

Microbes in the human gut and their beneficial role

Gut flora or gut microbiota is the complex community of microorganisms that live in the digestive tracts of humans and other animals, including insects. The gut metagenome is the aggregate of all the genomes of gut microbiota.

In humans, the gut microbiota has the largest numbers of bacteria and the greatest number of species compared to other areas of the body. The gut flora is established at one to two years after birth. The relationship between some gut flora and humans is not merely commensal (a non harmful coexistence), but rather a mutualistic relationship.

The composition of human gut flora changes over time, when the diet changes, and as overall health changes.

The microbial composition of the gut flora varies across the digestive tract. In the stomach and small intestine, relatively few species of bacteria are present. The colon, in contrast, contains a densely populated microbial ecosystem. These bacteria represent about 300-1000 different species. However, 99% of the bacteria are from 30 to 40 species.

Fungi, archaea, and viruses are also present in the gut flora, but less is known about their activities.

Over 99% of the bacteria in the gut are anaerobes. It is estimated that these gut flora have around a hundred times as many genes in total as there are in the human genome. The four dominant bacterial phyla in the human gut are Firmicutes, Bacteroidetes, Actinobacteria, and Proteobacteria. Most bacteria belong to the genera *Bacteroides*, *Clostridium*, *Eubacteria*, *Ruminococcus*, *Peptococcus*, *Peptostreptococcus*, and *Bifidobacterium*. Other genera, such as *Escherichia* and *Lactobacillus*, are also present to a lesser extent.

Fungal genera like *Candida*, *Saccharomyces*, *Aspergillus*, *Penicillium* are also present.

Archaea are also present in a large number in the gut, which are important in the metabolism of the bacterial products of fermentation.

The gut microbiota performs several beneficial roles:

1. The gut flora community plays a direct role in defending against pathogens by fully colonizing the space, making use of all available nutrients, and by secreting compounds that kill or inhibit organisms that would compete for nutrients with it.
2. The gut flora helps in metabolism. They contain enzymes which human cells lack for breaking down certain carbohydrates- certain starches, fiber, oligosaccharides, and sugars like lactose (in lactose intolerance). Bacteria ferment carbohydrates into short chain fatty acids (SCFAs).
3. Gut flora also synthesize vitamins like biotin and folate, and help with absorption of dietary elements, including magnesium, calcium and iron.
4. Gut microbiota can also metabolize other xenobiotics such as drugs, phytochemicals, and food toxicants. They maintain a host-gut microbiota-xenobiotic interaction.
5. Biochemical signalling takes place between the gastrointestinal tract and the central nervous system through the gut-brain axis.

Probiotics

Probiotics are defined as live microorganisms that are believed to provide health benefits when consumed. The term probiotic is used to name ingested microorganisms associated with benefits for humans and animals. They are live bacteria and yeasts that are good for the health, especially of the digestive system.

The concept of probiotics is generally attributed to Nobel laureate Elie Metchnikoff, who postulated that yogurt consuming Bulgarian peasants lived longer lives. The term came into more common use after 1980.