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THE IMPACT OF MICROPLASTICS ON HUMAN BODY: A SYSTEMATIC REVIEW

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ABSTRACT

Introduction: Small pieces of plastic, commonly called „microplastics" (MP), are the most common form of solid waste on Earth. Concerns about the dangers associated with the presence of microplastics in the environment and their influence on human health are widespread. Micro- and nanoplastics, formed by the breakdown of larger plastic materials, pose a serious threat to both the environment and living organisms.
The harmfulness of MP particles depends mostly on their size – in brief, the smaller the particle, the deeper it can be transported into the body. Those tiny plastic fragments pose a serious threat to the human body including respiratory, cardiovascular, digestive, endocrine, lymphatic, urinary and reproductive systems.
Methods: A literature review was written using databases such as PubMed, Google Scholar and the official WHO website, the official European Chemicals Agency website, the official British Plastics Federation website. The research was conducted using articles available as of March 2026.
Conclusions: Human exposure to microplastics occurs primarily through three routes. The most common of them is oral intake. Despite the growing body of evidence about the harmfulness of microplastics, we do not have enough data to show the correlation between microplastics and human health effects in some cases. To fully assess the toxicity and real impact of microplastics on the human body, more research needs to be conducted.

KEYWORDS

Microplastics, MPs, Nanoplastics, Human Exposure, Microplastic Pollution, Microplastics Human Body

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Introduction

Concerns about the dangers associated with the presence of microplastics in the environment and their influence on human health are widespread. It is essential to address the key question: what exactly are microplastics? The term„microplastics" was used for the first time by Thompson (Thompson et al., n.d.).

Despite numerous attempts to define what microplastics really are by various authors across the world (Elizalde-Velázquez & Gómez-Oliván, 2021) (Frias & Nash, 2019) it is still not possible to establish one universal and unambiguous answer to this question. Microplastics is such a heterogenous group of substances that even the WHO's definition is not clear (https://cdn.who.int/media/docs/default-source/wash-documents/microplastics-in-dw-information-sheet190822.pdf).

Types of plastic waste include a wide range of different polymers including polyvinyl chloride (PVC), polyethylene terephthalate (PET), polypropylene (PP), polycarbonate (PC), polyethylene (PE), polystyrene (PS), poly methylmethacrylate (PMMA) and polyurethane (PU) (Hirt & Body-Malapel, 2020).

Historically large-scale production of plastics began around the 1950s (Boucher & Billard, n.d.). Since then, plastics have become widespread in our daily use, and the extent of this phenomenon is growing rapidly. In 2023, the world produced 400.3 million tons of plastic. (Rhodes, 2018) and approximately 145,000 tons were used in the European Union alone. (https://echa.europa.eu/hot-topics/microplastics). The scale is so huge that it is estimated that on average, between 1.15 and 2.41 million tons of plastic waste ends up in the world's oceans each year, and by 2030, the mass of marine plastic will exceed the mass of fish (Lebreton et al., 2017) (Meegoda et al., 2025).

Microplastics are even present in the Mariana Trench ocean waters- up to 200-2200 particles per liter. This fact demonstrates the prevalence of microplastics on Earth (Peng et al., 2018). According to the British Plastics Federation, plastic is used in almost every sector, including medicine, construction, packaging, textiles, consumer products, transportation, electronics and industrial machinery (https://www.bpf.co.uk/plastipedia/applications/Default.aspx).

Because plastic is broadly accessible, inexpensive, versatile and durable, it has a wide range of applications across various industries and economies. We all encounter vast amounts of it every single day which presents a significant risk to public health.

Micro- and nanoplastics, formed from the breakdown of larger plastic materials, pose a serious threat to the environment due to their significant fragmentation. This process leads to the formation of microplastics (particles smaller than 5 mm) and nanoplastics (particles smaller than 1000 nanometers). NPs are generated from MPs due to the impact of environmental factors such as sunlight, water, temperature, ultraviolet radiation and physical stress. Due to their smaller size, they accumulate more easily in the cells of living organisms, crossing the cells membranes. They are significantly less stable and therefore more prone to various environmental interactions (Amobonye et al., 2021) (Marfella et al., 2024) (Kaseke et al., 2023) (Sunil et al., 2025).

Moreover, these fragments can be transported long distances, mainly by water or wind. This would explain the presence of microplastics on glaciers (Elizalde-Velázquez & Gómez-Oliván, 2021).

Other ways of transporting microplastics include emissions from sewage treatment plants, rainwater disposal, and discharge of domestic sewage (Dey et al., n.d.)

The harmfulness of MP particles depends mostly on their size – in brief, the smaller the particle, the deeper it can go into the human body. For example, their smaller size allows them to penetrate the skin (Nouri et al., 2025).

Microplastics are ubiquitous in the environment and marine organisms. It's hard to find a place on Earth where they are not present, but there's limited research on their presence and, even more importantly, their impact on systems and the human body as a whole.

In this review article, the impact of microplastics on the human body will be investigated, highlighting the potential health risks and the underlying mechanisms.

Additionally, detailed overview of how microplastics enter the environment will be provided. examining both primary and secondary sources. The discussion about current strategies and technologies aimed at mitigating the effects of microplastic pollution by limiting their amount in their environment will be conducted.

Methodology

This review paper is based on an analysis of review articles focusing on microplastics and their impact on the human body. Only original studies and review papers with full-text access were included. The papers reviewed were all published in English. Databases such as PubMed, Google Scholar and the official WHO, the official European Chemicals Agency website, the official British Plastics Federation website were utilized. The research was conducted using articles available as of March 2026. The literature search was conducted using the following keywords: microplastics, human health, MPs, human exposure, microplastic human consumption, microplastics human respiratory system microplastics impact on human health, microplastic human toxicity, microplastic in the environment, microplastic pollution.

Results

Implications for human health

Nowadays, the overall impact of microplastics on humans is inevitable. Many authors have attempted to describe their impact on human body systems, tissues, and organs, both in vivo and in animal studies (Sangkham et al., 2022) (Segovia-Mendoza et al., 2020) (Chang et al., 2020).

Zebrafish and mice were the most frequently studied animal organisms for the neurotoxicity of micro and nano plastics (Vojnits et al., 2025). Research by Aayushi Kundua, (Kundu et al., 2021) also showed that in agricultural areas in Europe, the first 10 cm of soil was contaminated with microplastics at a rate of 670 fibers per kilogram of soil. Between 1,000 and 4,000 MPs particles per kilogram of dry weight were detected (Kundu et al., 2021).

According to the information provided by multiple independent authors, MPs have been detected in various tissues and systems of the human body, including blood, liver, colectomy specimens, derived cells, knees, elbow joints, sputum, urine and stool using different detection techniques (Nouri et al., 2025) (Pironti et al., 2023a) (Roslan et al., 2024) (Vojnits et al., 2025).

Exposure

MPs with a diameter smaller than 130 µm are known to be able to get into human tissues. (Sharma et al., 2021). How are we, as human beings, exposed to microplastics?

Human exposure occurs primarily through three routes. The most common of them is oral intake (Vojnits et al., 2025). There are several studies confirming that microplastic particles have been detected in human feces (Rodrigues et al., 2022) (Zhang et al., 2021). The other major route is through inhalation of small micro- and nanoplastic particles, where fiber diameter plays a key role. Another frequently mentioned pathway of exposure is dermal contact (Chang et al., 2020) (Sangkham et al., 2022).

Skin, which serves, among other things, a protective and barrier function, has an important characteristic: semi-permeability. Besides the obvious advantages this provides, such as enabling the healing and nourishing effects of drugs and cosmetics, it can be also the gateway for fine particles, if damaged (Baker et al., 2023). In such case, particles can penetrate deep into the skin very easily (Winiarska et al., 2024) (Wolski & Kędzia, 2019).

Besides direct exposure routes, another route of human exposure to micro- and nanoplastics is through aquatic organisms. Not only zooplankton but both aquatic invertebrates and vertebrates such as lobsters, oysters, mussels, scallops and fishes ingest microplastics, which accumulate in the food chain (Chang et al., 2020) (da Costa et al., 2016).

Seafood is consumed by people worldwide. The Republic of Korea tops the rankings, with the highest estimated amount of seafood consumed per capita (78.5 kg/person) followed by Norway (66.6 kg/person) and Portugal (61.5 kg/person) (Mortensen et al., 2021).

Another study, led by Luís Gabriel A. Barboza was conducted on several of the most consumed fish species in Europe, including seabass (D. labrax), the Atlantic horse mackerel (T. trachurus) and Atlantic chub mackerel (S. colias) (Eu, n.d.). Researchers examined fish muscles, among other tissues, for microplastic content. Based on numerous analyses, they determined that the estimated human intake of microplastics through fish consumption was the highest in Portugal - 3078 MP items/year/capita (Barboza et al., 2020). Another interesting study exposed that 28% and 25% of the fish from fish markets in both Indonesia and the USA had plastics particles in their internal organs (Carbery et al., 2018).

Small pieces of plastic, so-called "microplastics" (MP), are the most common form of solid waste on Earth (Blackburn & Green, 2022). Plastic waste is ubiquitous – it is found in rivers, oceans, air, soil, glaciers and coastal lines it even reached Antarctica (Waller et al., 2017) (Cózar et al., 2014). A 2017 report found that 83% of tap water worldwide contains microplastics (Mortensen et al., 2021). In 2018, bottled water samples were tested for the presence of microplastics and it was detected in 93 % of them. In 2020, the UK government announced that a large percentage of microplastics found in the seas come indirectly from car tires and other means of transport (Issac & Kandasubramanian, n.d.).

The estimated emission of microplastic particles from tires into the environment per person ranges from 0.23 to 4.7 kg/year. It is worth noting that the contribution of car tires to environmental pollution is significantly higher than, for example, airplane tires (Jan Kole et al., 2017). With the growing number of vehicles and urbanization, this is a phenomenon that is likely to grow everlastingly. The occurrence of microplastics in tap water was reported in numerous studies around the world. Among these countries, the highest concentration of microplastics in tap water is attributed to the USA (9.24 pcs/l), while the lowest concentration can be found in Germany, with an average of 0.91 pcs/l (Almaiman et al., 2021). People who had the recommended amount of adequate water intake only through bottled water were exposed to ingesting an additional 90,000 microplastics per year, while those who drank only tap water ingested 4,000 microplastics per year (Blackburn & Green, 2022). Not only drinking water contains MPs (Leslie et al., 2022a). It was also found in mineral water (Paul et al., 2020)

(Mortensen et al., 2021), seafood (Ma et al., 2020) (Carbery et al., 2018) (Boucher & Billard, n.d.), table salt (Mortensen et al., 2021) (Heo et al., 2025), milk (Lin et al., 2022) and beer (Kadac-Czapska et al., 2024)(Zhang et al., 2021). Plastic consumer products, such as toothpaste additives, abrasive ingredients in bath gel, sunscreens, lotions, eye shadows, cleaning products, facial scrubs, cleansers, microbeads, exfoliants, and abrasives are full of mainly primary MPs (Martinho et al., 2022) (Cheng et al., 2024). The authors note the risk associated with the fact that plastic tea bags can release both microplastics and nanoplastics when brewing tea (Fard et al., 2025).

A simple example proposed by Imogen E. Napper and Richard C. Thompson illustrates the scale of the problem. Washing 6 kg of clothing releases huge quantities of microplastics. The specific amount depends on the material the clothes are made of. It's not surprising that acrylic releases the most fibers during washing, with over 700,000 particles. Polyester-cotton and polyester release 137,951 fibers and 496,030 fibers, respectively (Napper et al., 2015).

In today's world, when ordering takeaway food is extremely common, it is impossible not to mention the widely used plastic food containers. In a study conducted by Fangni Dua and co-authors, the takeout containers were tested for the content of microplastics. The results were both interesting and alarming – the highest amounts of microplastics were found in containers made of polystyrene (PS). To illustrate the scale of the problem, the researchers were able to determine the average amount of microplastics ingested by white-collar workers in China based on the amount of microplastics in takeout containers and the frequency of their takeout orders. The amounts ranged from 12 to 203 pieces per week, assuming each person ate from a single container and a meal lasted 20 minutes. The pathway that nano- and microplastic particles take after entering the body is as follows: after passing through the intestinal barrier, they enter the systemic circulation and then disperse across various organs – including the lungs, kidneys, heart, liver, spleen, thymus, reproductive organs, and brain (Du et al., 2020).

The scooping review was carried out by Nur Sakinah Roslan and co-authors. In conclusion, the study found out that microplastics were detected in 8 of 12 human organ systems including respiratory, cardiovascular, digestive, endocrine, lymphatic, urinary and reproductive (Roslan et al., 2024b).

The impact of microplastics on human body

Respiratory system

Due to their small size, atmospheric MPs and NPs can be inhaled by humans and pose significant health risks by potentially crossing the blood-brain barrier (BBB), intestinal epithelium, placenta and accumulating in the respiratory tracts (Sangkham et al., 2022) (Nouri et al., 2025). Several methods of MPs translocation into the lungs and bronchus are mentioned in the literature: direct cellular penetration, active cellular uptake via endocytosis and phagocytosis (Amato-Lourenço et al., 2021). A group of researchers conducted an interesting study on a group of 50 polypropylene flocking workers who underwent extensive tests, including physical examinations and serum interleukin-8 (IL-8) and tumor necrosis factor-alpha (TNF-α) levels. Moreover, medical imaging studies were performed and demonstrated diffuse frosted glass suppression and peri bronchial thickening. Laboratory tests of these individuals revealed elevated IL-8 and TNF-α levels in the polypropylene flocking workers. The authors suggested that IL-8 and TNF-α may be involved in inflammatory lung injury in the pathogenesis of polypropylene flocking workers' lungs. PP (polypropylene) is the polymer that it is the most widely used polymer in the world (Maddah, 2016).

Another example is the study carried out by Sartorelli and co-investigators in 2020. It concerned a 66-year-old male worker who worked in the production of PET bottles from 1992 to 2013. It is worth noting that the patient was not a smoker. Due to previous occupational exposure to asbestos, the worker had suffered from asbestosis since 2012 and was therefore under observation. In 2017, a high- resolution computed tomography (HRCT) performed on him revealed mild progression of pulmonary fibrosis. The patient experienced the onset of progressive dyspnea and auscultatory abnormalities were detected. During a more in-depth examination, his lung function tests showed a decreased diffusing capacity for carbon monoxide (CO). Occupational hypersensitivity pneumonitis (OHP) was suspected. It was concluded that the cause was most likely etherophthalic acid and dimethyl terephthalate, precursors in PET production. To the authors' knowledge, this was the first case of OHP associated with exposure to polyethylene terephthalate (PET) (Sartorelli et al., 2020).

Cardiovascular system

MPs have the capacity to enter systemic circulation. This phenomenon occurs via lymphatic pathways (Nouri et al., 2025). In the literature, we can find descriptions of various ways in which microplastics affect both the cardiac muscle itself and affects the atherosclerotic plaque formation. Adrian Goldsworthy and others' review describe several pathophysiological mechanisms showing how nano- and microplastics affect heart tissue. The myocardium under their influence shows impaired myocardial contractility. Nano- and microplastics induce apoptosis of myocardial cells. On top of all the above, they lead to fibrosis via the Wnt/ß-catenin pathway. The authors also describe the effects of nano- and microplastics on vascular smooth cells. It triggers inflammation in the body through elevated interleukin-6 and TNF-A expression. NMPs provoke oxidative stress in the body. A group of researchers led by Raffaele Marfella reached interesting conclusions. Their prospective observational study was conducted on patients undergoing carotid endarterectomy for asymptomatic carotid artery disease. They examined whether the carotid plaque in these patients contained microplastics.

After analyzing the data, the results were as follows: MPs was present in 58.4% of atherosclerotic plaques. Patients whose carotid plaques contained microplastics particles had a higher incidence of myocardial infarction, stroke, or death from any cause at 34- month follow- up compared to patients whose atherosclerotic plaques did not contain traces of microplastics. The atherosclerotic plaques of the study participants were examined for the presence of microplastics using pyrolysis–gas chromatography–mass spectrometry, stable isotope analysis and electron microscopy (Marfella et al., 2024).

In 2023, MPs were found in human heart tissue and carotid artery (Cheng et al., 2024).

In 2022 researchers have reached some innovative conclusions and published a pioneering scientific paper confirming the presence of microplastics in human blood. Human whole blood samples were collected from 22 healthy volunteers. The presence of plastic polymers in human blood was confirmed. The polymers included polyethylene terephthalate and polyethylene. The fact that microplastics can circulate in the human bloodstream is groundbreaking from a scientific perspective (Leslie et al., 2022). A pilot study published in 2025 showed that microplastics were identified in the human saphenous vein tissue samples. Four out of the five samples tested contained microplastic particles. The most widely present polymer was alkyd resin. According to the researchers, the amount of microplastics in saphenous vein tissue is greater than in the lungs and comparable to the amount identified in the colon (Rotchell et al., 2023).

Gastrointestinal tract

A growing number of studies and scientific reports attribute a significant role to the gut microbiome in maintaining the broadly understood health and balance of the human body. Available literature clearly indicates that the composition and diversity of the gut microbiota can be seriously disrupted by plastic particles. Researchers who confirmed this phenomenon in animal studies on mice in 2019 reached similar conclusions. They proved that the diversity of the gut microbiota changed after the exposure to microplastics, resulting in metabolic disorders in mice (Jin et al., 2019). Exposure to ingested microplastics promotes metabolic inflammation (Bhattacharyya et al., 2025).

Currently, limited data are available on the impact of microplastics on the human digestive system (Sinha et al., 2025) (Jin et al., 2019). Another animal study showed that polystyrene was present in the intestines of mice, negatively affecting the secretion of intestinal mucus and disrupting the function of the intestinal barrier.

The ubiquity of microplastics in our colon and digestive system is illustrated by the researchers' conclusions published in 2020. Microplastics were detected in all the colectomy samples obtained for scientific purposes (Ibrahim et al., 2021).

The authors of the following study analyzed the literature focusing on the impact of the exposure to microplastics, specifically to PVC. Their main interest were workers who were subjected to MPs on daily basis. Over 30 evaluated studies supported the conclusion that occupational exposure to microplastics and their polymers leads to serious health consequences. The authors investigated the impact of MPs on respiratory system, gastrointestinal system, liver, including some forms of liver cancer – angiosarcomas and hepatocellular carcinomas. The researchers of the published papers demonstrated a causal pathway between the exposure to PVC, especially when continuous and increased risk of both liver cancer and liver toxicity (Zarus et al., 2023).

Urinary system

Concetta Pironti et al. conducted a groundbreaking study that revealed the presence of polyvinyl chloride (PVC), polyethylene vinyl acetate (PVA), polypropylene (PP), and polyethylene (PE) in four urine samples collected from participants aged 16-35, using Raman micro spectroscopy (RMS). This indicates MPs may undergo multiple processes in the human body. The authors explain the results through renal excretion mechanisms. Microplastic particles are transported in the bloodstream and flow inside the glomerular tuft. However, because of their size, they are unable to pass the filtration barrier. They are absorbed by the epithelial cells of the proximal convoluted tubules (PCT) using endo- and micropinocytosis and finally excreted with urine (Pironti et al., 2023b).

The scoping review by Liam O'Callaghan and co- authors aimed to prove that microplastic and nanoplastics particles are detectable in the urinary tract. The researchers reviewed available literature and scientific papers covering this topic. A large percentage of these studies were conducted on human renal tubular epithelial cells, human embryonic cells and human podocyte cells. The authors note that microplastic particles create favorable conditions for bacterial growth. The rough surfaces of MNPs are suitable for microorganisms that form biofilm, providing an ideal environment for bacteria responsible for urinary tract infections. The risk of pyelonephritis, cystitis, and urethritis is also increased. MNPs increase the risk of oxidative stress and apoptosis (O'Callaghan et al., 2025).

There are no conclusive studies or answers regarding microplastics in human kidneys. However, we do have in vitro and in vivo studies that clearly demonstrate the negative impact of these particles on these organs. They have been proven to cause processes such as inflammation, apoptosis (programmed cell death) and fibrosis (scarring) (La Porta et al., 2023).

Nervous system and neurotoxicity of microplastics

As mentioned above, microplastics' particles cross the blood-brain barrier and build up in the brain (Liu et al., 2023). Louis Fernando Amato- Lourenco and colleagues reached some very interesting conclusions in their research in 2024. They conducted post-mortem studies on a group of 15 individuals. The methodology included, among other methods, direct examination of the cerebrum region called the olfactory bulb followed by micro- Fourier transform spectroscopy. Eight out of the fifteen individuals tested positively for the presence of microplastics in their olfactory bulbs. Polypropylene was the most abundant polymer. This study shows another possible route how the MPs particle can reach human brain tissue. (Amato-Lourenço et al., 2024).

Some authors suggest that processes such as oxidative stress and inflammation in the nervous system are associated with neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, or Huntington's disease (Prüst et al., 2020).

Researchers from the United States have reached interesting conclusions by assessing communities of people living in 218 coastal regions of the USA. These individuals, due to their location, were exposed to marine microplastics. They demonstrated reduced cognitive abilities, mobility and reduced ability to live independently. Variables such as their age, living conditions and access to medical care were considered as well (Marfella & Kallweit, 2025). The neurological effects and cellular toxicity of microplastics are present and have a real impact on clinical practice.

Reproductive System

A less obvious and overlooked group of toxic chemicals that pose a threat to human health are certain plastic additives, such as bisphenol A (BPA) and phthalates. They are commonly used additives for plastic production (Pironti et al., 2023a).

An interesting correlation was observed in women with elevated levels of dibutyl phthalate (DBP) and butyl benzyl phthalate (BBP) metabolites in their blood during the third trimester of pregnancy. Children of these mothers had a 70% higher risk of developing asthma between ages 5 and 11 (Whyatt et al., 2014).

As Segovia-Mendoza M and co-authors write in their scientific paper, BPA and phthalates may have a real impact on the development of Polycystic ovary syndrome and endometriosis. This occurs by activating the pulsatile secretion of gonadotropin-releasing hormone, which in turn triggers the secretion of luteinizing hormone. This, in turn, stimulates ovarian androgen production. Finally, this results in impaired proper maturation of the ovarian follicle, which carries further health implications (Segovia-Mendoza et al., 2020). MPs were found in testicular tissue, contributing to decreased sperm quality (Guo et al., 2025).

The first groundbreaking research proved that microplastics are present in human placenta. Placental fragments were collected from six women after a physiological pregnancy that ended in labor. Pieces were obtained not only from the maternal but also from the fetal portion of the placenta and chorioamniotic membranes. The placenta tissue samples were tested using the Raman analysis.

Four out of the six placentas showed a total of 12 microplastic particles. Most of the fragments were located on the fetal side. Based on this innovative study, we know that microplastic particles can get to the placenta. Unfortunately, the study was based on a small sample size and therefore had its limitations. However, it is an important step forward for science. The placenta tissue samples were tested using the Raman analysis (Ragusa et al., 2021).

Inflammation and cancer

As stated by Cheng Y and co- authors, it is known that exposure to MP causes a series of immunological processes at the cellular level. It leads to changes in DNA, increased expression of reactive oxygen species (ROS), release of pro-inflammatory cytokines and chronic inflammation (Cheng et al., 2024b).

Marcella Bonanomi and others described that polystyrene micro- and nanoparticles are internalized in human colon cells. Both chronic and periodic exposure to polystyrene particles causes changes in cell metabolism of the living organisms. A normal human colon cell line exhibits a rearrangement of the metabolic pathways in response to the exposure to polystyrene particles. Chronic exposure is a serious risk factor for cancer (Bonanomi et al., 2022).

Discussion

An interesting phenomenon in terms of environmental pollution with microplastics was the COVID-19 pandemic.

It's safe to say that the global pandemic has contributed to the challenge of increasing plastic pollution in the environment. The emergency of COVID-19 has indirectly contributed to the increase in the number of masks produced from Polymeric Nanofibers. At this time, not only medical masks but also non-medical masks have been produced in huge quantities worldwide. (Aragaw, 2020). According to WHO data, approximately 89 million procedural masks were required during COVID-19 each month (Fadare & Okoffo, 2020).

For examination gloves, this number is 76 million and the international demand for goggles reached 1.6 million per month. The sanitary equipment released massive amounts of microplastics into the environment. During attempts to combat the COVID-19 pandemic, massive amounts of microplastics have also been indirectly released into the environment. Disinfectants in plastic bottles, individually packaged groceries and disposable utensils are just a few examples. This occurrence had a noticeable impact on the terrestrial and aquatic environment (https://www.who.int/news/item/03-03-2020-shortage-of-personal-protective-equipment-endangering-health-workers-worldwide) (Pambianchi et al., 2022).

MNPs are complex molecules. They are very durable and are characterized by stability, hydrophobicity and large surface area/ volume ratio. They are lightweight which allow them to move over long distances (Sharma et al., 2021). They are characterized by various physical and chemical properties- different sizes, shapes or chemical composition (Napper et al., 2015). Microplastics occur in several forms: primary and secondary MPs. Primary MPs are plastic particles desirable due to their abrasive properties. Their size is below 2 mm (Ziani et al., 2023). A great example of primary microplastics are so called microbeads - microplastics used in cosmetic products known for their exfoliating characteristics. Other examples of their origin include clothing industry, fishing industry and plastic production.

Secondary MPs are products made from plastic, because of its fragmentation by UV, sunlight or mechanical fraction. It includes items such as discarded plastic items and synthetic textiles. The diameter of secondary microplastic particles is 0.1 µm to 5 mm and secondary nanoplastics diameter is below 100 nm (Prüst et al., 2020). As the authors of many of the studies cited above report, our body's tissues and organs, without exception, contain some amount of microplastics.

According to the information I obtained in many sources, microplastics accumulate in heart tissue (Iannuzzi et al., 2025). According to data from 2010, the United States produced the most plastic waste of all countries (Law et al., 2020). Many countries nowadays are working to reduce the amount of plastic they use. Currently, 60 countries are doing so (Alberghini et al., 2023).

Despite many attempts and developing technology, there is still no clear answer to the question of how to get rid of the vast amounts of microplastics in the environment. Another, perhaps more important question is how to produce less of it.

We know that microplastic particles can pass from the bloodstream to the placenta. Human embryos are already exposed during fetal life. Organs such as the heart, brain, and lungs are also influenced. An interesting fact is that nanoparticles and microplastics cross the blood-brain barrier. Microplastic fragmentation depends on environmental conditions. UV radiation accelerates the oxidation of particles and high temperatures also favor this process. In the water, this process is much slower (Ziani et al., 2023).

Although the ultimate destiny of MPs is a matter of dispute, many scientific works deal with the topic of the detection and eradication of MPs. One of the ways to identify microplastics is the stereomicroscope. The focus of this method is morphological analysis of MPs.

Removing MPs from the environment is a complex phenomenon. There are many different methods for dealing with these environmental pollutants. Physical methods include simpler biological processes such as filtration (e.g., membrane filtration, sand filtration), adsorption (e.g., magnetic adsorbents) and agglomeration.

More advanced methods are chemical methods. The processes are more complex and often require more advanced technology. Examples include electrocoagulation, catalytic degradation, photocatalytic degradation).

The third group mentioned in the literature is biological methods such as biodegradation by microorganisms (bacteria, fungi) and bioremediation using organisms which can break down plastics (Sharma et al., 2021).

Probiotics may mitigate the harmful effects of microplastics on the human body. The research focuses specifically on the digestive system, where probiotics could potentially strengthen the intestinal barrier, restore balance to disturbed intestinal microbiota and limit the immune response or inflammatory processes in the digestive system. This could potentially reverse the negative effects resulting from the exposure to microplastics. These studies are extremely promising and could lead to real breakthroughs. As the authors state, more large-scale human trials are necessary to reliably and confidently confirm this thesis (Bazeli et al., 2023).

Conclusions

We are exposed to microplastics from the beginning as the presence of microplastics in human placentas has been proved. We still do not fully understand its impact on the fetus development. Microplastics are found in human lungs and in the bloodstream, where they can penetrate the blood-brain barrier, accumulating in the brain. They also cross the intestinal barrier, where they interfere with many processes, impairing immune functions. These are just a few examples of how ubiquitous microplastics are in the 21st century.

Even though there are many publications available on the impact of microplastics on the human body, there is still one conclusion: we do not have clear conclusions on the subject. Although studies indicate a clear health risk associated with microplastics, further research is required to provide clear statements.

Small pieces of plastic debris commonly called„microplastics''(MPs) are the most abundant form of solid waste on Earth (Blackburn & Green, 2022). Their impact on the human body is indispensable, which is why it is so important to take specific actions to reduce their occurrence in our environment. The question arises as to how MPs can be removed from the environment and our bodies. However, it is still open to question if it is even possible.

Various scientific reports erge about microplastics. The topic is currently receiving significant media attention. Public awareness of this issue has increased significantly. People are aware that this problem is a real challenge for humans, animals and the planet. Despite the growing body of evidence about the harmfulness of microplastics, we do not have enough data to show the correlation between microplastics and human health effects in some cases. To fully assess the toxicity and real impact of microplastics on the human body, more research needs to be conducted. It is obvious that there are various limitations to the research, also related to the fact that it concerns living organisms – both humans and animals. The conclusions presented by scientists provide a base for further, needed research.

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