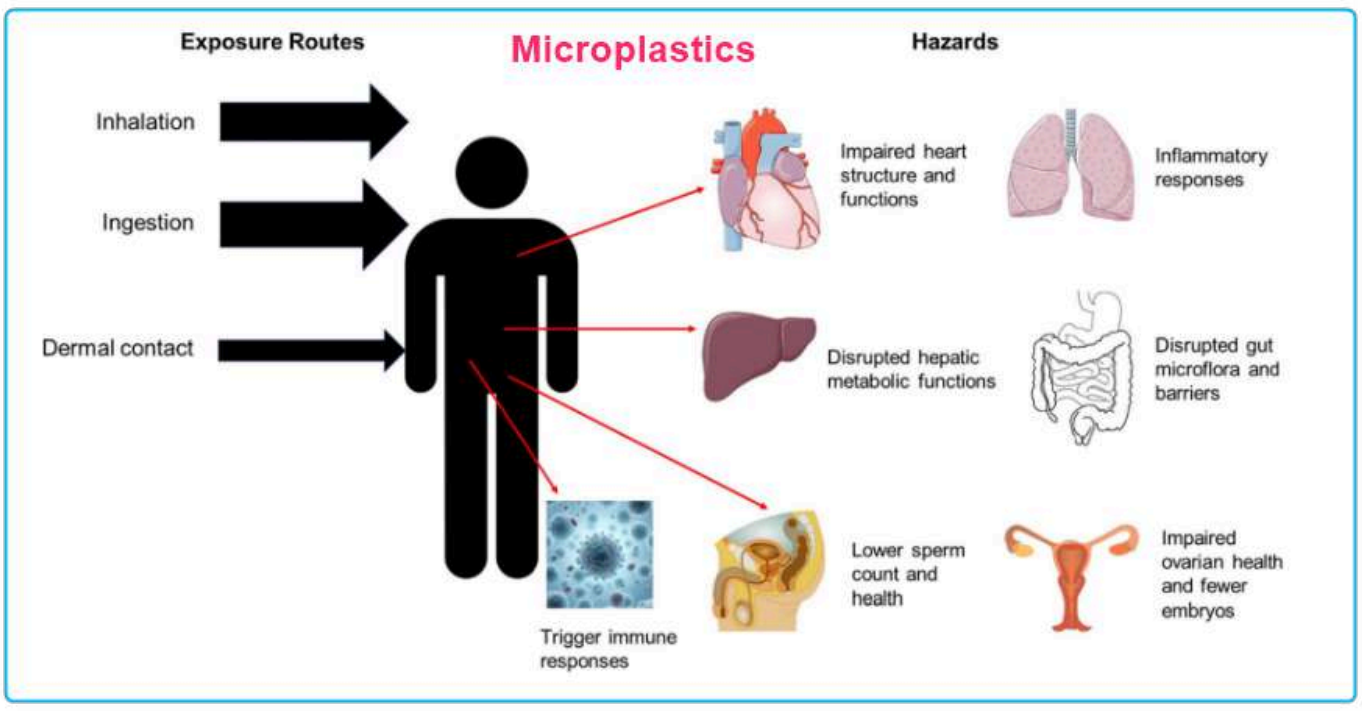
**Robert Malone**

- Microplastics and Nanoplastics in Atheromas and Cardiovascular Events- March 2024 (see below)
- Raman Microspectroscopy Detection and Characterisation of Microplastics in Human Breastmilk - June 2022
- Impact of Microplastics and Nanoplastics on Livestock Health: An Emerging Risk for Reproductive Efficiency - March 2023
- Exposure to microplastics and human reproductive outcomes: A systematic review - April 2024
- Isolation and identification of microplastics in infant formulas - A potential health risk for children - May 2024
- A Children's Health Perspective on Nano- and Microplastics - Jan 2022
- 266 studies of microplastic toxicity

## Health risk of human exposure to microplastics: a review - March 2024

Environmental Chemistry Letters https://doi.org/10.1007/s10311-024-01727-1 References online Can be read in DeepDyve - free trial

Kuok Ho Daniel Tang, Ronghua Li, Zhi Li & Dun Wang




Microplastics are emerging contaminants that have been detected recently in most environmental and biological systems, yet their health risk for humans has not been clearly summarized. Here we review human health risk associated with exposure to microplastics with focus on methods of exposure assessment, hazard identification, dose–response assessment, exposure assessment, and risk characterization. Hazards include direct hazards, hazards from contaminants released by microplastics, and hazards from microplastic interactions with surrounding contaminants.

Microplastics

- trigger oxidative stress,
- disrupt metabolism,
- interfere with gut microflora and gastrointestinal functions,
- disrupt hepatic, cardiopulmonary and immune systems, and
- degrade reproductive health.

Some additives leached from microplastics such as phthalates are endocrine disruptors and thus impact reproductive health. The interaction of microplastics with other pollutants in the environment induces varied hazards following synergistic or antagonistic effects.

## Microplastics appear to impact human organs ($65 paywall) - March 2024

**The possible impacts of nano and microplastics on human health: lessons from experimental models across multiple organs**

Journal of Toxicology and Environmental Health, Part B https://doi.org/10.1080/10937404.2024.2330962 35 pages

Bernardo Lannes Monteiro Fontes,Lorena Cristina de Souza e Souza,Ana Paula Santos da Silva de Oliveira,Rodrigo Nunes da Fonseca,Marinaldo Pacifico Cavalcanti Neto & Cintia Rodrigues Pinheiro

The widespread production and use of plastics have resulted in accumulation of plastic debris in the environment, gradually breaking down into smaller particles over time. Nano-plastics (NPs) and microplastics (MPs), defined as particles smaller than 100 nanometers and 5 millimeters, respectively, raise concerns due to their ability to enter the human body through various pathways including ingestion, inhalation, and skin contact. Various investigators demonstrated that these particles may produce

- physical and chemical damage to human cells, tissues, and organs,
- disrupting cellular processes,
- triggering inflammation and oxidative stress, and
- impacting hormone and neurotransmitter balance.

In addition, micro- and nano-plastics (MNPLs) may carry toxic chemicals and pathogens, exacerbating adverse effects on human health. The magnitude and nature of these effects are not yet fully understood, requiring further research for a comprehensive risk assessment. Nevertheless, evidence available suggests that accumulation of these particles in the environment and potential human uptake are causes for concern. Urgent measures to reduce plastic pollution and limit human exposure to MNPLs are necessary to safeguard human health and the environment. In this review, current knowledge regarding the influence of MNPLs on human health is summarized, including toxicity mechanisms, exposure pathways, and health outcomes across multiple organs. The critical need for additional research is also emphasized to comprehensively assess potential risks posed by degradation of MNPLs on human health and inform strategies for addressing this emerging environmental health challenge. Finally, new research directions are proposed including evaluation of gene regulation associated with MNPLs exposure.

## Microplastics Linked to Heart Attack, Stroke and Death - Scientific American March 2024

Use incognito web page to access it without a subscription

## Plaques were removed: those having microplastics had a 4.5 X increased risk of stroke, heart attack, etc. - March 2024

Plastic Found Inside More Than 50% of Plaques From Clogged Arteries - Science Alert **the following is the text without hyperlinks**

Now, a small study in Italy has found shards of microplastics in fatty deposits surgically removed from patients who had an operation to open up their clogged arteries – and reported their health outcomes nearly 3 years later.

Removing fatty plaques from narrowed arteries in a procedure called a carotid endarterectomy reduces the risk of future strokes.

The team behind this new study, led by Raffaele Marfella, a medical researcher at the University of Campania in Naples, wondered how the risk of stroke – as well as heart attacks and death – compared between patients who had microplastics in their plaques and those who did not.

Following 257 patients for 34 months, the researchers found nearly 60 percent of them had measurable amounts of polyethylene in plaques pulled from their fat-thickened arteries, and 12 percent also had polyvinyl chloride (PVC) in extracted fat deposits.

PVC comes in both rigid and flexible forms, and is used to make water pipes, plastic bottles, flooring, and packaging. Polyethylene is the most commonly produced plastic, used for plastic bags, films, and bottles, too.

In the study, **patients with microplastics in their excised plaques were 4.5 times as likely to have experienced a stroke, non-fatal heart attack or died from any cause after 34 months** than people who had no detectable microplastics in the plaques that surgeons had removed.

The amount of microplastics, and even smaller particles called nanoplastics, **was measured using a technique called pyrolysis–gas chromatography–mass spectrometry**, and their presence confirmed using another method, stable isotopes analysis, which can distinguish between the carbon of human tissues and that of plastics made from petrochemicals.

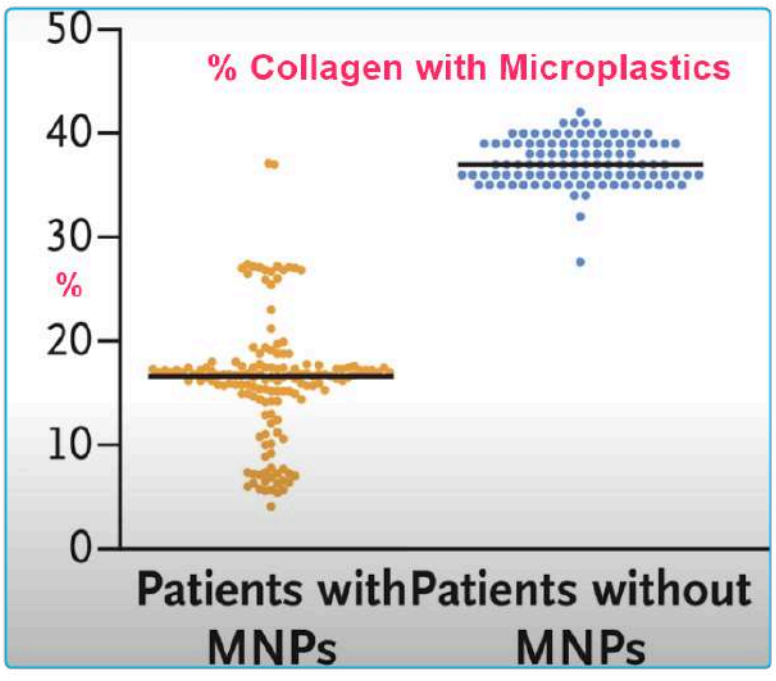
Microplastics were also visible under powerful microscopes: The researchers observed plastic fragments with jagged edges inside immune cells called macrophages, and within the fatty plaques. Examining the tissue samples, the team also found **higher levels of inflammatory markers in patients with microplastics in their plaques.**

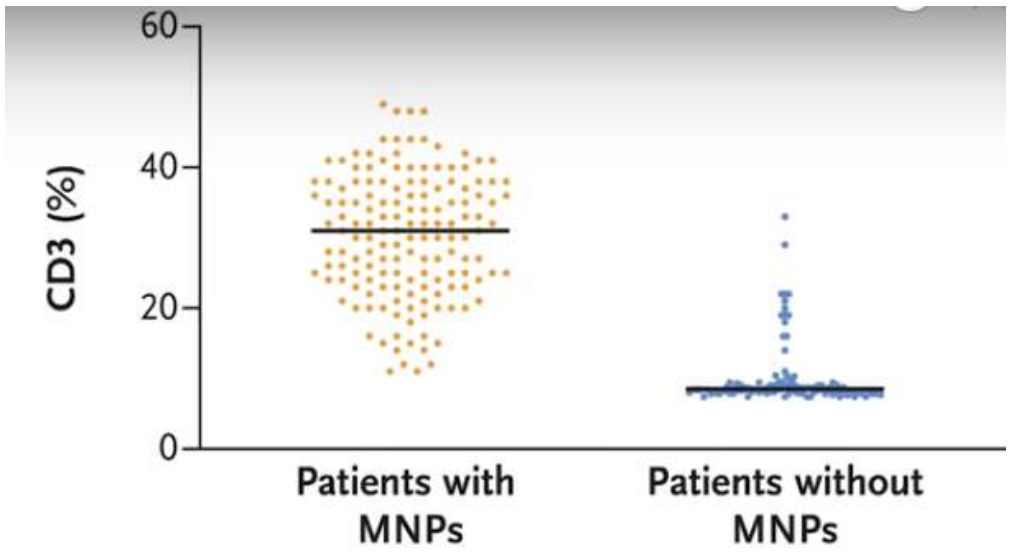
**Based on New England Journal of Medicine study published March 7, 2023**
Microplastics and Nanoplastics in Atheromas and Cardiovascular Events
https://www.nejm.org/doi/10.1056/NEJMoa2309822 PDF is behind paywall

**Study was described in a 8 minute video March 2024 - 2 charts from PDF**

[Dr Brad Stanfield]

**Half as much Collagen (needed for mechanical stability) in plaques with microplastics**




**Effects of Microplastics and Nanoplastics in Agro-ecosystems and Human Health: A review - Jan 2024**

Vingnanam Journal of Science Volume: 18 Issue: 2 Page/Article: 39-52 DOI: 10.4038/vingnanam.v18i2.4229

Rathiverni Rajaratnam. Nadeeka U JayawardanaEmail Nadeeka U Jayawardana Sri Lanka

Life on land and ocean is being threatened by microplastics (MPs) and nanoplastics (NPs). Despite, the fate and effects of MPs and NPs in agro-ecosystems have not been clearly understood. However, recent studies showed that these polymers can be transported and accumulated in food crops, humans, and other organisms. The introduction of plastics into terrestrial land has led to the accumulation of MPs and NPs in food crops. The bioaccumulation has been found in stems, leaves, flowers, and fruits. Thus, causes a change in physicochemical activities in plants that leads to a decline in crop production. Further, MPs accumulation in human placenta and breast milk have been evidently proven in recent studies. MPs themselves are being potential vectors of pollutants, including anti-resistance genes, harmful microbes, heavy metals, and carcinogenic compounds. Alarmingly, these pollutants can be horizontally transferred to organisms along with the MPs and remain intact throughout the food chain. Poor solid waste management, inadequacy in plastic recycling, and application of MPs contaminated compost in agricultural practices are the major entry points of MPs into the agro-ecosystem. The collection of these results in this study will help both on-going and upcoming investigations on bioaccumulation of MPs and NPs in crops and their movement through the food chain.

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**Detection of Various Microplastics in Patients Undergoing Cardiac Surgery - July 2023**

"Microplastic specimens were collected from 15 cardiac surgery patients, including 6 pericardia, 6 epicardial adipose tissues, 11 pericardial adipose tissues, 3 myocardia, 5 left atrial appendages, and 7 pairs of pre- and postoperative venous blood samples. "
https://doi.org/10.1021/acs.est.2c07179 PDF behind paywall

**Microplastics reduced bio-avalability of Zinc and Magnesium essential for vitamin D metabolism (in mice) - July 2023**

**Reduced dietary Ca, Cu, Zn, Mn, and Mg bioavailability but increased Fe bioavailability with polyethylene microplastic ingestion in a mouse model: Changes in intestinal permeability and gut metabolites**

Science of The Total Environment Volume 885, 10 August 2023, https://doi.org/10.1016/j.scitotenv.2023.163853 PDF behind paywall

Shan Chen a, Shi-Wei Li b, Xue-Yuan Gu a, Lena Q. Ma c, Dong-Mei Zhou a, Hong-Bo Li a

Microplastics emerge as a new environmental and human health crisis. Minimal research exists on effects of microplastic ingestion on the oral bioavailability of minerals (Fe, Ca, Cu, Zn, Mn, and Mg) in the gastrointestinal tract via impacting intestinal permeability, mineral transcellular transporters, and gut metabolites. Here, mice were exposed to polyethylene spheres of 30 and 200 μm (PE-30 and PE-200) in diet (2, 20, and 200 μg PE g−1) for 35 d to determine the microplastic effects on mineral oral bioavailability.

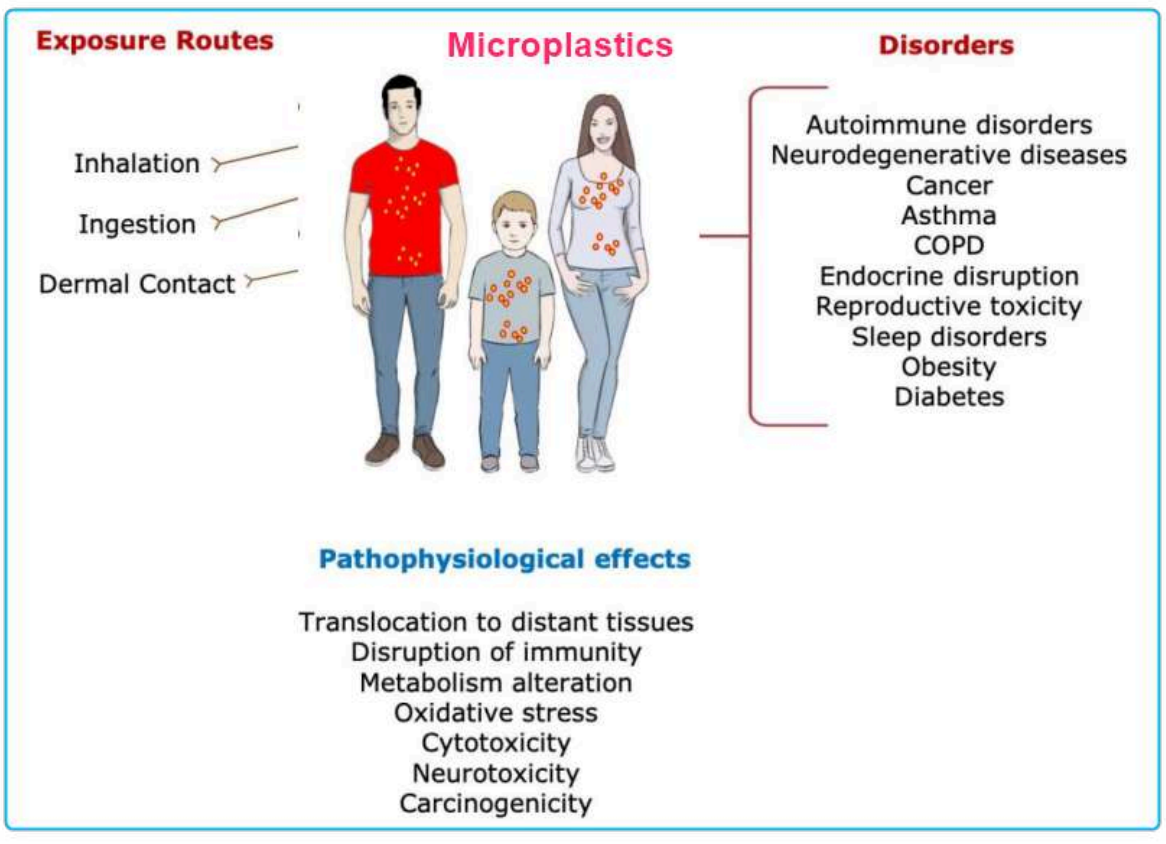
Results showed that for mice fed diet amended with PE-30 and PE-200 at 2–200 μg g−1, Ca, Cu, Zn, Mn, and **Mg** concentrations in the small intestine tissue were 43.3–68.8 %, 28.6–52.4 %, 19.3–27.1 %, 12.9–29.9 %, and **10.2–22.4 %** lower compared to control mice, suggesting hampered bioavailability of these minerals. In addition, Ca and Mg concentrations in mouse femur were 10.6 % and 11.0 % lower with PE-200 at 200 μg g−1. In contrast, Fe bioavailability was elevated, as suggested by significantly ($p < 0.05$) higher Fe concentration in the intestine tissue of mice exposed to PE-200 than control mice (157–180 vs. 115 ± 7.58 μg Fe g−1) and significantly ($p < 0.05$) higher Fe concentrations in liver and kidney with PE-30 and PE-200 at 200 μg g−1. Following PE-200 exposure at 200 μg g−1, genes coding for duodenal expression of tight junction proteins (e.g., claudin 4, occludin, zona occludins 1, and cingulin) were significantly up-regulated, possibility weakening intestinal permeability to Ca, Cu, Zn, Mn, and Mg ions. The elevated Fe bioavailability was possibly related to microplastic-induced greater abundances of small peptides in the intestinal tract, which inhibited Fe precipitation and elevated Fe solubility. Results showed that microplastic ingestion may cause Ca, Cu, Zn, Mn, and Mg deficiency but Fe overload via altering intestinal permeability and gut metabolites, posing a threat to human nutrition health.

**Note by VitaminDWiki: Topical Magnesium would not be blocked by microplastics**

## Microplastics and human health: Integrating pharmacokinetics - April 2023

https://doi.org/10.1080/10643389.2023.2195798 FREE PDF

## Microplastics as an Emerging Threat to the Global Environment and Human Health - July 2023




- "Exposure to microplastics can also pose potential health risks to humans, including respiratory and digestive problems, as well as disrupt sleep, contribute to obesity, and increase the risk of diabetes."

**PDF**

## Microplastics and human health: Integrating pharmacokinetics - April 2023

https://doi.org/10.1080/10643389.2023.2195798 FREE PDF

## The Plastic Within: Microplastics Invading Human Organs and Bodily Fluids Systems - Nov 2023

Environments 2023, 10(11), 194; https://doi.org/10.3390/environments10110194
by Christian Ebere Enyoh 1,*ORCID,Arti Devi 1,Hirofumi Kadono 1,Qingyue Wang 1ORCID andMominul Haque Rabin 1,2ORCID

- 1 Graduate School of Science and Engineering, Saitama University, 255 Shimo-Okubo, Sakura-ku, Saitama City 338-8570, Japan
- 2 Department of Agricultural Chemistry, Faculty of Agriculture, Sher-e-Bangla Agricultural University, Dhaka 1207, Bangladesh

Microplastics (MPs), small plastic particles resulting from the degradation of larger plastic items and from primary sources such as textiles, engineered plastic pellets, etc., have become a ubiquitous environmental pollutant. As their prevalence in the natural environment grows, concerns about their potential impacts on human health have escalated.

This review discusses current research findings on the presence of MPs in organs such as the

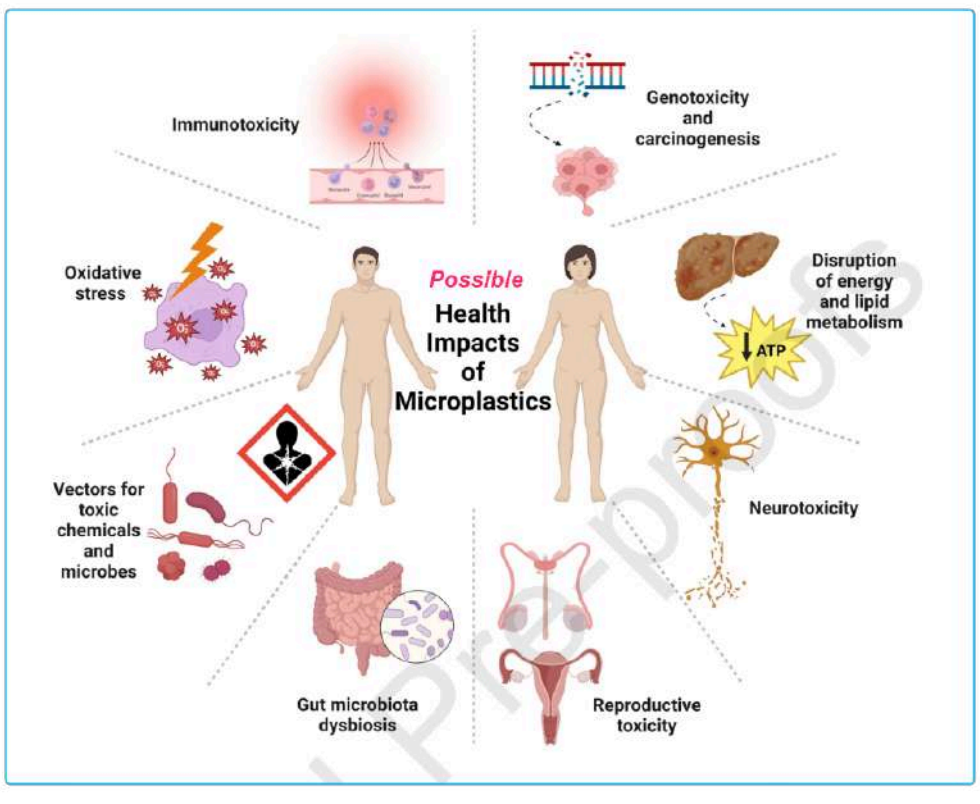
- liver,
- blood,
- heart,
- placenta,
- breast milk,
- sputum,
- semen,
- testis, and
- urine,

while also exploring plausible mechanisms of translocation. Furthermore, the review emphasizes the importance of understanding the potential toxicological effects of MPs on various physiological processes within these organs and their broader implications for human health. This review also examines the pathways through which MPs can enter and accumulate in human organs and bodily fluids, shedding light on the intricate routes of exposure and potential health implications. It is worth noting that the invasive medical procedures may permit direct access of MPs to the bloodstream and tissues, serving as a potential contamination source. However, it is evident that a comprehensive understanding of MPs' invasion into human organs is vital for effective mitigation strategies and the preservation of both human health and the environment.

## No such attachment on this page

## Microplastics contamination in food products: Occurrence, analytical techniques and potential impacts on human health - Feb 2024

Current Research in Biotechnology Feb 2024 https://doi.org/10.1016/j.crbiot.2024.100190
Suman Giri a, Gopal Lamichhane b c, Dipendra Khadka d e, Hari Prasad Devkota f g




Chemically, microplastics (MPs) are synthetic materials composed of plastic monomers and additives and vary in size from 0.1 to 5000 µm. Due to their chemical stability and the widespread use of plastics for various purposes, MP contamination of the environment has increased dramatically, leading to the contamination of daily consumer products as well. Although previous studies have reported the environmental impacts of MPs, only a few studies have highlighted the occurrence of MPs in food products and their possible effects on human health. Recent investigations have identified MP particles in drinking water and other beverages, seafood, plant products, salt, sugar, and honey, raising an alarm over the safety and quality of these food items. Ingestion, inhalation, and dermal contact of such food and other consumer goods are the common routes through which MPs may enter the human body and can have several deleterious health

impacts including oxidative stress, inflammation, immunotoxicity, increased risk of neoplasia, cellular metabolism impairment, neurotoxicity, gut microbiome dysbiosis, disruption of reproductive system among others. A collective approach employing source control, recycling, biodegradable plastics, strengthening legislation, and bioremediation could be a promising and sustainable solution to control the MP pollution. The key challenge appears to standarize detection methods along with reducing the MP contamination from the food products as well as from the environment. Therefore, this review focuses on the occurrence of MPs in several food products, current methods of analysis, potential health impacts, and strategies to mitigate the widespread MP pollution. It also adds novel findings, knowledge gaps, and recommendations that can guide future research in this field.

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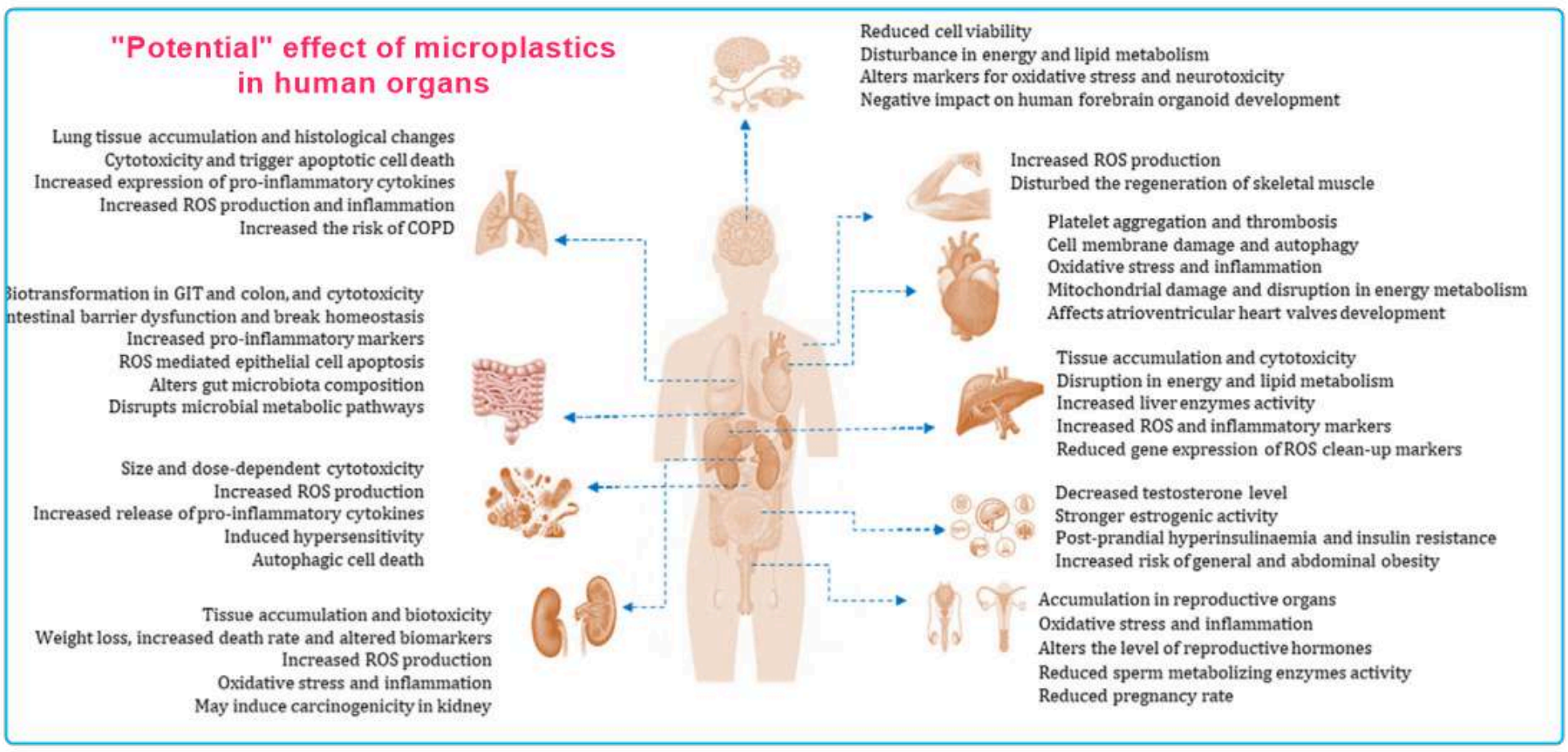
## The potential impacts of micro-and-nano plastics on various organ systems in humans - Lancet Jan 2024

eBioMedicine 2024;99: 104901 https://doi.org/10.1016/j.ebiom.2023.104901

Nurshad Ali, Jenny Katsouli, Emma L. Marczylo, Timothy W. Gant, Stephanie Wright

- Impact of MNPs on organ systems
  - Respiratory system
  - Gastrointestinal system
  - Cardiovascular system
  - Hepatic system
  - Renal system
  - Reproductive and developmental system
  - Nervous system
  - Immune system
  - Endocrine system
  - Muscular system
  - Other effects
  - Toxicity mechanisms of MNPs
  - Outstanding questions
  - Conclusions




Humans are exposed to micro-and-nano plastics (MNPs) through various routes, but the adverse health effects of MNPs on different organ systems are not yet fully understood. This review aims to provide an overview of the potential impacts of MNPs on various organ systems and identify knowledge gaps in current research.

The summarized results suggest that exposure to MNPs can lead to health effects through oxidative stress, inflammation, immune dysfunction, altered biochemical and energy metabolism, impaired cell proliferation, disrupted microbial metabolic pathways, abnormal organ development, and carcinogenicity. There is limited human data on the health effects of MNPs, despite evidence from animal and cellular studies.

Most of the published research has focused on specific types of MNPs to assess their toxicity, while other types of plastic particles commonly found in the environment remain unstudied.

Future studies should investigate MNPs exposure by considering realistic concentrations, dose-dependent effects, individual susceptibility, and confounding factors.

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**VitaminDWiki - [Autism risk if toxins, heavy metals, microplastics, etc during pregnancy (unless add Vitamin D) – Feb 2024]**

## Microplastics causing problems in Zebra fish - reduced by 40% if Vitamin D was added - Nov 2023

**Vitamin D modulation of brain-gut-virome disorder caused by polystyrene nanoplastics exposure in zebrafish (Danio rerio)**

Microbiome . 2023 Nov 27;11(1):266. doi: 10.1186/s40168-023-01680-1.

Miaomiao Teng # 1, Yunxia Li # 1, Xiaoli Zhao 2, Jason C White 3, Lihui Zhao 1, Jiaqi Sun 4, Wentao Zhu 5, Fengchang Wu 6

Background: Many studies have investigated how nanoplastics (NPs) exposure mediates nerve and intestinal toxicity through a dysregulated brain-gut axis interaction, but there are few studies aimed at alleviating those effects. To determine whether and how vitamin D can impact that toxicity, fish were supplemented with a vitamin D-low diet and vitamin D-high diet.

Results: Transmission electron microscopy (TEM) showed that polystyrene nanoplastics (PS-NPs) accumulated in zebrafish brain and intestine, resulting in brain blood-brain barrier basement membrane damage and the vacuolization of intestinal goblet cells and mitochondria. A high concentration of vitamin D reduced the accumulation of PS-NPs in zebrafish brain tissues by 20% and intestinal tissues by 58.8% and 52.2%, respectively, and alleviated the pathological damage induced by PS-NPs. Adequate vitamin D significantly increased the content of serotonin (5-HT) and reduced the anxiety-like behavior of zebrafish caused by PS-NPs exposure. Virus metagenome showed that PS-NPs exposure affected the composition and abundance of zebrafish intestinal viruses. Differentially expressed viruses in the vitamin D-low and vitamin D-high group affected the secretion of brain neurotransmitters in zebrafish. Virus AF191073 was negatively correlated with neurotransmitter 5-HT, whereas KT319643 was positively correlated with malondialdehyde (MDA) content and the expression of cytochrome 1a1 (cyp1a1) and cytochrome 1b1 (cyp1b1) in the intestine. This suggests that AF191073 and KT319643 may be key viruses that mediate the vitamin D reduction in neurotoxicity and immunotoxicity induced by PS-NPs.

Conclusion: **Vitamin D can alleviate neurotoxicity and immunotoxicity induced by PS-NPs** exposure by directionally altering the gut virome. These findings highlight the potential of vitamin D to alleviate the brain-gut-virome disorder caused by PS-NPs exposure and suggest potential therapeutic strategies to reduce the risk of NPs toxicity in aquaculture, that is, adding adequate vitamin D to diet. Video Abstract.

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## People are now INHALING a credit card's worth of plastics each week - Sept 2023

**You breathe in a credit card's worth of microplastic every week**

- "We breathe in about 16 bits of microplastic every hour,"
- "Experts are starting to correlate microplastics with lung inflammation, shortness of breath and a higher risk of lung cancer. Research on rats suggests that when microplastics infiltrate lung cells, they can start to jumble up cell composition. This suggests that exposure to microplastics can cause lung injury in humans, too. "

## Study: people could be EATING a credit card's worth of microplastics per week- 2019

**BoingBoing**

## Microplastics may increase snow melt, and thus increase climate warming

**Microplastics' contribution to melting snow: A global crisis - Canadian Geographic** **April 2021**

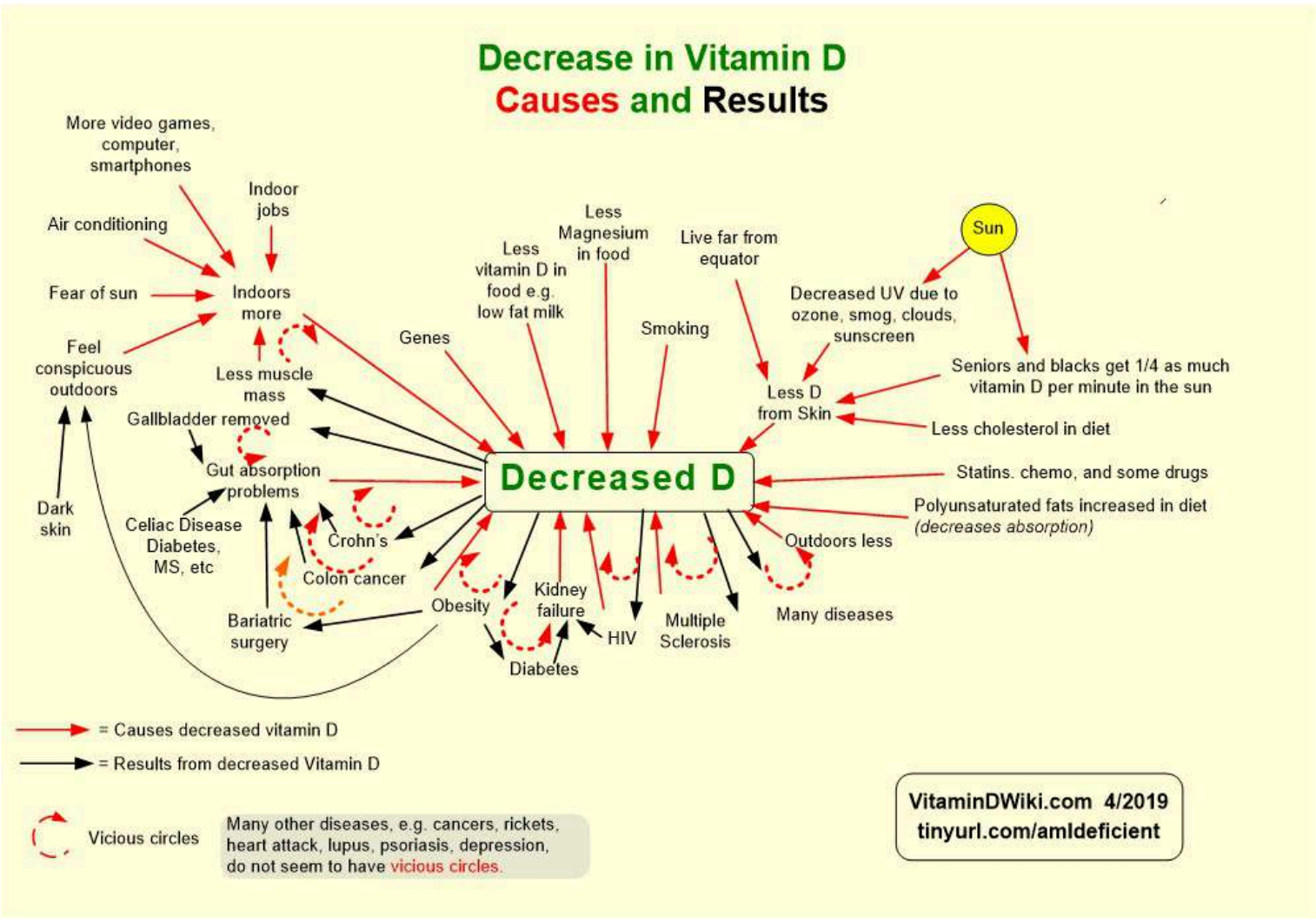
## 8 Types of Plastic Discovered in People Who Had Heart Surgery - Sept 2023

**The Defender**

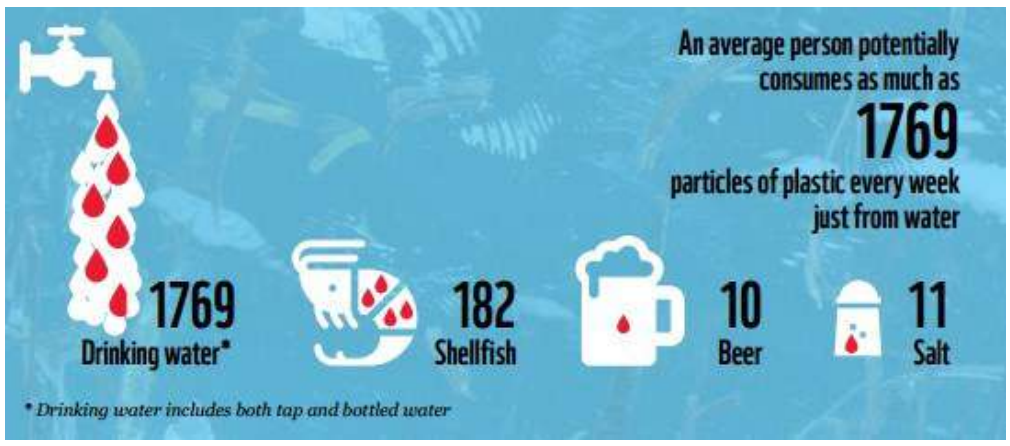
- "It's believed that most plastic particles enter the human bloodstream after being ingested or inhaled via food, water, air and other sources."

- Off topic: Plastics and BPA are getting into seafood and your bloodstream – Dr. Greger Spring 2019
- Plastics, BPA, PCB and Vitamin D deficiency
    - No indication of the mechanism,
    - Wonder if microplastics decrease Vitamin D in women more than smoking
- Many reasons why vitamin D deficiency has become epidemic
    - Microplastics is one of the 22 new reasons
- Vitamin D levels cut in half in 18 years

**Chart does not yet show microplastics decreasing Vitamin D Levels**



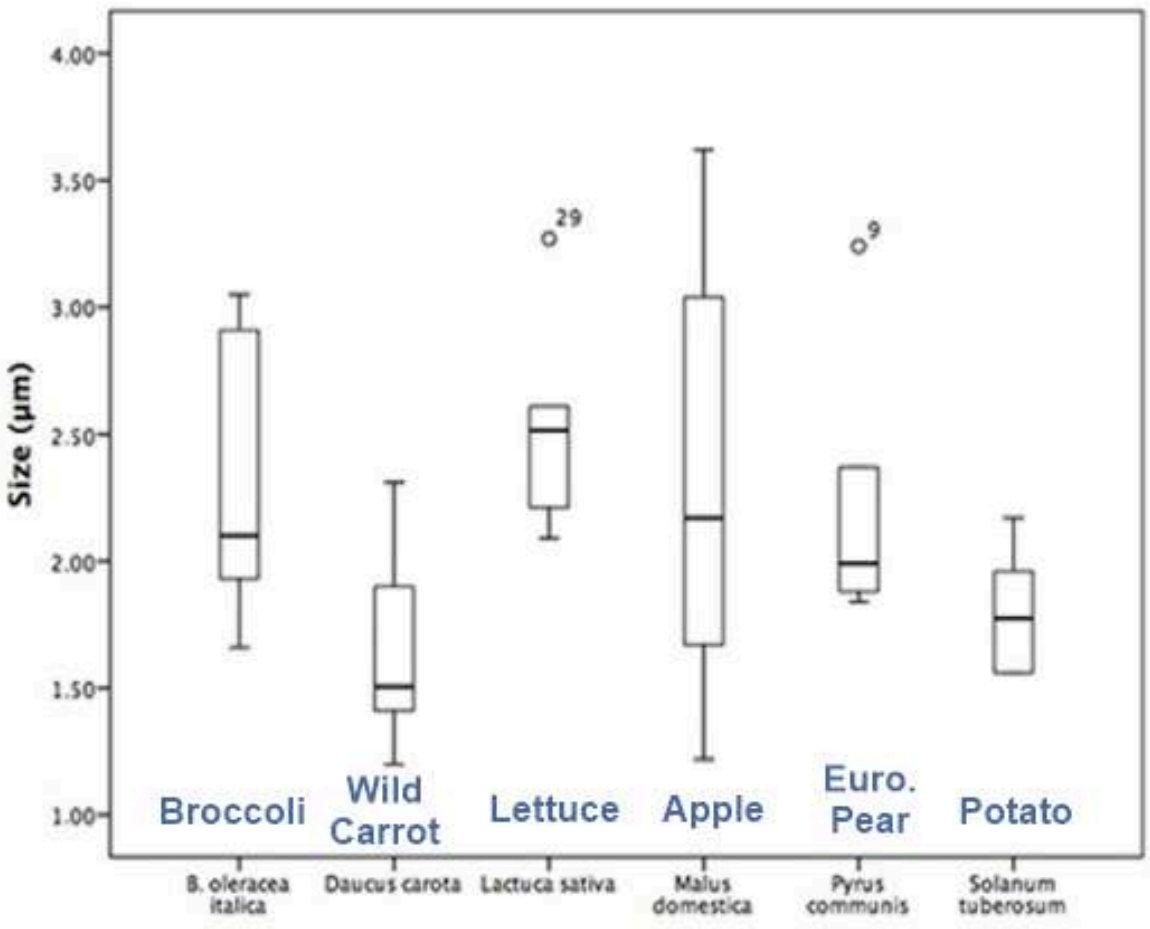

**Download the Report from VitaminDWiki**



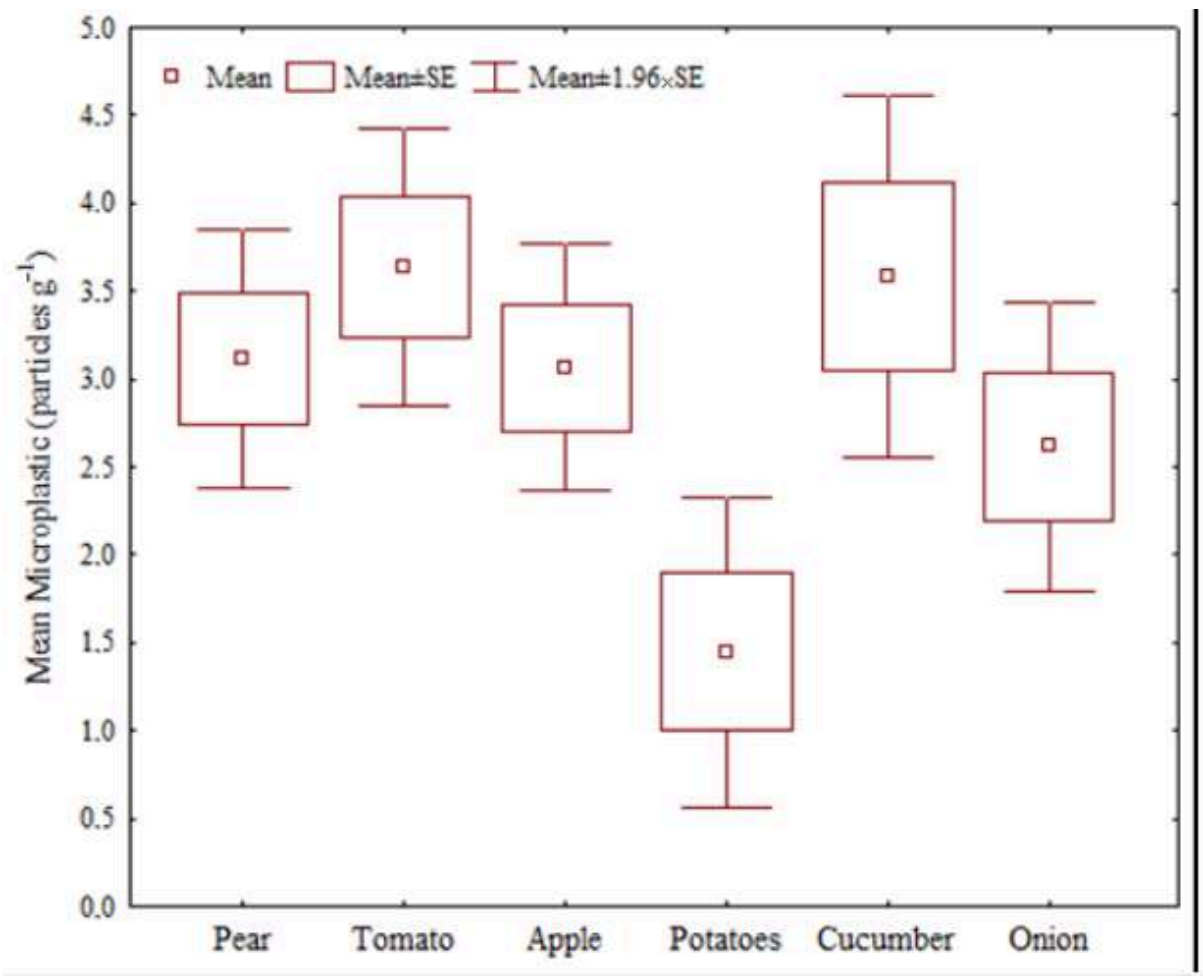

## Microplastics in fruit and vegetables

- Micro- and nano-plastics in edible fruit and vegetables.

  The first diet risks assessment for the general population - Aug 2020 - (may not have been able to detect nanoplastics) PDF




- Occurrence of Microplastics in Most Consumed Fruits and Vegetables from Turkey and Public Risk Assessment for Consumers Aug 2023 - (may not have been able to detect nanoplastics) [PDF]




## 100K-400K NANOplastic particles in a liter of bottled water - Jan 2024

**AP News**

## Microplastics perturb macrophages in the lab - May 2023

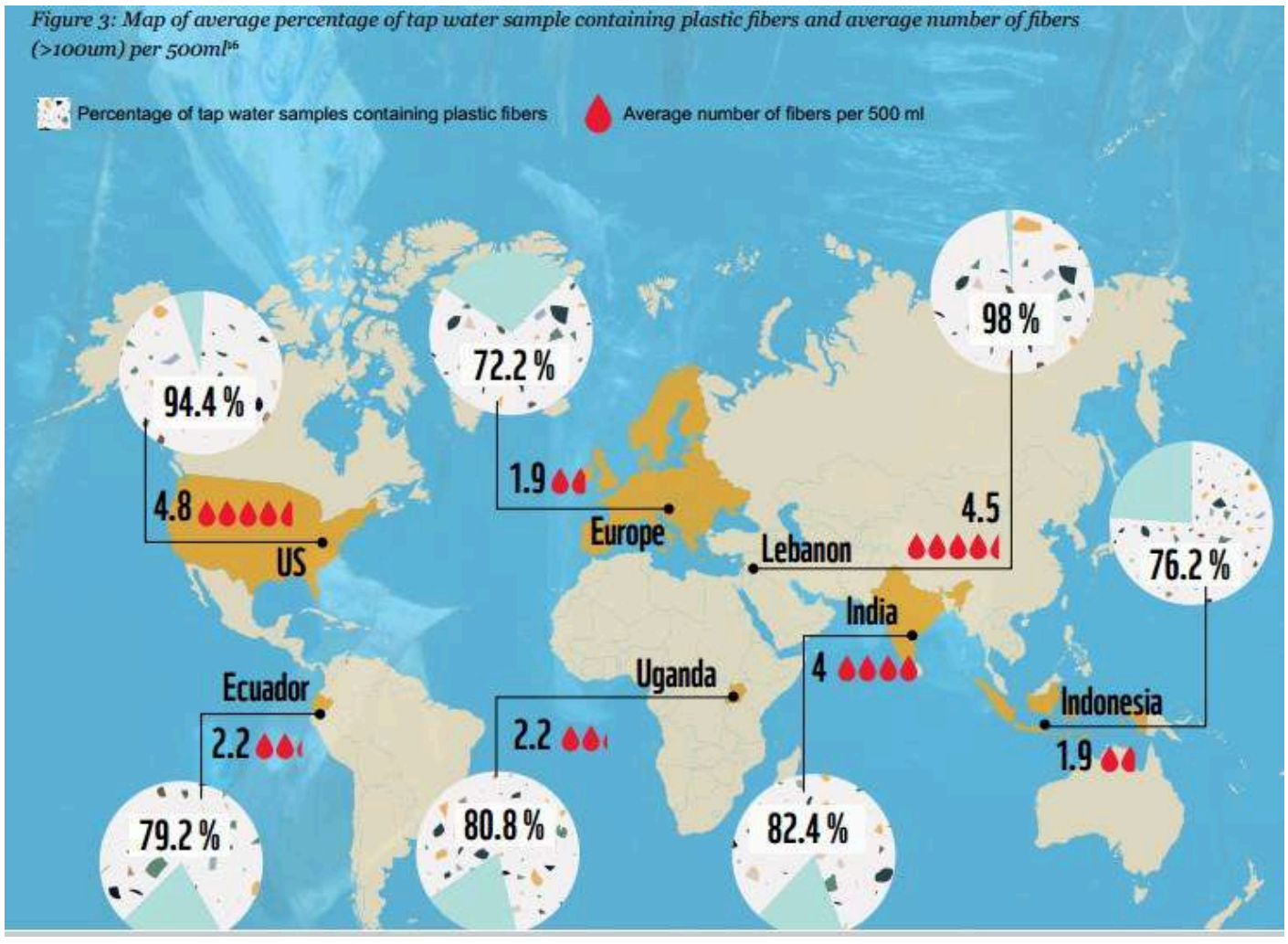
**The internal dose makes the poison: higher internalization of polystyrene particles induce increased perturbation of macrophages**
Front Immunol. 2023; 14: May doi: 10.3389/fimmu.2023.1092743

**From abstract**

- " Using polystyrene as a model of micro and nanoplastics, with size ranging from under 100 nm to 6 microns, we have showed that although non-toxic, polystyrene nano and microbeads alter the normal functioning of macrophages in a size and dose-dependent manner. **Alterations in the oxidative stress, lysosomal and mitochondrial functions were detected**"

[Download the Report from VitaminDWiki]

## 94% of US water contains microplastics



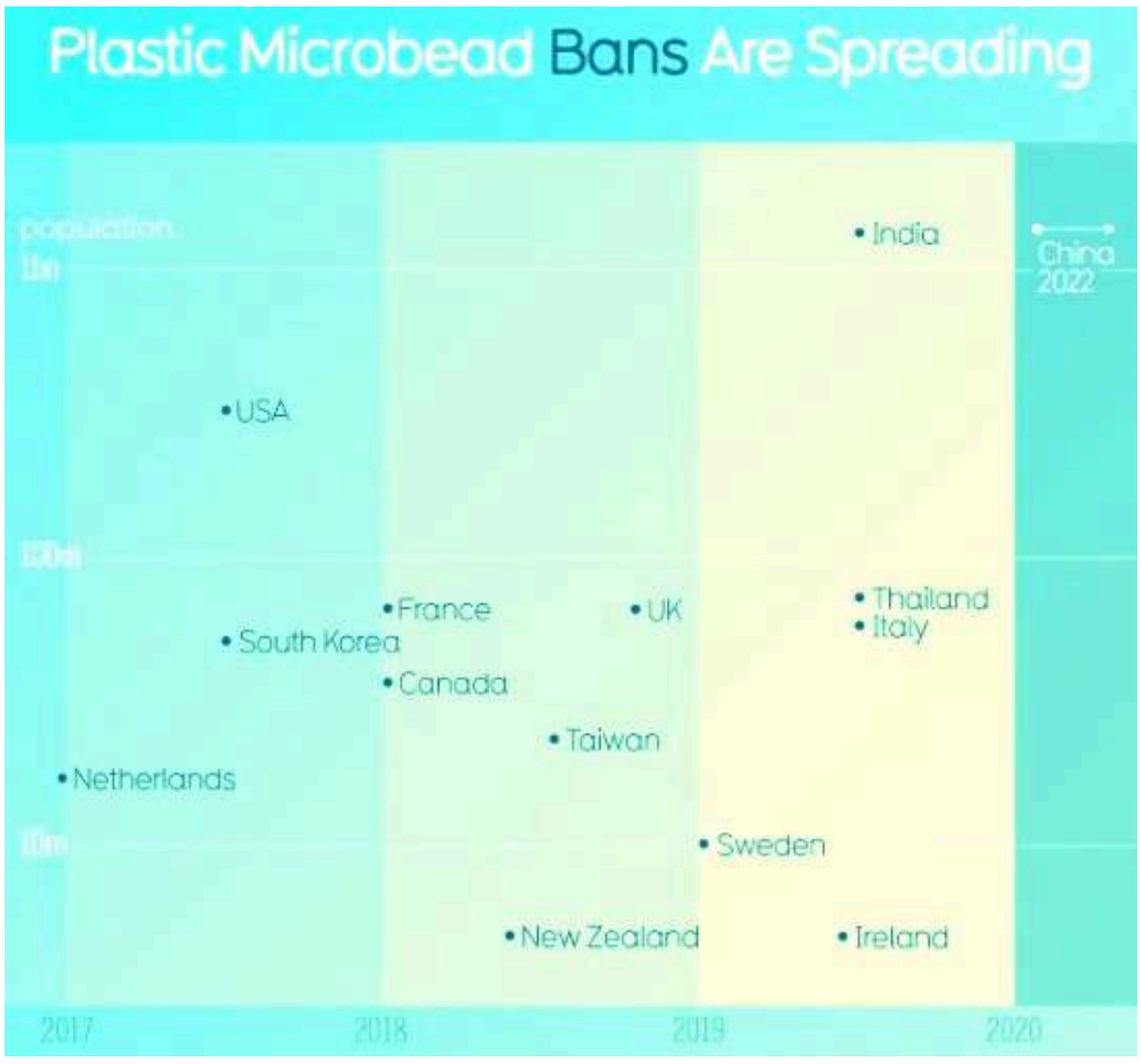

### 500 tons of RF chaff into the US annually, vs 878 tons of microplastics into the ocean from all washing machines US and Canada - Feb 2024

- **The Military Routinely Disperses Aluminum-Coated Fiberglass Into the Air Mercola Feb 2024**
  - ranging in lengths from 0.8 to 0.75 cm, so not microplastics at the time of release
- __https://ocean.org/blog/canadian-and-us-laundry-releases-trillions-of-plastic-microfibers-into-the-ocean/Laundry Releases Trillions of Plastic Microfibers Into the Ocean 2019

### Web- seabirds, humans, baby formula, breast cancer

- Microplastics are messing with the microbiomes of seabirds - MIT Review March 2023
- Microplastics as an emerging source of particulate air pollution: A critical review - Sept 2021 https://doi.org/10.1016/j.jhazmat.2021.126245 lots of text available for free, $$ for entire PDF7
- Micro to nano plastics and its link to human health Oct 2022 doi: 10.14744/ijmb.2022.64326 FREE PDF
- Baby Poop Is Loaded With Microplastics Wired Sept 2021
  - "An alarming new study finds that infant feces contain **10 times** more polyethylene terephthalate (aka polyester) than an adult's."
  - "Different varieties of plastic can contain any of at least 10,000 different chemicals, a quarter of which are of concern for people,.."
  - "Of particular concern are a class of chemicals called **endocrine-disrupting chemicals**, or EDCs, which disrupt hormones and have been connected to reproductive, neurological, and metabolic problems, for instance, increased obesity. The infamous plastic ingredient bisphenol A, or BPA, is one such EDC that has been linked to various cancers. "
- Researchers 'Gobsmacked' by Number of Microplastic Particles in Baby Bottles Treehugger Oct 2020
  - High temperature water releases >1,000,000 microplastics into each bottle of formula
  - 55 million per liter of water at 203 degrees F
- How Plastics Can Affect Your Love Life Dr. Greger Dec 2018
- "Women working in automotive plastics and food canning are at five times the odds of **breast cancer**" **Free PDF online
- ocean water was thought to have 10 microplastics per cubic meter is found to have 8,300,000 per cubic meter Dec 2019
  - They finally got around to looking for the very very small particles
  - Every single one of the micro planktons (saps) contained microplastics
  - Microplastics are associated with brain damage and liver tumors in fish
  - Future research will determine microplastic effects further up the food chain - such as in humans

- *Bans on Plastic Microbead - March 2020




### Rainfall in the Rocky Mountains contains microplastics - 2019

**[It's raining plastic in the Rockies ](#) Mother Nature Network**

- "A study from scientists at the U.S. Geological Survey has found that 90 percent of rainwater samples from eight different locations along the Rockies contained plastics."

### Microplastics in Mosquitoes - Sept 2018

**[Microplastics are getting into mosquitoes and contaminating new food chains](#)**

In the lab they fed larva microplastics. "Plastics were retained as the mosquitoes went through different life stages"

Mosquitoes are eaten by birds and fish

### Zero Water countertop filter eliminates microplastic (nanoplastic too?)

**[Zerowater.com](#)**

many different sizes, all models include a small meter to test the amount of dissolved solids

Removes [https://waterpurificationguide.com/water-filters-that-remove-microplastics/ 99.9% of microplastics](#) ( unclear what sizes, see chart below) and [100% of Glyphosate](#), Fluoride, etc.

[Amazon $29, 3,000 reviews](#) - also WalMart, Home Depot, etc.

[Great 2019 review compared many filters - taste, quality, ergonomics, etc](#) found Zero to be best

Does remove beneficial Magnesium ions from the water (**10 mg/liter**)

I take daily Magnesium supplements (**400 mg/day**), so I do not feel the need to remineralize the water

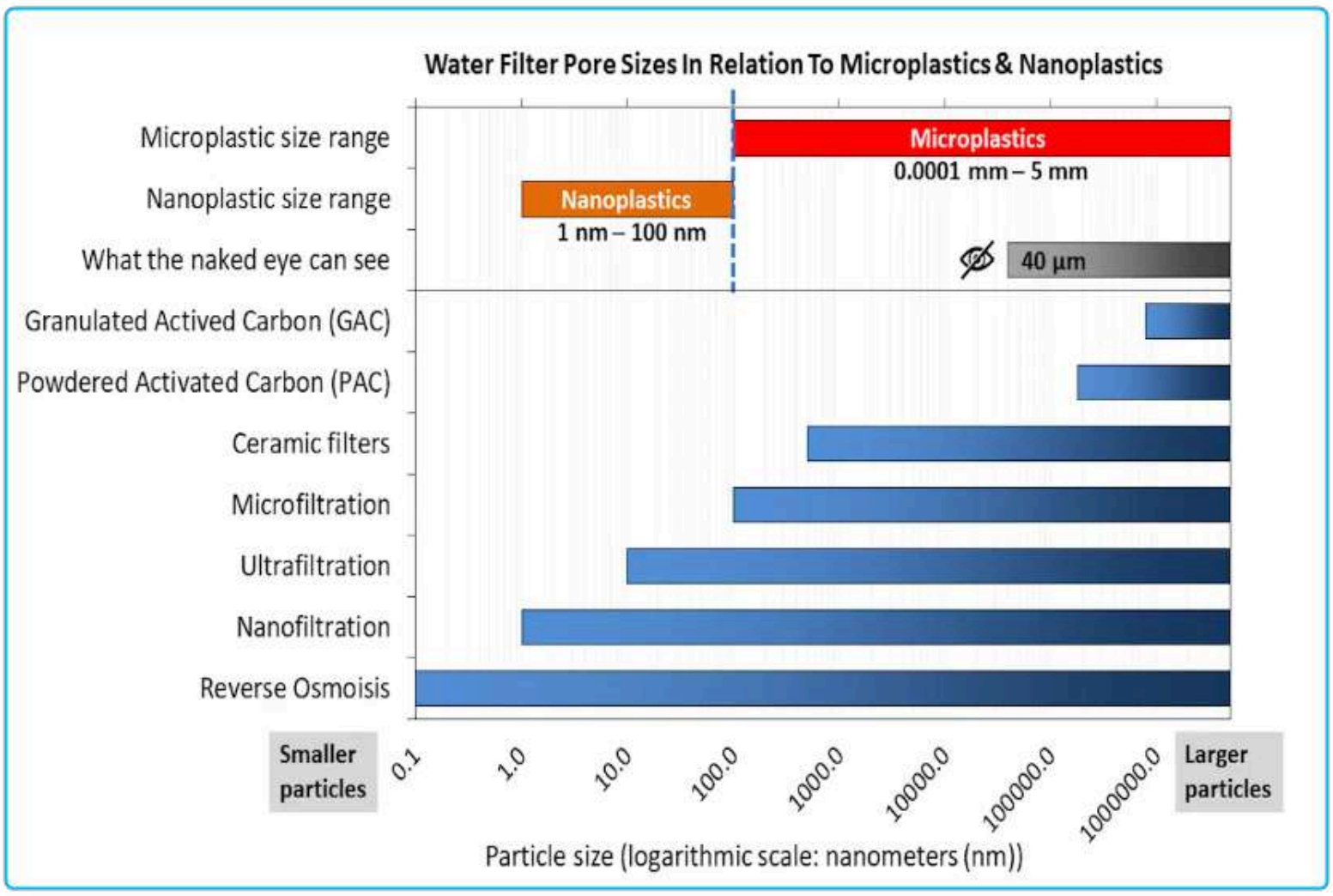
It is not practical in areas with hard water (there is a US harness map at their website)

the filter stops at 18 grams of dissolved solids - will not last a month if there is hard water

Uses some of the chemicals and filters used in RO systems

[You can recycle 2 filters for $10 - but you pay the postage](#)

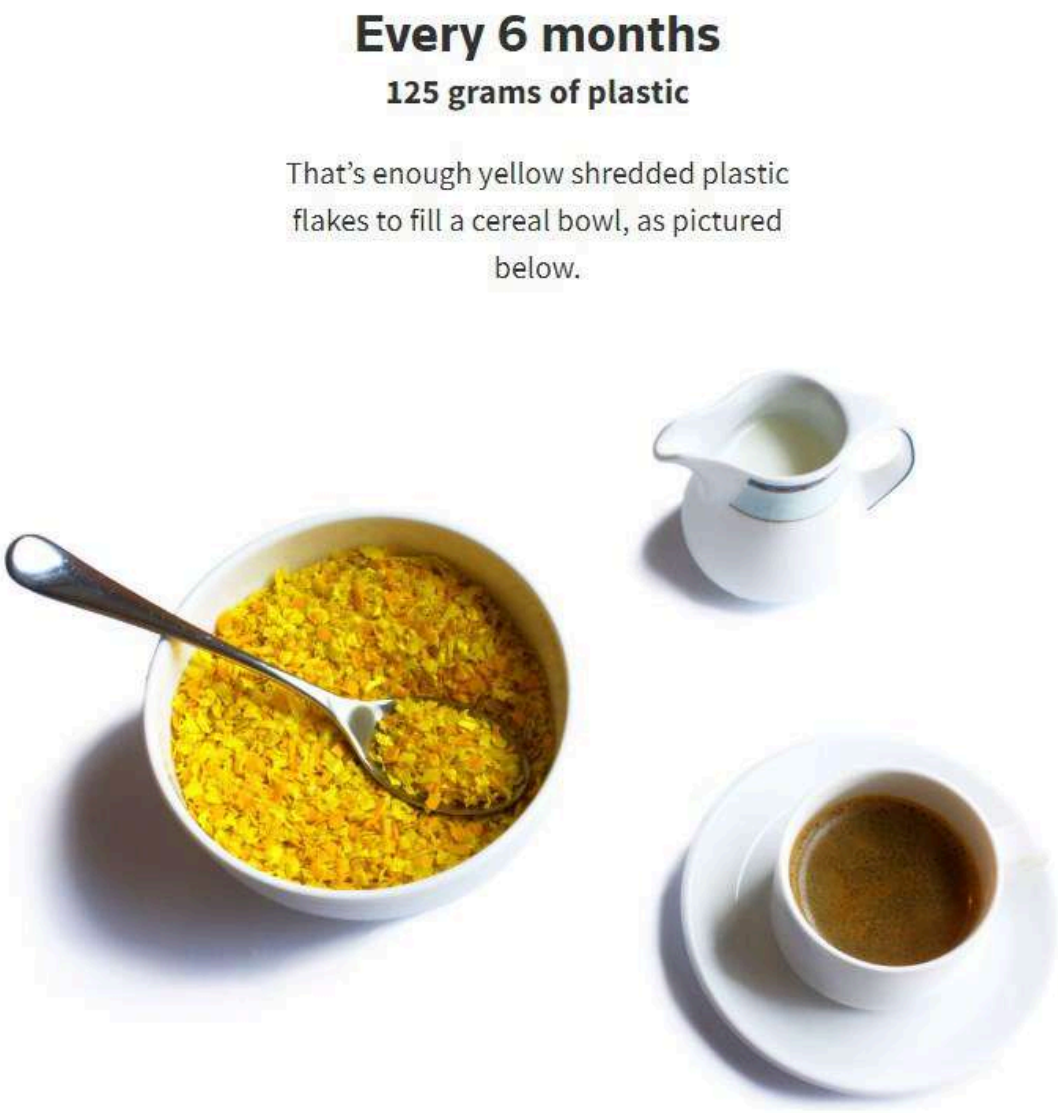
### Chart of the size of nano and microplastics removed by type of water filter - Jan 2024?




**From:** [Water Filters That Remove Microplastics](#) **10 types reviewed**

## Visualizing the amount of microplastic we eat - Dec 2019

**Reuters**




## 5+ VitaminDWiki pages with BPA in title

*This list is automatically updated*

Items found: 5

| Title | Modified |
| --- | --- |
| Plastics, BPA, PCB and Vitamin D deficiency | 27 Oct, 2021 |
| BPA is a possible cause of obesity epidemic - Dr. Greger June 2019 | 18 Jun, 2019 |
| Off topic: Plastics and BPA are getting into seafood and your bloodstream – Dr. Greger Spring 2019 | 02 May, 2019 |
| BPA associated with 3 percent lower level of vitamin D in women – Sept 2016 | 22 Sep, 2017 |
| BPA increased risk of vitamin D deficiency by 20 percent – Sept 2016 | 20 Sep, 2016 |

### Your clothes can shed 700,000 microplastic fibers in a single wash - Feb 2023

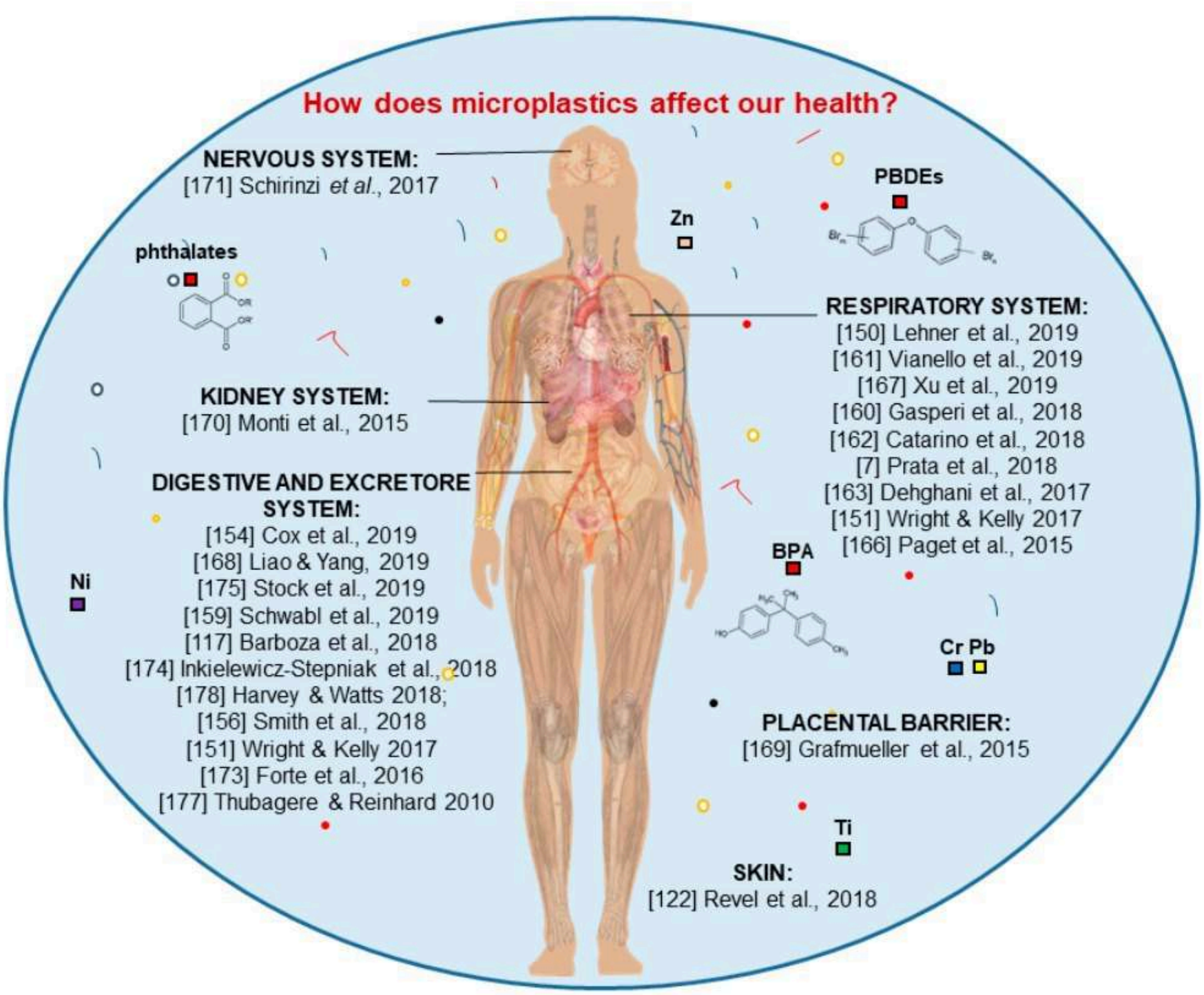
**Fast Company**

### A Detailed Review Study on Potential Effects of Microplastics and Additives of Concern on Human Health - Feb 2020

Int. J. Environ. Res. Public Health 2020, 17(4), 1212; https://doi.org/10.3390/ijerph17041212

by Claudia Campanale *ORCID,Carmine MassarelliORCID,Ilaria Savino,Vito Locaputo andVito Felice Uricchio

Water Research Institute-Italian National Research Council (IRSA-CNR), Bari, BA, Italy




The distribution and abundance of microplastics into the world are so extensive that many scientists use them as key indicators of the recent and contemporary period defining a new historical epoch: The Plasticene. However, the implications of microplastics are not yet thoroughly understood. There is considerable complexity involved to understand their impact due to different physical–chemical properties that make microplastics multifaceted stressors. If, on the one hand, microplastics carry toxic chemicals in the ecosystems, thus serving as vectors of transport, they are themselves, on the other hand, a cocktail of hazardous chemicals that are added voluntarily during their production as additives to increase polymer properties and prolong their life. To date, there is a considerable lack of knowledge on the major additives of concern that are used in the plastic industry, on their fate once microplastics dispose into the environment, and on their consequent effects on human health when associated with micro and nanoplastics. The present study emphasizes the most toxic and dangerous chemical substances that are contained in all plastic products to describe the effects and implications of these hazardous chemicals on human health, providing a detailed

overview of studies that have investigated their abundance on microplastics. In the present work, we conducted a capillary review of the literature on micro and nanoplastic exposure pathways and their potential risk to human health to summarize current knowledge with the intention of better focus future research in this area and fill knowledge gaps.

**Download the PDF from VitaminDWiki**

## Microplastics Pollution as an Invisible Potential Threat to Food Safety and Security, Policy Challenges and the Way Forward - Dec 2020

Int. J. Environ. Res. Public Health 2020, 17(24), 9591; https://doi.org/10.3390/ijerph17249591

by Sunusi Usman 1ORCID,Ahmad Faizal Abdull Razis 1,2,*ORCID,Khozirah Shaari 1,3,Mohammad Noor Azmai Amal 4,5ORCID,Mohd Zamri Saad 5,6ORCID,Nurulfiza Mat Isa 7,8,Muhammad Farhan Nazarudin 5ORCID,Syaizwan Zahmir Zulkifli 4ORCID,Jumria Sutra 4 andMusa Adamu Ibrahim 4

Technological advances, coupled with increasing demands by consumers, have led to a drastic increase in plastic production. After serving their purposes, these plastics reach our water bodies as their destination and become ingested by aquatic organisms. This ubiquitous phenomenon has exposed humans to microplastics mostly through the consumption of sea food. This has led the World Health Organization (WHO) to make an urgent call for the assessment of environmental pollution due to microplastics and its effect on human health. This review summarizes studies between 1999 and 2020 in relation to microplastics in aquatic ecosystems and human food products, their potential toxic effects as elicited in animal studies, and policies on their use and disposal. There is a paucity of information on the toxicity mechanisms of microplastics in animal studies, and despite their documented presence in food products, no policy has been in place so far, to monitor and regulates microplastics in commercial foods meant for human consumption. Although there are policies and regulations with respect to plastics, these are only in a few countries and in most instances are not fully implemented due to socioeconomic reasons, so they do not address the problem across the entire life cycle of plastics from production to disposal. More animal research to elucidate pathways and early biomarkers of microplastic toxicity that can easily be detected in humans is needed. This is to create awareness and influence policies that will address this neglected threat to food safety and security.

**Download the PDF from VitaminDWiki**

**VitaminDWiki – PFAS (forever chemicals) reduce Vitamin D and VDR, cause health problems - many studies**

**VitaminDWiki – Interactions with Vitamin D contains**

**Interactions with Vitamin D has 126 items**

**Various drugs decrease Vitamin D**

Drug interactions with Vitamin D - many studies - Feb 2024

Antidepressants reduce cellular Vitamin D, increasing fractures, CVD, etc. - Oct 2022

Medications that appear to lower Vitamin D – Aug 2021

24 drugs that typically reduce Vitamin D levels – Review Aug 2021

Proton pump inhibitors decrease Vitamin D and Magnesium – Dec 2018

Statins and Vitamin D - many studies

Glyphosate decreases Vitamin D getting to cells in many ways

Antibiotics and Vitamin D are associated with many of the same diseases

More colas lower vitamin D by 3 ng– July 2014

**A few Drugs increase Vitamin D**

Contraceptives, Probiotics

**Vitamin D can decrease/increase impact of drugs**

be careful of Chemotheraphy and Vitamin D

Vitamin D generally improves the efficacy of drugs while reducing their adverse effects – Jan 2020

**Some Drugs decrease Vitiamin D co-factors or limit vitamin D getting to cells**

Drugs which create deficiencies in Vitamin D, Vitamin K, Magnesium, Zinc, Iron, etc. – Sept 2017

Drugs Deplete Magnesium

Interaction of drugs with Vitamin D cofactors

**Non-drugs also decrease vitamin D levels in blood and cells**

**Plastics, BPA, PCB and Vitamin D deficiency**

Microplastics now causing problems in most life forms - many studies

Air pollution, toxins, heavy metals and smoking each result in lower Vitamin D levels – Nov 2018

Air Pollution reduces Vitamin D production - many studies

Pesticides increase risk of Cancers, Alz, ALS, Asthma, ADHD, etc. (all related to low vitamin D) – Oct 2016

Smoking Coffee

The original document is available at https://vitamindwiki.com/Microplastics+now+causing+problems+in+most+life+forms+-+many+studies