Effect of microplastic on aquatic animals & human health.

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Abstract: - Plastics are one of the emerging issues for the aquatic ecosystems worldwide,e mainly due to anthropogenic activities. Since plastic is non-biodegradable, it remains in water for prolonged period of time. Due to action of waves and tides, plastic is broken into pieces & fragments of various sizes including microplastic. These microplastics enter food chain & reach various systems & organs of aquatic animals and have deleterious effects. On accumulation in tissues, microplastic is known to cause cellular damage in animal tissues.
Microplastics are also known to have affinity for heavy metals and thus carry extra load of heavy metals which enhance their harmful effect on animals. Many researchers found microplastics in commercially important edible marine animals including fishes.
Microplastic makes entry in human body after consumption of plastic contaminated food species from aquatic ecosystem. Deleterious effects of microplastic on various aspects of human health are well documented in scientific research of many researchers.
Keywords: - Plastic, Microplastic, Anthropogenic Activities, heavy metals, Cellular damage.

Introduction: -

Plastics were discovered by Belgian chemist and clever marketer Leo Baekeland pioneered in 1907. Plastics is totally synthetic product which do not contained any molecules found in nature. Over the years, our dependency on plastic goods increased & plastic become integral part of human life and plastic production eventually grew many folds in past few decades. (*Vighi et. al 2021*)

Presently around 45 various types of plastics including polypropylene, polyethylene, polyethylene terephthalates, polystyrene, polyurethane, polyvinyl chloride, and polycarbonate etc are much in use. (*Allen et, al 2021; Allen et, al 2021; Kumar et, al 2022*)

In modern life plastic has become integral part of daily life. Polyethylene bags, containers, food packaging, water & beverage bottles, automobile parts, electrical devices, healthcare & medical equipments, farming equipments, furnishings, toys, reusable plastic containers, food wrap films, cable insulators, net, fishing nets & so many other goods are made up of plastic. When plastic remains in aquatic ecosystem for a prolonged time, wave and tidal action breaks it into fragments. Plastics fragments are categorized into Nanoplastics (1 to 1000 nm), Microplastics (<5 mm), Macroplastics (5-25 mm) and Mesoplastics (above 25 mm). (*Bartkova et, al 2021; Picó et, al 2022; Sangkham et al. 2022*)

Plastics fragment have different shapes like pellet, nurdles, micro bead, spherical bead, irregular bead, granule foam, fibers film and commercial fragments etc. (*Sangkham et al. 2022; Daniel et, al 2022*).

Due to non-degradable nature, plastic has become very difficult to handle & a real menace in aquatic ecosystem (*Anthony L. Andrady 2011*) leading to pollution of biotic and abiotic components of environment. (*Revel et al., 2018, Mendoza and Balcer 2019*).

All the plastic dumped carelessly finally reaches to marine ecosystem. (*Chassignet et, al 2021; Jayasiri et, al 2013; Shivika Sharma and Subhankar Chatterjee 2017, Allen et.al 2022*). Microplastic may also act as vehicle for chemicals like polystyrene, toxic metals, phthalates etc. (*Hwang et, al 2020, de Souza et, al 2022 Rodrigues et, al*). Microplastics show great capacity to absorb different chemical pollutants (metals and medicine) which are released from various textile and pharmaceutical industries etc. It causes adverse effects on marine organisms from where these toxic substances reach humans through the food chain. (*Godoy et.al. 2019 Rodrigues et, al 2022*) Microplastic in marine water is swallowed by zooplankton accidently along with food & later on it makes entry in plankton-feeder animals including fishes. (*Beiras et, al 2018*).

Presence of microplastic in marine edible fishes is common in recent past (Barbosa et.al 2018, Daniel et.al. 2020, Gundogdu et.a. 2020, Wu et al 2020, Thiele, et.a. 2021,Foo et.al 2022, Prata, et.al 2022). It is a matter of global concern since seafood forms an integral part of our diet. Recent research indicates, microplastic affects various tissues of fishes like skin, gills, muscle and alimentary canal). (*Barboza et, al. 2022; GÜNDOĞDU et, al* 2022; *Foo et, al 2022*). Microplastic also compromises immune system causing immunosuppression, abnormal inflammatory response and immune activation. (*Barboza et, al 2018*). Studies on effect of microplastic on several aquatic animals like crustaceans, mollusk and fish etc. indicate that the effect of microplastic on various organs of animals caused heavy damage in DNA, immunotoxicity, cancer, oxidative stress, genotoxicity, reproductive impairment, mortality, decline in population growth and transgential effect etc. (*Hirt et, al 2020; Palaniappan et, al 2022; Sangkham et, al 2022 Yong et, al 2020*).

Deleterious effects of microplastic in human being are caused by consumption of fish & shellfish from plastic polluted waters. (*Wu et al 2020 Thiele et, al 2021 Smith et al 2018*). Endocytosis & persorption are two common methods for microplastic to enter human body (*Galloway, 2015, Wright & Kelly, 2017, Md. Simul Bhuyan, 2022*).
Microplastic has severe hazardous effects on human health.

Due to oxidative stress, microplastic is known to cause cellular damage, neuroinflammation in the brain tissue and is also responsible for various neurological disorders. (*Barboza et, al. 2022*)

Dysbiosis and immune cell toxicity resulting from nanoplastics and microplastics exposure, in particulars microplastics have been promoting the growth of bacterial pathogens on their surfaces and absorb harmful contaminants found in surrounding which may lead to intestinal toxicity and chronic disorders.

Microplastic impairs immune system and can cause autoimmune disorders in human (*Prata 2018, Prata et.al. 2020*).

Inflammation due to microplastic also leads to increased porosity of epithelial membranes which ultimately enhances

microplastic transfer in human body (*Campanale et. al, 2020 Rudolph et, al 2021*)

Limitations: -

1. Assessment of levels of microplastics in seafood & food products would have to be done on regular bases as concentration of plastics and microplastics is expected to increase.
2. To estimate the quantity of microplastics in marine fishes will be challenging.
3. Analysis of toxins released from the plastics would require additional research.

Discussion and Conclusion: - Plastic is non-biodegradable substance which remains in aquatic ecosystem. Microplastic passes through aquatic food chain and enters in human body. Microplastic not only deteriorates the quality of aquatic ecosystem but also harms the aquatic animals including commercially important edible animals. Fish & shellfish form significant part of human food for being rich source of protein. Microplastic makes entry in human body through the edible aquatic forms and are known to affect different systems and organs in human body.

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