MICROPLASTIC- AN EMERGING ISSUE IN SEAFOOD SAFETY, FOOD SECURITY AND HUMAN HEALTH

[Article ID: SIMM0217]

Ulaganathan Arisekar
Department of Fish Quality Assurance and Management (DFQAM)
Fisheries College and Research Institute (FC&RI)
Tamil Nadu Fisheries University (TNFU),
Thoothukudi-628 008, Tamil Nadu, India

ABSTRACT

Microplastics' threat to the environment and humans is currently a prevalent theme. The emphasis of concern is not only on the impact of microplastics as such but also on additives and chemical pollutants absorbed by microplastics that may be released and negatively impact the health of animals and the environment. Even though there have been numerous works done on the subject, there are still a number of information gaps that need to be filled in order to properly estimate the risk associated with this crucial issue. For instance, the importance of microplastics for food safety has not yet been fully proven, and research findings intended to determine a potential health risk for pollutants connected with microplastics are fairly debatable. Currently, there are relatively few research available on the monitoring of microplastics in foodstuff and their impacts on human health. The risk assessment of microplastics in foodstuffs is still in its very early stages. Additionally, it is challenging to compare the findings of several studies because techniques and study designs varied for each research.

INTRODUCTION

Plastics have been discovered in the marine environment all around the world, with estimations indicating to more than 5 trillion pieces of plastic waste (about 250,000 tonnes) floating approximately. A significant proportion of this plastic trash enters the marine environment through continental sources, primarily rivers (Lebreton et al., 2017), industrial and urban effluents, and runoff from coastal sediments and neighbouring fields. The remaining portion is the direct result of events like offshore industrial activity (such as oil and gas production and aquaculture), net loss in fisheries, and waste released during maritime activities, including tourism. Due to their small size, the inability of current technology to quantify the presence of the smallest microplastics in the environment, and their potential to have negative impacts on both humans and the marine biota, microplastics are particularly concerning for the ecosystem as well as animal and human health. There is currently no lower size restriction for microplastics, which are defined as tiny plastic particles smaller than five millimeters (GESAMP, 2016). The microplastics seen in the marine environment are a result of larger plastic debris breaking into smaller pieces, or they may have already been introduced to the water and sediments as micro- or nano-sized particles. Examples of microplastics include

pre-production pellets and parts of various products, such as pieces of fishing equipment, packages and drink bottles, synthetic textiles, car tyres, paints, cosmetics and personal care items (such as facial cleansers, bath gels, and toothpaste), and electronic equipment (GESAMP, 2016). As a result, microplastics include an extremely heterogeneous collection of particles that differ among other characteristics in size, shape, and chemical composition (Andrady, 2017). Microplastics have been discovered all over the world, are extremely persistent in the environment, and are consequently accumulating in various marine ecosystems at accelerating rates.

EVIDENCE OF MICROPLASTICS IN SEAFOODS

The presence, movement, and distribution of microplastics in the marine environment, as well as their detrimental impacts on marine life, are the subject of an increasing number of scientific investigations. However, researchers have only just started to take the possible implications on human health into account. Research has demonstrated that a wide range of commercially significant fish species, including crustaceans and bivalves, are frequently polluted with microplastics. Additionally, two significant edible fish species (*Scomberomorus cavalla* and *Rhizoprionodonlalandii*) collected off the eastern coast of Brazil have microplastics in their digestive tracts (Miranda and Carvalho-Souza, 2016). Neves et al. (2015) reported microplastics in 19.8% of commercial fish caught off the Portuguese coast. Microplastics have also been found in the stomachs of economically significant fish from the Mediterranean (Romeo et al., 2015), as well as in the liver and gastrointestinal system of anchovies and sardines that are occasionally completely consumed (i.e. the entire fish).In general, seafood species that we eat whole (e.g., some molluscs and crustaceans, and small or juvenile stages of fish) pose a greater hazard to seafood contamination than gutted fish or peeled shrimp. However, the presence of microplastics in the eviscerated flesh (whole fish excluding the viscera and gills) of two commonly consumed dried fish species (*Chelonsubviridis* and *Johniusbelangerii*) was significantly higher than in excised organs (viscera and gills), exhibiting that the risk of microplastics intake by human consumers is not always eliminated by evisceration (Karami et al., 2017).

IMPLICATIONS FOR THE ENVIRONMENT AND HUMAN FOOD SECURITY

It is now widely acknowledged that microplastics are highly persistent in the environment and are accumulating in many ecosystems at potential increase. Microplastics are regarded as a rapidly increasing problem because of uncertainty and unpredictability in the data, however, are seen to be one of the key barriers to a true evaluation of the environmental concerns connected to these microparticles. Therefore, it is unclear what the true environmental concerns associated with microplastics are. Recently studies have produced significant findings demonstrating that microplastics are ingested and absorbed by marine organisms, that they cause negative effects and are accumulated in many species, that they interact with other environmental pollutants and stressors to produce toxic effects, and that trophic transfer of microplastics and the chemicals associated with them occurs (Andrady,

2017). Micro- and nano-sized plastics may be transmitted within various food webs, according to recent research that shows the trophic transmission of these materials in the wild and in lab settings. These findings raise questions about the hazards and harmful effects of microplastics' bioaccumulation and biomagnification, which mostly affect top predators.

The internationally peer-reviewed expert panel reports by EFSA (2016) and Lusher et al. (2017) determine that microplastics may have a negligible effect on the exposure to some pollutants and additives when taking into account the total dietary exposure of humans. This is because of the high concentrations of additives or contaminants reported in microplastics and their potential release from the microplastics upon ingestion. However, given the uncertainties surrounding this matter (such as the assumptions in modeling exercises, and the analytical difficulty of measuring micro- and nano-sized microplastics in environmental matrices including seafood), future studies on the contribution of chemicals produced from plastic to the human diet should continue to pay focus on this issue.It is still uncertain if pathogens can spread from ingested plastic to humans. The contribution of plastic waste to the spread of infectious diseases to people is currently unknown. However, little research has been done on how long these pathogenic organisms can survive on plastic waste, therefore more research will be needed to understand how pathogens are transmitted through seafood eating and the hazards associated with infectious diseases. Other vital concerns for the health of animals, ecosystems, and people include the toxicological interactions between microplastics and other environmental pollutants of concern as well as the impact of changes driven on by global climate change, particularly temperature variations.

MICROPLASTICS: CHALLENGES, KNOWLEDGE GAPS, AND IMPACTS ON HUMAN FOOD SECURITY, FOOD SAFETY, AND HEALTH

- It will become more crucial to routinely monitor the amounts of microplastics in seafood and other food products since microplastic concentrations are predicted to rise in the future.
- The amount of microplastics found in fish and shellfish edible tissues has to be measured. Additionally, as edible echinoderms, tunicates, and algae are commonly consumed in many nations, their quantification merits study.
- It will be necessary to implement active surveillance programs to assess whether microplastics are present in environmental compartments and prevent global fish and shellfish supplies from declining.
- Additionally, research should concentrate on developing ways to assess the ingestion and transportation of these particles in humans as well as the associated chemical and microbiological hazards and risks.
- Adopting frameworks for food safety risk analysis is crucial to assessing the hazards and risks consumers face when consuming fish, shellfish, and

other food items contaminated with microplastics.

- Research on the incorporation of a variety of microplastic sizes and compositions into human tissues is desperately required, as is the development of methods for detecting the presence of microplastics in the human body
- The existence of nanoscale plastics in seafood, about which there is even less information in the literature, is another area that needs immediate attention.
- To further understand their possible effects on the safety of seafood and human health, research on analytical techniques, toxicokinetics, and toxicity of micro- and nanosized plastics is required.

CONCLUSION

Microplastic pollution of the oceans is a problem not just because of its effects on the environment, but also because it may compromise food safety, food security, and eventually human health. We are susceptible to microplastic exposure through the intake of seafood and other foods, as well as through other pathways including the air, due to the presence of microplastics in species utilized for human consumption. However, there is little known about the prevalence of microplastics in these items, exposure levels are often unknown, and it is unclear what the possible impacts on consumers. This information is required to establish a baseline data for a risk assessment. The entry and assimilation of microplastics into human tissues, as well as the possible impacts on human health, are key study areas that should be investigated in the coming decades.

REFERENCES

Andrady, A.L., 2017. The plastic in microplastics: a review. Mar. Pollut. Bull. 119 (1), 12–22

Barboza, L.G.A., Vethaak, A.D., Lavorante, B.R., Lundebye, A.K. and Guilhermino, L., 2018. Marine microplastic debris: An emerging issue for food security, food safety and human health. *Marine pollution bulletin*, *133*, pp.336-348.

EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), 2016. Statement on the presence of microplastics and nanoplastics in food, with particular focus on seafood. EFSA J. 2016 (14), 4501 (30 p).

GESAMP, 2016. Sources, fate and effects of microplastics in the marine environment: part two of a global assessment. In: Kershaw, P.J., Rochmann, C.M. (Eds.), (IMO/FAO/ UNESCO-IOC/UNIDO/WMO/IAEA/UN/UNEP/UNDP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Rep. Stud. GESAMP No. 93 (220 p)

Lebreton, L.C.M., van der Zwet, J., Damsteeg, J.-W., Slat, B., Andrady, A., Reisser, J., 2017. River plastic emissions to the world's oceans. Nat. Commun. 8, 15611

Lusher, A.L., Hollman, P.C.H., Mendoza-Hill, J.J., 2017. Microplastics in fisheries and aquaculture: status of knowledge on their occurrence and implications for aquatic organisms and food safety. In: FAO Fisheries and Aquaculture Technical Paper. No. 615. Rome, Italy

Miranda, D.A., Carvalho-Souza, G.F., 2016. Are we eating plastic-ingesting fish? Mar. Pollut. Bull. 103, 109–114.

Neves, D., Sobral, P., Ferreira, J.L., Pereira, T., 2015. Ingestion of microplastics by commercial fish off the Portuguese coast. Mar. Pollut. Bull. 101 (1), 119–126.

Romeo, T., Pietro, B., Pedà, C., Consoli, P., Andaloro, F., Fossi, M.C., 2015. First evidence of presence of plastic debris in stomach