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Systematic Literature Review: The Presence of Microplastics in the Body and Their Impact on Human Health

Lestari Sudaryanti[1], Hermanto Tri Joewono[2]

Abstract

Microplastics have been found in various environments, including water, air and food, increasing the risk of exposure to the human body. The accumulation of microplastics in the body can cause health impacts according to the route of entry into the body. This study reviews literature on microplastics that accumulate in the human body and their impact on health. Microplastics are small plastic particles that often come from consumer products and environmental pollution, and have been detected in various tissues of the human body. In the human body, microplastics cause oxidative stress conditions, affect the general body system and cause disorders in organ systems including the digestive system, respiratory system, reproductive system, trigger inflammation and potentially have long-term effects on the endocrine and nervous systems.This study presents current evidence on the mechanisms of exposure, distribution of microplastics in organs, and health implications, providing important insights for the development of mitigation strategies and public health policies. The literature review articles obtained were screened with predetermined criteria. After screening, 10 main reference articles were obtained. The results of this study showed that there were 10 articles stating that the presence and form of microplastics in the human body were found, and explained that there were health impacts due to exposure to microplastics on human health. The conclusion that can be drawn from this literature review is that microplastics have a long-term health impact on humans. Microplastics have additive carrier properties that can cause cancer. However, no research has been found on the real impact of microplastics that cause death.Food and beverage companies and the pharmaceutical industry should increase surveillance of microplastic contamination in their products and invest in more advanced filtration technology to protect consumers. In addition, the government and health sector need to develop mitigation policies and educate the public about the risks of microplastics and encourage innovation in reducing the use of single-use plastics.

Keywords: *Literature Review, Microplastics, Impact, Health.*

Introduction

Microplastics, which are very small plastic particles that originate from the degradation of larger plastics, have become one of the most alarming environmental contaminants in the modern era. Microplastics are plastic particles less than 5 mm in diameter that have become a global concern in recent decades. With the increase in plastic production and poor waste management, microplastics are now found polluting the environment around humans, including air, water and soil (Wu et al, 2022). The issue is becoming more concerning as microplastics have been detected in food and beverages consumed by humans. These particles not only pollute the ecosystem, but also enter the food chain and are eventually deposited in the human body (Yang et al, 2022; Prata et al, 2020). This phenomenon raises important questions about how these microplastics in the human body affect human health.

This study aims to present an in-depth literature review on the presence of microplastics in the human body and their potential impact on health. The main focus of this review is to explore how microplastics enter the human body through the ingestion of food, water and air, how these particles are distributed and contaminate various organs of the body and identify the distribution pattern of their accumulation in organs and evaluate the potential health impacts of microplastic exposure, both in the short and long term. Impacts to be assessed include effects on the immune system, organ function, and potential cancer risk. By reviewing previous findings, it is hoped that this research can provide greater insight into the health risks associated with microplastics and propose mitigation measures needed to effectively protect human health.

[1] Midwifery Study Programme Faculty of Medicine, Airlangga University Surabaya, Indonesia, Email: lestari.sudaryanti@vokasi.unair.ac.id, (Corresponding Author)

[2] Master of Medical Education Faculty of Medicine, Airlangga University Surabaya, Indonesia

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Previous research on microplastics on the human body points to the fact that these tiny particles not only pollute the environment, but also affect our health directly (Sana et al, 2020; Ebrahimi et al, 2022). These tiny particles can enter the body through food, drink and air (Winiarska, Jutel & Zemelka-Wiacek, 2024; Emenike et al, 2023; Ghosh et al, 2023; Campanale et al, 2020). Microplastics entering the human body come from consumer products such as single-use plastics and synthetic textile materials, these particles accumulate in organs and tissues (Katyal, Kong & Villanueva, 2020; Al Mamun et al, 2023). Other literature studies reveal that exposure to microplastics can cause harmful accumulation in vital organs, disrupt cellular function, and potentially trigger inflammation and other health disorders (Smith et al, 2018; Rahman et al, 2021). Microplastics found in various consumer products, such as plastic bottles and food packaging, can end up in the human digestive system and blood circulation. These inhaled or ingested microplastics enter the body system, accumulate in vital organs over the long term and trigger various health problems. This impact is of increasing global concern, given that microplastics are found in the food, water and air we consume every day.

Exposure to microplastics is still being researched, but several studies have shown that exposure to microplastics has a negative impact on human health. Microplastics are harmful chemicals in the body and have the potential to increase the risk of chronic diseases such as cancer and endocrine disorders (Yang et al, 2023; Yuan, Nag & Cummins, 2022). Several other researchers have also reported similar findings. Exposure to microplastics can lead to inflammation, immune system disorders, and risk of chronic diseases such as cancer. (Barceló, Picó & Alfarhan, 2023; Bhuyan, 2022). Digestive system disorders and immune system disorders and potential cancer risk (Vijayaraman, Mondal, Nandan & Siddiqui, 2020; Weis et al, 2015). Chronic inflammation, impaired immune system and possible carcinogenic effects (Li, Tao, Wang & Song, 2023; Emenike et al, 2023).

The importance of this research lies not only in the assessment of health risks, but also in the urgent need to develop mitigation strategies and stricter environmental policies. By understanding how much impact microplastics have on human health, we can be better prepared to meet this challenge. The results of this study can encourage more effective preventive measures and raise awareness about the importance of sustainable plastic waste management to protect human and ecosystem health. This literature review is expected to provide a deeper understanding of the problem of microplastics in the human body and their impact on health. The findings from this study will provide important insights for researchers, policy makers and the general public in their efforts to protect human health and the environment from the threat of microplastics.

Research Methods

This literature review on microplastics in the human body and their health effects involved an in-depth analysis of published studies. The process began with the identification and selection of relevant sources from current scientific journals, articles and research reports. Next, the researcher assesses the quality and relevance of each source, categorises the findings based on key themes or variables, and compares the results to reveal common patterns and information gaps (Sangkham et al, 2022). The method used in literature review research is traditional literature review. The source of the article comes from Researcgate and Google scholar, scopus. There are screening stages in selecting journals consisting of 3 stages, namely screening 1 selecting paid and unpaid journals, screening 2 reviewing titles and abstracts, screening 3 reviewing background, methods, results and discussions. With this systematic approach, the literature review aims to provide a comprehensive overview of the extent to which microplastics affect human health, as well as identify areas that require further research (Ayun & Neily Qurrata, 2019).

Results

Microplastics have become a major focus in human health studies. This literature review examines recent studies and reveals how microplastics can potentially enter the human body through food, beverage and air ingestion, and examines their impact on health. This review provides an in-depth understanding of the hazards of microplastics, including their potential health problems and long-term consequences. These

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findings are important for formulating policies and mitigation strategies to protect public health from the threat of microplastics. The following is a compilation of the results of Microplastic Research in the Human Body:

Table 1. Presence of Microplastics in Humans

No.	Organ	Number of Microplastics	Polymer Type	Literature (Jurnal)	Result
1.	Human faeces	17 particles/10 grams	Didominasi EVOH (*Ethyl Vinyl Alkohol*)	Budiarti, E. C. (2021). Identifikasi Mikroplasti pada Feses Manusia. *Environmental Pollution Journal*, *1*(2).	The results obtained were that all faecal samples were positive for microplastics with a median value of 17.5 particles/10g. The types and polymers of microplastics obtained were 4 types each with the highest fibre at 36% while polymers were 38 types with the highest EVOH polymer at 19%. Various microplastics were detected in human faeces, indicating unintentional ingestion from both food sources and contaminated environments.
2.	Placenta	12 particle/4 placenta	Polyethylene, (dampak) Polypropylene, Polystyrene, Phthalocyanine, Polivinil Klorida, Polyethylene tereftalat	Braun, T., Ehrlich, L., Henrich, W., Koeppel, S., Lomako, I., Schwabl, P., & Liebmann, B. (2021). Detection of microplastic in human placenta and meconium in a clinical setting. Pharmaceutics,	Shuman placenta and meconium samples were positive for polyethylene, polypropylene, polystyrene and polyurethane, of which only the latter was also detected as airborne debris in the operating theatre - suggesting potential contamination.
3.	Sperm	0.23 ± 0.45 partikel/mL	Polypropylene, Polystyrene, Polyethylene terephthalate, Polyethylene , Polyvinyl	Zhao, Q., Zhu, L., Weng, J., Jin, Z., Cao, Y., Jiang, H., & Zhang, Z. (2023). Detection	The results showed that MPs were detected in testes and semen, with an average abundance

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No.	Organ	Number of Microplastics	Polymer Type	Literature (Jurnal)	Result
			chloride , Polycarbonate , Polyoxymethylene Acrylic	and characterization of microplastics in the human testis and semen. Science of The Total Environment,	of 0.23 ± 0.45 particles/mL in semen and 11.60 ± 15.52 particles/g in testes. Microplastics in testes consisted of polystyrene (PS) with 67.7%, while polyethylene (PE) and polyvinyl chloride (PVC) were the dominant polymers in semen. Compared to the fragments, fibres and layers detected in semen, fragments were the main form found in the testes. The size of these microplastics ranged from 21.76 µm to 286.71 µm, and most (67% and 80.6%) were 20-100 µm in size in semen and testes, respectively.
4.	Breast milk	2,3 partikel/mL	polipropilena, polietilena, polistirena, and polivinil klorida	Ragusa, A., Svelato, A., Santacroce, C., et al. (2021). Plasticenta: First evidence of microplastics in human placenta. Environment International,	Microplastics can pass from the environment to living organisms, including mammals. In this study, six human placentas, collected from women consenting to a physiological pregnancy, were analysed by Raman Microspectroscopy to evaluate the presence of microplastics. Overall, 12 microplastic fragments (ranging in size from 5 to 10 µm), with round or irregular shapes were found in 4 placentas (5 on the

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No.	Organ	Number of Microplastics	Polymer Type	Literature (Jurnal)	Result
					fetal side, 4 on the maternal side, and 3 in the amniotic membrane); all microplastic particles were characterised in terms of their morphology and chemical composition. All were pigmented; three were identified as stained polypropylene, a thermoplastic polymer, while for the other nine only the pigment could be identified, all of which are used in man-made coatings, paints, adhesives, plasters, finger paints, polymers, and cosmetics and personal care products.
5.	Human lungs	1,42 ± 1,50 MP/g	Polipropilen, polietilen tereftalat, Polyethylene terephthalate and resin	Jenner, L. C., Rotchell, J. M., Bennett, R. T., Cowen, M., Tentzeris, V., & Sadofsky, L. R. (2022). Detection of microplastics in human lung tissue using μFTIR spectroscopy. Science of the Total Environment,	This study demonstrated the highest level of contamination control and reported unadjusted values along with different contamination adjustment techniques. These results support inhalation as an exposure route for environmental MPs, and characterisation of these types and levels can now inform realistic conditions for laboratory exposure experiments, with the aim of

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No.	Organ	Number of Microplastics	Polymer Type	Literature (Jurnal)	Result
					determining health impacts.
6.	Human blood vessels	Polyethylene: 21.7±24.5 µg/mg plak, Polyvinyl Chloride: 5.2±2.4 µg/mg plak	Polyethylene, Polyvinyl Chloride	Marfella, R., Prattichizzo, F., Sardu, C., Fulgenzi, G., Graciotti, L., Spadoni, T., ... & Paolisso, G. (2024). Microplastics and nanoplastics in atheromas and cardiovascular events. New England Journal of Medicine,	A total of 304 patients were enrolled in the study, and 257 patients completed a mean (±SD) follow-up period of 33.7±6.9 months. Polyethylene was detected in the carotid artery plaques of 150 patients (58.4%), with a mean level of 21.7±24.5 µg per milligram of plaque; 31 patients (12.1%) also had measurable amounts of polyvinyl chloride, with a mean level of 5.2±2.4 µg per milligram of plaque. Electron microscopy showed serrated-edged foreign particles visible among plaque macrophages and scattered in the external debris. Radiographic examination showed that some of these particles included chlorine. Patients in whom MNPs were detected within the atheroma had a higher risk for primary endpoint events than those in whom these substances were not detected (hazard ratio, 4.53; 95% confidence interval,

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No.	Organ	Number of Microplastics	Polymer Type	Literature (Jurnal)	Result
					2.00 to 10.27; P<0.001).
7.	Human blood	1,6 µg/ml	PET, polistirene, polietilene	Leslie, H. A., Van Velzen, M. J., Brandsma, S. H., Vethaak, A. D., Garcia-Vallejo, J. J., & Lamoree, M. H. (2022). Discovery and quantification of plastic particle pollution in human blood. *Environment international*.	In this study of a small number of donors, the average measured concentration of plastic particles in the blood was 1.6 µg/ml, representing the first measurement of mass concentrations of plastic polymer components in human blood. This pioneering biomonitoring study in humans shows that plastic particles are bioavailable for absorption into the human bloodstream. An understanding of human exposure to these substances and the hazards associated with such exposure is needed to determine whether or not exposure to plastic particles is a public health risk.
8.	The human heart	4,6 particles/g	Polietilen tereftalat, Poliystyrene and silicon, polivinil klorida, polimetil metakrilat, polioksimetilen, and polipropilen	Horvatits, T., Tamminga, M., Liu, B., Sebode, M., Carambia, A., Fischer, L., ... & Fischer, E. K. (2022). Microplastics detected in cirrhotic liver tissue. EBioMedicine,	Considering the limit of detection, all liver, kidney and spleen samples from patients without underlying liver disease tested negative for MP. In contrast, MP concentrations in cirrhotic liver tissue were positive and showed significantly higher concentrations

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No.	Organ	Number of Microplastics	Polymer Type	Literature (Jurnal)	Result
					compared to liver samples of individuals without underlying liver disease. Six different microplastic polymers with sizes ranging from 4 to 30 µm were detected.
9.	Human testicles	11.60 ± 15.52 particles/g	Polistirena, polietilena and polivinil klorida	Zhao, Q., Zhu, L., Weng, J., Jin, Z., Cao, Y., Jiang, H., & Zhang, Z. (2023). Detection and characterization of microplastics in the human testis and semen. Science of The Total Environment,	The results showed that MPs were detected in testes and semen, with an average abundance of 0.23 ± 0.45 particles/mL in semen and 11.60 ± 15.52 particles/g in testes. Microplastics in testes consisted of polystyrene (PS) with 67.7%, while polyethylene (PE) and polyvinyl chloride (PVC) were the dominant polymers in semen. Compared to the fragments, fibres and layers detected in semen, fragments were the main form found in the testes. The size of these microplastics ranged from 21.76 µm to 286.71 µm, and most (67% and 80.6%) were 20-100 µm in size in semen and testes, respectively. In summary, this study revealed for the first time that MPs contaminate the human male reproductive system and that various characteristics of MPs appear in different regions,

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No.	Organ	Number of Microplastics	Polymer Type	Literature (Jurnal)	Result
					which provides important information and basic data for risk assessment of MPs to human health.
10.	Urine and kidney	66 particles	Polietilene and polistirene	Massardo, S., Verzola, D., Alberti, S., Caboni, C., Santostefano, M., Verrina, E. E., ... & Artini, C. (2024). MicroRaman spectroscopy detects the presence of microplastics in human urine and kidney tissue. Environment International.	Healthy sections of ten kidneys obtained from nephrectomy, as well as ten urine samples from healthy donors were analysed: 26 particles in the kidney and urine samples were identified, with sizes ranging from 3 to 13 µm in urine and 1 to 29 µm in kidney. The most frequently determined polymers were polyethylene and polystyrene, while the most common pigments were hematite and Cu-phthalocyanine. This preclinical study proved the presence of microplastics in kidney tissue and confirmed their presence in urine, providing the first evidence of renal microplastic deposition in humans.

Based on the findings of 10 journals that have been analysed, there are various human organs that have detected the presence of microplastics such as human faeces, placenta, sperm, breast milk (breast milk), human lungs, human blood vessels, human blood, human liver, human testes, urine and kidneys. The presence of microplastics in the human body is now a serious concern, given their wide and varied impacts. These tiny plastic particles, which typically come from consumer products and environmental pollution, have been found in various parts of the human body, including faeces, placenta, sperm, breast milk, lungs, blood vessels, blood, liver, testes, urine and kidneys. This discovery has raised concerns about potential long-term health risks, ranging from hormonal disruption to impacts on vital organ function.

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Understanding the impact of microplastics in the body is critical for the development of mitigation strategies and public health protection.

Some types of polymers found in the human body according to the results of several literature reviews above are as follows:

Polypropylene (PP) is a plastic often used in food packaging and household products. In general, PP is considered relatively safe and chemically stable. However, there are concerns about possible contamination from chemical additives used in its production process, which could affect health if exposed in the long term. This type of plastic is commonly used in food packaging and household products thanks to its stability and durable properties. While PP is generally considered relatively safe, there are some concerns that need to be addressed. One of the main concerns is the use of chemical additives in its production process, which can leach out and potentially contaminate food or beverages packed in this plastic. When these additives leach into food, they can affect health if exposed long-term. Some of these chemicals are potentially toxic or have hormonal effects that can upset the body's balance. Therefore, while PP is a stable plastic, it is important to pay attention to how it is used and look for safer alternatives if needed, especially for packaging that comes into direct contact with food.

Polystyrene (PS), known by its trademarks such as Styrofoam, is often used in food packaging and disposable items. Polystyrene can release styrene, a substance known to be potentially carcinogenic. Long-term exposure to styrene can negatively affect the nervous system and potentially increase the risk of cancer. Polystyrene poses serious health risks. It can release styrene, a chemical compound known to be potentially carcinogenic. Long-term exposure to styrene can disrupt the nervous system and increase the risk of cancer. Styrene is known to cause impaired brain function, including memory and coordination problems. In addition, the cancer risk of styrene is a major concern, especially for those who are exposed for long periods of time or in large quantities. As an alternative, consider using safer and more environmentally-friendly packaging materials, such as recycled cardboard or biodegradable materials, to reduce negative health and environmental impacts.

Polyethylene terephthalate (PET) is a common plastic used in beverage bottles and food packaging. PET is considered relatively safe, but there are concerns about the possible migration of chemicals such as antimony from the plastic to food and drink. Although the risk is considered low, it is important not to use PET bottles repeatedly or in high temperatures. While PET is considered relatively safe for single-use, there are concerns about the potential migration of chemicals from the plastic to food and drink, such as antimony. Antimony is a soluble constituent of PET and has the potential to affect health if exposed to large amounts. The health risks posed by PET are considered low, but to avoid possible negative impacts, it is best not to use PET bottles repeatedly or store them in high temperatures. High temperatures, such as in a hot car, can increase the likelihood of chemicals leaching from the plastic into the beverage. Given this, it is important to use PET bottles as directed and replace them regularly to minimise potential risks.

Polyethylene (PE), used in a variety of products from plastic bags to bottles. PE is considered safe for food and beverage use, but problems arise when this plastic degrades, releasing microplastics into the environment, which can enter the food chain and impact human health. While PE is often considered safe for food and beverage use, there are serious concerns regarding its impact on the environment and human health. When this plastic degrades, either due to exposure to sunlight or contact with chemicals, it begins to break down into tiny particles known as microplastics. These microplastics can easily make their way into the food chain, contaminating the food and drink we consume. Research shows that microplastics can have negative effects on human health, ranging from digestive system disorders to potential long-term impacts that are not yet fully understood. In addition, microplastics can also accumulate harmful toxins from the environment, which can then be transferred to the human body.

Polyvinyl chloride (PVC) is often used in pipes and building materials. PVC can contain additives such as phthalates that can be leached and exposed, potentially affecting the hormonal system and increasing the risk of health problems such as reproductive disorders and cancer. PVC typically contains additives such as phthalates, which are used to increase the flexibility of the plastic. Phthalates can leach out of PVC and be

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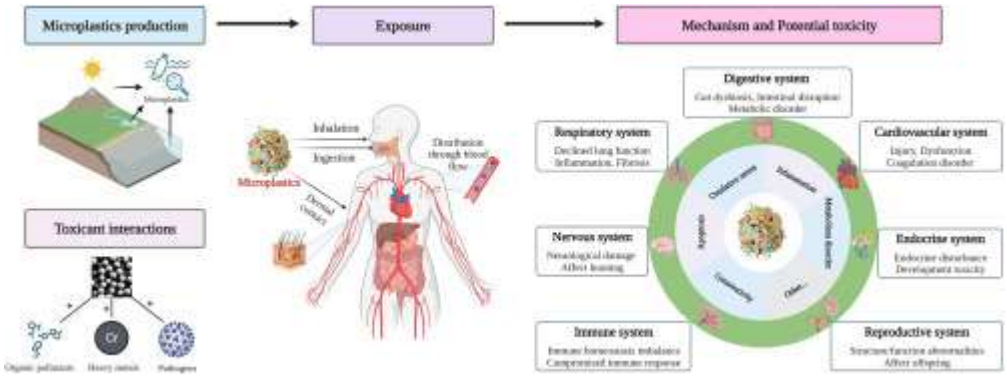
exposed to the environment and human body. Phthalate exposure has been linked to hormonal disruptions that can affect the reproductive system and overall health. Research shows that phthalates can affect sexual development and reproductive function in both men and women. In addition, some studies link phthalate exposure to an increased risk of certain cancers. It is important to be mindful of these potential dangers, especially in the use of PVC in environments that may lead to direct exposure. Using safer alternatives or choosing PVC products with strict additive control can be a wise move to reduce health risks.

Polycarbonate (PC), is known for its strength and is often used in water bottles and cutlery. The main issue with PC is the presence of bisphenol A (BPA), which can leach out and affect the endocrine system, potentially causing hormonal disruption and long-term health problems such as obesity and diabetes. Despite its good durability, polycarbonate contains bisphenol A (BPA), a chemical compound that can pose a threat to human health. BPA can leach out of the plastic and enter the food or beverages consumed. BPA is a chemical that serves as a reinforcement in the manufacture of polycarbonate, but it can also disrupt the body's endocrine system. Exposure to BPA can alter natural hormonal function and potentially cause serious health problems, such as obesity and diabetes. This risk is especially a concern when polycarbonate-based products are used repeatedly or under extreme conditions, such as at high temperatures. As an alternative, many products are now starting to use BPA-free plastics or other safer materials. It is important for consumers to check product labels and choose options that do not contain BPA to protect their long-term health.

Discussion

The impact of the presence of microplastics on various parts of the human body can interfere with human health according to the route, microplastics that enter through the air will pass through the respiratory organs before finally entering the blood and being distributed throughout the body. Microplastics that enter through food and drink will pass through the digestive organs first before finally entering the blood and being distributed throughout the body. In the blood, microplastics will circulate throughout the human organ system, including the heart, muscles, breast milk glands, placenta, testes, and even the human brain. Until finally it will accumulate in these organs, then with the body's metabolic system will be eliminated in organs that function to dispose of materials that are harmful to the body such as the liver and sewerage, namely the colon and kidneys, microplastics finally exit the human body with faeces and urine.



Microplastics can be inhaled from contaminated air and settle in the lungs. The accumulation of these particles can cause respiratory tract irritation, inflammation, and potentially increase the risk of respiratory diseases such as asthma or bronchitis. is now a serious problem in the quality of the air we breathe. These particles come from a variety of sources, including plastic waste disposal, vehicles, and industry. When the air is contaminated with microplastics, these particles can be inhaled and deposited in the lungs. The accumulation of microplastics in the respiratory tract can lead to various health problems. These particles can cause irritation, trigger inflammation, and damage lung tissue. In the long run, exposure to microplastics can increase the risk of developing respiratory diseases such as asthma and bronchitis. Reduce exposure to microplastics and raise awareness about the issue.

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Microplastics that enter through food and drink also have a serious impact. Microplastics in the liver can cause inflammation and oxidative stress. This accumulation can impair liver function, which is important for metabolism and detoxification, and increase the risk of liver disease. When these microplastics enter the body, they can reach vital organs such as the liver. Research shows that microplastics can trigger inflammation in the liver as well as oxidative stress, which is an imbalance between free radicals and the body's defence system. This inflammation and oxidative stress can damage liver cells and impair its function. Microplastics contribute to lipid peroxidation, DNA damage, activation of mitogen-activated protein kinase pathways, cell membrane damage, mitochondrial dysfunction, lysosomal defects, inflammation, and apoptosis. A study in rats points to the fact that exposure to PS-NP or PS-MP induces cell apoptosis. PS-NP increases the secretion of inflammatory cytokines (Tumour necrosis factor-α, Interleukin-6 and Interleukin-10). PS-MPs increase the secretion of TNF-α and IL-10 microplastics cause cytotoxicity and inflammatory effects by producing reactive oxygen species and nitric oxide in the cells. PS-NP and PS-MP have cytotoxicity and pro-inflammatory effects on macrophages, which may further lead to intestinal inflammation. PS-NP has a stronger adverse impact on macrophages than PS-MP (Zhang, Y., et al., 2020). The liver plays a crucial role in metabolism and detoxification, so damage caused by microplastics can inhibit its ability to process toxic substances and metabolites. The accumulation of microplastics in the liver also increases the risk of liver disease, which can affect overall health. Therefore, attention to sources of microplastic contamination and efforts to reduce plastic pollution are essential to protect the health of our liver and body as a whole.

Microplastics can be found in human faeces, indicating that these tiny particles are accumulating in the digestive system. Research shows that consumption of food and water contaminated with microplastics can lead to accumulation in the digestive tract, potentially affecting gut health and impairing digestive function. Microplastics, very small plastic particles, are now being found in human faeces, revealing that these particles can accumulate in our digestive system. Recent research shows that microplastics can enter the body through contaminated food and water. When these particles collect in the digestive tract, they have the potential to disrupt gut health and negatively affect digestive function. This accumulation of microplastics can cause serious health problems, such as inflammation and impaired nutrient absorption, as well as threaten the balance of the gut microbiota.

Microplastics are also detected in the placenta, the organ that connects the foetus to the mother during pregnancy. The presence of microplastics in the placenta may raise concerns regarding potential negative impacts on foetal development, such as developmental disorders or future health risks. Microplastics, tiny particles of plastic less than 5 millimetres in size, have become an increasingly worrying environmental issue. Recently, research found that microplastics not only pollute the oceans and air, but can also be detected in the placenta, a vital organ that connects the foetus to the mother during pregnancy. This finding adds to concerns about the impact of microplastics on human health, especially for the developing foetus. The placenta serves as a link and filter between mother and baby, but the presence of microplastics in this organ can disrupt this important process. While more research is needed to understand the specific impacts, there are worrying potential risks, including impaired foetal development and possible long-term health problems. These findings emphasise the need for further action to reduce exposure to microplastics and protect human health from the impacts of plastic pollution.

Microplastics have been found in breast milk, which suggests that breastfeeding mothers may transfer these particles to their babies. Babies' early exposure to microplastics can affect their health, especially as their immune and digestive systems are still developing. Microplastics, tiny plastic particles from consumer products and the environment, have now been found in breast milk, raising new concerns for infant health. Research shows that breastfeeding mothers can transfer microplastics to their babies through breast milk. This early exposure is particularly important as babies' immune and digestive systems are still in a vulnerable stage of development. Babies exposed to microplastics early on are at risk for a range of health problems, including disruption to the digestive system and potential impacts on their still-developing immune systems. While further research is needed, these findings underscore the importance of reducing plastic pollution and raising awareness about its impact on human health, especially for future generations.

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Microplastics accumulated in the testicles can affect male reproductive health by interfering with sperm and hormone production. This can impact male fertility and sexual health. is now a major concern in environmental health studies due to its wide-ranging impact on various aspects of human health. One area that is starting to gain attention is how microplastics accumulating in the testes can affect male reproductive health. Research shows that microplastics can disrupt sperm production and hormonal balance in the male body, which in turn can decrease fertility and sexual health. When microplastics enter the body, either through food, water or air, these particles can accumulate in certain organs, including the testicles. This accumulation can potentially cause damage to the testicular tissue and disrupt the function of the cells that produce sperm. In addition, microplastics can affect the production of important hormones such as testosterone, which plays a role in the regulation of libido and sperm quality. The impact of these disruptions can be significant, as male reproductive health is highly dependent on hormonal balance and sperm quality. If left untreated, these issues can lead to decreased fertility and other sexual health problems. Further research is needed to fully understand how microplastics affect reproductive health and to find effective solutions to protect men's health in the future.

Research shows that microplastics can affect sperm quality by reducing their motility and vitality. This can impact male fertility and potentially reduce the chances of reproductive success. Microplastics, tiny plastic particles scattered in the environment, have been found to have a serious impact on men's reproductive health. Recent research has shown that microplastics can affect sperm quality by reducing their motility-the ability of sperm to move efficiently-and their vitality, i.e. the lifespan of the sperm itself. This effect is caused by the harmful chemicals contained in microplastics, which can damage sperm cells and affect their normal function. A decrease in sperm motility and vitality can potentially reduce male fertility. Sperm that are less active or less healthy have less chance of fertilising an egg, which can reduce the chances of reproductive success. With more and more microplastics polluting the environment, attention to this issue is becoming increasingly important. Maintaining environmental quality and reducing exposure to microplastics are key steps to protecting reproductive health and increasing the chances of reproductive success.

The toxicity caused by MPs and NPs is size-dependent, as smaller particles have better absorption capacity and larger surface area, releasing more EDCs and toxic chemicals. Various EDCs contained or carried by MPs and NPs have structural similarities with certain hormone receptors; hence they interfere with normal hormone receptors, altering the hormonal action of endocrine glands. This fact suggests size-dependent bioaccumulation, distribution and translocation of MPs with potential harm to endocrine glands. We reviewed that MPs and NPs disrupt the hypothalamic-pituitary axis, including the hypothalamic-pituitary-thyroid/adrenal/testis/ovarian axis causing oxidative stress, reproductive toxicity, neurotoxicity, cytotoxicity, developmental abnormalities, decreased sperm quality, and immunotoxicity. The direct consequences of MP and NP on the thyroid, testes, and ovaries are documented (Morrison, R. L., et al. (2021).

Microplastics can be found in urine, suggesting that the kidneys play a role in filtering these particles from the blood. The accumulation of microplastics in the kidneys can impair kidney function and potentially lead to long-term health problems, including impaired kidney function. microplastics can now be found in human urine, indicating the important role the kidneys play in filtering these particles from the blood. This filtering process indicates that our kidneys function not only to eliminate metabolic waste, but also to deal with contaminants such as microplastics trapped in the body system. The accumulation of microplastics in the kidneys can significantly impair the function of this organ. These tiny particles can attach to the kidney tissues and interfere with the natural filtration process, which in turn can potentially lead to impaired kidney function. If left untreated, the long-term effects of microplastic exposure can involve serious health issues, such as a decrease in the kidneys' ability to filter blood efficiently and an increased risk of chronic kidney disease. Impaired kidney health can affect the entire body system, highlighting the importance of reducing exposure to microplastics in daily life.

Research results regarding the presence of microplastics in the human body show that these particles have become a real threat to our health. Studies reveal that microplastics are found in various organs of the body, including the blood, lungs and intestines, with varying potential toxic effects. Their health impacts, ranging

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from immune system disorders to cancer risk, further emphasise the urgency to understand and address this phenomenon. This talk will review key findings from recent studies, identifying emerging patterns and anticipated health implications. Further research is needed to fully understand the long-term impacts of microplastics on human health, but preliminary findings point to significant potential risks.

Conclusion

The conclusion that can be drawn from the literature review entitled Microplastics in the human body, very small plastic particles that are widespread in the environment The existence of microplastics is not only found in seawater and sediments, but also in various species of marine life, including seafood such as fish, shrimp, and shellfish. The discovery of microplastics in seafood makes it one of the novel food contaminants. Its discovery in seafood can pose a threat to domestic food safety. Moreover, Indonesia is known as one of the maritime countries that has great potential in the fisheries sector where in the final quarter of 2015 the total production of Indonesian marine products reached 14.79 million tonnes. The impact has been detected in various parts of the human body, including the gastrointestinal tract and other vital organs. The reviewed literature suggests that exposure to microplastics can cause a variety of health problems, ranging from digestive system disorders to potential toxic effects on cells and tissues.

Although research on long-term impacts is still in its infancy, there is serious concern that the accumulation of microplastics in the human body may contribute to a range of chronic diseases, including inflammation, hormonal disruption and cancer risk. Therefore, it is important to raise awareness and efforts to reduce plastic pollution to protect human health.

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