



The Invisible Threat: Microplastics in Human Blood and Placenta

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Article Info:



Article History:

Received 17 Sep 2024
Reviewed 09 Nov 2024
Accepted 04 Dec 2024
Published 15 Dec 2024

Cite this article as:

Mishra A, Modak S, Bhattacharjee S, Vishwanaath R, Mohan A, Kumar B, The Invisible Threat: Microplastics in Human Blood and Placenta, Journal of Drug Delivery and Therapeutics. 2024; 14(12):202-205 DOI: <http://dx.doi.org/10.22270/jddt.v14i12.6923>

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Abstract

Today, microplastics are probably the most abundant and cardinal pollutant in soil and marine life. These particles are small and have a greater risk of endangering the ecosystem and human health. The use of plastic has become so abundant that it has spread over a wide area of the sea and has now migrated and reached the human plate as well.

Aim: To study the inconspicuous invasion of microplastics from ocean to human placenta and breasts milk.

Objective: Detailed excavation of the literature available in this topic was done from various search engines, like google scholar, PubMed, Science direct. This study is an attempt to describe the reflection of different toxicological forms of microplastics in biotic and abiotic forms which may hamper the coming generations in the long run. Therefore, there is an urgent need to assess toxicity and biohazards to save our homes i.e. our "motherland".

Conclusion: The increasing environmental catastrophe with possible public health repercussions is highlighted by the discovery of microplastics in human breast milk and placenta, underscoring the urgent need for coordinated global efforts to minimise plastic pollution.

Keywords: Microplastics, human placenta, pollutants, ecosystem, biohazards

Introduction

In the hidden places of our daily lives, an unnoticed invader has quietly crept into our oceans, soil and even the air we breathe, and this overlooked invader is simply the infamous "MICROPLASTIC". Invisible, ignored, and shunned tiny creatures contain the history of a modern world trapped in their creation¹. Although these particles are few, they usually have a big impact on our planet. When it comes to plastic, the main thing that separates macroplastic from microplastics is its morphology. A smaller size indicates a low presence of plastic particles². While large particles are easier to collect, smaller particles are often very difficult to clean. Great efforts and awareness have been made to stop the dangerous use of microplastics, but the presence of microplastics has been ignored somewhere. The use and availability of microplastics are often so wide and widespread because it is formed in a different way, lighter, and cheaper than other modern materials. While we have replaced everything we need with plastic without even accepting its strange consequences, the irrational use of plastic

everywhere, and the omnipresence of microplastics can never be ignored^{3,4}.

Environmental science has long focused on large plastic waste, i.e. macroplastics, and quotes that it can affect the marine ecosystem. In sync with these vital concerns, the occurrence of microplastics in the aquamarine environment is a major problem to tackle, leading to the death of a huge number of marine entities. Aquamarine pollution not only attacks aquatic lives but also hampers industries like shipping, fishing, power accumulation, and aquaculture. The presence of plastics in these industries leads to equipment wear and tear⁵. Damage and death from ingesting plastics and the ingestion of seabirds, whales, fish, and insects are just some of the environmental impacts of microplastics. Another setback from the presence of microplastics is the growth and flourishing of unwelcomed species which often hamper the growth of residential flora and fauna^{6,7}.

The results of large-scale plastic squander, or "macroplastics," on oceanic environments have long provoked the interest of natural science. As the ocean occupies the largest area on the earth, the presence

of microplastics, within the water column isn't as it were a stylish issue but also a major natural stress that jeopardizes a few sea businesses, such as aquaculture, angling, shipping, and vitality era. Furthermore, the utilization of plastic in these sectors can tangle and hurt apparatus. Many of the negative natural impacts of plastics that are large scale incorporate hurt and mortality to marine fowls, creatures, angels, and reptiles due to trap and ingestion⁸.

Foremost and secondary microplastics

Foremost microplastics are those microplastics that were called to be of minuscule morphology. Even though there is developing proof of these plastics being utilized as mediate vectors in medication, they are essentially found in discussions impacting media, facial cleansers, and makeup. The incorporation of virgin plastic pellets, which are ordinarily 3-5 mm in breadth, as essential microplastics fall beneath the broader definitions of the microplastic estimate, despite a few pundits challenging this classification. Exfoliating hand wipes and confront cleans that once contained common fixings like pumice, oats, and powdered almonds have been supplanted by microplastic "scrubbers." Exfoliating cleansers utilizing plastics have been much better known since the 1980s when modest plastic scrubbers utilized in makeup were licensed. The basic difference in micro beads or microplastics is their emergence in sizes, external morphology, or configuration setup. More as of late, found that another restorative item had a colossal sum of circular microplastics, ordinarily with a distance across of less than 0.5 mm and a mode estimate of less than 0.1 mm^{8,9}. Auxiliary microplastics are little pieces of plastic that break down from bigger plastic squanders, which might happen on arrival or in the ocean. Persistent presentation to daylight can cause plastics to photodegrade; bright (UV) radiation oxidizes the polymer lattice and breaks bonds, as uncovered by recommended that the corruption of plastics may lead to the filtering of added substances aiming to move forward solidness and erosion resistance. The ocean environment's extreme saltiness, wave-action, and turbulence fractures the big plastics coming about from scraped areas. This preparation proceeds and the parts end up little over time until they become microplastics. Microplastics are thought to proceed to corrupt into nanoplastics, even though the littlest microparticle right now identified within the seas is 1.6 μm in breadth. The presence of nanoplastics within the marine environment is going to surpass its current number, owing to the non-stoppable use of plastics worldwide^{10,11}.

Microplastics in Marine environment

The increasing presence of microplastics in the marine environment is becoming more significant in the upcoming years¹². Researchers are already speculating on the potential impact of this pollution on the marine food web, as these particles can accumulate in organisms, leading to physical harm such as internal friction and blockages¹³. Apart from the risks associated with ingested microplastics, toxicity can also result from the leaching of contaminated impurities like monomers and plastic additives, contributing to issues such as

carcinogenesis and hormone disruption¹⁴. The accumulation of low-density microplastic debris in ocean gyres poses a threat to pelagic invertebrates, potentially causing harm through ingestion. Additionally, benthic organisms act as sinks for high densities of microplastics, with some microbes capable of absorbing these particles and incorporating them into marine aggregates. Consequently, benthic suspensions and sediment feeders are likely to ingest sinking and immobilized microplastics^{15,16}.

Microplastics in Human plate

Microplastics have become a growing concern in the human diet as these tiny plastic particles infiltrate various food sources. These particles often measuring less than 5 millimeters, find their way into the food chain through contamination of water and soil. Seafood, salt, and even the air we breathe can carry microplastics. Distinct human indulges in activities like, packaging and multiple processing continuously release toxic microplastics into the human milieu. Due to the omnipresence of plastics, we humans as well as animals unknowingly consume microplastics and potential health hazards occur. These occurrences have paved the way for extensive research in microplastics and their effects on humans and aquatic life^{16,17}.

Because fish have a filter-feeding mechanism, they exhibit a high incidence of microplastics. This is especially true of shellfish. Because these particles are common in the water column, they build up in the connective tissues of these organisms and can be consumed by people. Plastic consumption has been documented in marine mammals, fish, invertebrates, and the birds that eat them at different trophic levels in the food chain. Because of their small size, microplastics are readily ingested by a variety of organisms, including those that feed on organic debris, animals that feed on silt, and filter feeders. Studies involving a wide range of marine organisms, including zooplankton fish, seabirds, shellfish, and bivalves, in both natural and controlled environments have reported cases of microplastic ingestion. Some of these studies are intended^{17,18}.

Popular brands of bottles have been found to display the prevalence of microplastics in them¹⁹. It is vital to understand that in the water treatment plant, the equipment and storage units too are made up of microplastics, which may also leach microplastics into the water, even though this aqua treatment plant is designed to evacuate water borne plastics and well as other nuisances of water²⁰. In addition to water bottles, sometimes caps and closures are also constituted with plastics which may react with aqua and leach out its toxic elements in water and render it useless²¹.

Ubiquitously plastic emerges from toothbrushes, plastic water bottles, dining plates, and many personal care items. Nowadays, toilet preparations like eye shadow, nail polishes, and shower gels have microbeads in them which are microplastics. Eventually, these products are washed off and reach the water bodies²². It is obvious that the accumulation of small plastics in aquatic life is due to fragmentations of larger ones. It is vital to not let

this untreated water reach the marine ecosystem unless treated. In a shocking result, in Macao, Hong Kong, waste water was released without filtration and treatment which led to deposition of 49-880 billion per year²³.

Microplastics in Human placenta

The presence of microplastic in the human placenta has raised concerns about potential health, impacts during pregnancy. Recent studies have detected microplastic in placental tissues, indicating that these tiny plastic fragments can cross the placental barrier. The exact consequences of microplastic exposure on fetal development are not fully understood, and research in this area is ongoing. Nevertheless, the presence of microplastics in the placenta underscores the need for investigation into the potential risks and implications for maternal and fetal health. Efforts to reduce overall plastic pollution remain crucial to mitigate potential harm to both the environment and human well-being²⁴.

To detect the presence of microplastic in the human placenta, various clinical studies have been done. However extensive studies are still left to occur, and there is huge room for research in this area²⁵. The following method has been absorbed to study the occurrence of microplastics in the human placenta. The study was done on 6 females who were pregnant, and around 6 placentas were collected. The observation emerged as a big shock when 5 to 10 micron spherical, and irregularly shaped microplastics were seen, to be precise 4 spherical structures were present on the fetal side, 5 on the maternal end, and 3 irregular shape entities in the choriomniotic end²⁵. Nine of these were identified as thermoplastic polymers, while three were identified as recolored PP. A chance is presented to the growing embryo by the measuring run of microplastics found, which is consistent with conveyance through the bloodstream, section over layers, and conveyance in cells. Microplastics in this organ could alter the baby's recognition as a non-foreign corpse and be linked to the safe framework. More recently, Zhu et al. (2023) evaluated the proximity and features of MPs in 17 placentas, noting that MPs were present in all placenta testing, with a range of 0.28–9.55 particles/g and a plenitude of 2.70 ± 2.65 particles/g. PVC (43.27%), PP (14.55%), and polybutylene succinate (PBS) (10.90%) made up most of the MPs, with a measure ranging from 20 to 34 micrometer^{26,27}.

Microplastics in Breast milk

In addition to the human placenta, MPs have also been discovered in meconium and the stool of newborn children in 2019, yet it is difficult to determine where these plastics originate from. Early life exposures can occur from plastic toys, supplementing bottles, nursing, and other means, as well as from the placenta²⁸. For example, it has been suggested that a newborn's formula placed in polypropylene (PP) bottles has the potential to release millions of MPs. That being said, these presentation courses' relative importance hasn't yet been established. Recently, a study collected three meconium and six newborn children from Modern York State and evaluated the concentrations of polyethylene

terephthalate (PET) and polycarbonate (PC) MPs. The results showed that the concentration of PET was significantly higher in newborn baby feces than it was in adult feces. Selecting the primary MP sources is essential to reducing the presentation because of the tall appearance and to foresee any negative effects. Breast milk is considered the gold standard of nutrition for infants, valued for its ability to optimize the immune system and arrange nutrients. As a result, assessing its quality in terms of potential pollution is necessary²⁹. Mothers encounter a remarkable variety of synthetics daily from the environment, such as in food, beverages, and personal care products. As a result, breast milk may become contaminated by these mixes, potentially harming children's health. Thus far, human milk has been found to contain metals, phenols, per- and poly-fluoroalkyl substances (PFASs), phthalates and phthalate metabolites, polychlorinated biphenyls (PCBs), organ chlorine insecticides, polybrominated diphenyl esters (PBDEs), phthalates, and phthalate metabolites. In actuality, these pollutants may be drained during lactation since the majority of them are lipophilic and prefer to accumulate in fat tissue³⁰. Early developmental stages are known to be the most vulnerable to the negative effects of PCBs, which primarily include a severe influence on the endocrine and mental systems, leading to altered behavior and a lowered IQ. Furthermore, PBDEs are thought to be neurotoxic, especially in children, having negative effects on behavior, the brain, and the engine. Phthalates have been explained in the text as hurting the usefulness of male regeneration. Furthermore, youth exposure to phthalates was shown to increase the risk of adversely susceptible illnesses and modify improvements in physical and neurocognitive functions^{31,32}.

Conclusion

The plastic parts move like slippery apparitions in this minuscule world, so they recount the tale of humankind's utilization and ecological effect. The universality of minuscule plastic particles challenges our impression of the air we are breathing, from glimmering ocean surfaces to remote corners of uncontaminated scenes. It is clear, with regards to unwinding this secret emergency, that understanding the impacts of these little trespassers is significantly more than basically logical endeavors; they call upon activity in a world at a crossing point of plastic multiplication and planetary conservation. Subsequently, this article has endeavored to investigate the multi-layered nature of microplastics trying to do so, and in the end, it is accepted we should focus on a tranquil orchestra of small particles that keeps on reverberating all through our biological systems.

Acknowledgements: All the authors are thankful to the entire team for constant support and encouragement in completion of this article.

Conflict of Interest: None.

Funding Source: None.

Author Contributions: All authors have equal contribution in the preparation of manuscript and compilation.

Source of Support: Nil.

Ethics approval and consent to participate: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data supporting in this paper are available in the cited references.

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