



## Impact of Microplastics on Gut Microbiomes

**For Prelims:** Impact of Microplastics on Gut Microbiomes, [FAO](#), [Microplastics](#), **Dysbiosis**.

**For Mains:** Impact of Microplastics on Human Health and Environment.

### Why in News?

Recently, the [FAO \(Food and Agriculture Organization\)](#) in its report “**Impact of Microplastics and Nanoplastics on Human Health**” highlighted that the [Microplastics](#) and nano plastics considerably impact human and animal gut microbiomes as well as the environment.

### What is Gut Microbiome?

- The gut microbiome is the **totality of microorganisms, bacteria, viruses, protozoa, and fungi, and their collective genetic material present in the gastrointestinal tract (GIT)**.
- The gut microbiota plays an important role **in nutrient and mineral absorption, synthesis of enzymes, vitamins and amino acids**, and production of short-chain fatty acids (SCFAs).
  - The microbiome refers to the collection of genomes from all the microorganisms in the environment while **Microbiota usually refers to microorganisms that are found within a specific environment**.

### What are the Key Highlights of the Report?

- **Intestinal Inflammation and Dysbiosis:**
  - **Exposure to plastic has led to intestinal inflammation and gut dysbiosis** — changes in the gut microbiome and microbiota.
  - Microplastics act as stressors and cause inflammatory responses in the host, affecting certain microorganisms and **resulting in microbial dysbiosis**.
    - Dysbiosis is defined by an imbalance in bacterial composition, changes in bacterial metabolic activities, or changes in bacterial distribution within the gut.
- **Deposition in Human Body:**
  - **Microplastics found in water bottles and food items** such as sugar, honey, sea salt, tea and others have eventually deposited in human lung tissue, placenta, stool, blood and meconium.
- **Plastics' Interaction with the Environment:**
  - Plastics of hydrophobic nature can adsorb hydrophobic chemicals or **persistent organic pollutants from the environment** (for example, polychlorinated biphenyls, polycyclic aromatic hydrocarbons and dichloro diphenyl trichloroethane).
- **Impact on Organism and Metabolism:**
  - Accumulation of microplastic in the gut, changes in the mucus layer and gut **permeability, alterations of the mucosal structure**, oxidative stress and immune response.

- Physical abrasion of microplastic and its accumulation in the gut can lead to satiety in the organism and even reduce food consumption.
- It may eventually lead to weight loss and metabolic changes and can also affect liver function and metabolism.
- The severity of the impact is proportional to the **concentration and particle shape of microplastics**.

## What is the Significance of the Findings?

- The FAO report emphasizes the significant impact of microplastics and nanoplastics on gut microbiomes and human health.
- Understanding the effects of plastic exposure **on gut microbiomes and the environment is crucial for developing effective mitigation strategies**.

## What are Microplastics?

### ▪ About:

- They are defined as **plastics less than five millimeters in diameter**—smaller in diameter than the standard pearl used in jewelry. It can be harmful to our ocean and aquatic life.
- Under the influence of **solar UV radiation**, wind, currents and other natural factors, plastic fragments into small particles, termed **microplastics (particles smaller than 5 mm) or nanoplastics (particles smaller than 100 nm)**.
- There are **two categories of microplastics**: primary and secondary.

### ▪ Classification:

- **Primary Microplastics**: They are tiny particles **designed for commercial use and microfibers shed** from clothing and other textiles.
- E.g Microbeads found in personal care products, plastic pellets and plastic fibres.

### ▪ Secondary Microplastics: They are **formed from the breakdown of larger plastics** such as water bottles.

- This breakdown is caused by exposure to environmental factors, mainly the sun's radiation and ocean waves.

## UPSC Civil Services Exam, Previous Year Questions (PYQ)

**Q. Why is there a great concern about the 'microbeads' that are released into environment? (2019)**

- (a)** They are considered harmful to marine ecosystems.
- (b)** They are considered to cause skin cancer in children.
- (c)** They are small enough to be absorbed by crop plants in irrigated fields.
- (d)** They are often found to be used as food adulterants.

**Ans: (a)**

**Source: DTE**

