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YOUR GUIDE TO

The Gut Microbiota

The word 'microbiota' refers to the population of microorganisms that live on or in the human body, including bacteria, archaea, yeast and viruses.

In the gastrointestinal tract there are at least as many bacterial cells as there are human cells in the whole of the body[1] – this cluster of microorganisms is referred to as the gut microbiota.

The word 'microbiome' refers to the genetic information from these microorganisms. The human microbiome has 150 times more genes than the human genome.[2]

TAXONOMY

Bacteria are classified according to phylum, class, order, family, genus and species.

There are four main phyla in the human gut microbiota including; Proteobacteria, Firmicutes, Actinobacteria and Bacteroidetes[3], with Firmicutes and Bacteroidetes predominating in western populations.[4,5]

EXAMPLES OF BACTEROIDETES GENERA[4,5]

Bacteroides, Prevotella, Porphyromonas

EXAMPLES OF FIRMICUTES GENERA[4]

Lactobacillus, Bacillus, Clostridium, Enterococcus

Taxonomical classification of *Lactobacillus casei* Shirota:

Domain	Bacteria
Phylum	Firmicutes
Class	Bacilli
Order	Lactobacillales
Family	Lactobacillaceae
Genus	*Lactobacillus*
Species	*casei*
Strain	Shirota

There is no core 'healthy' microbiota that is common to all individuals.

The gut microbiota population varies throughout the gastrointestinal tract and between individuals. In general, we consider a gut microbiota to be optimal when it is diverse, stable and resilient.[6]

Studies have shown that these characteristics are associated with healthy long-living people[7] and the absence of certain gut-microbiota associated diseases.[6,8-10]

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THE GUT MICROBIOTA THROUGHOUT THE LIFE COURSE

Birth is a significant time for microbial colonisation. Our mode of birth (vaginal or caesarean section) can influence the microbes that initially colonise the infants gastrointestinal tract. Infants born by vaginal delivery will develop a gut microbiota that resembles the maternal vaginal and faecal microbiota, which is rich in lactobacilli.[3] Infants delivered by c-section are more commonly dominated by microbes that are associated with the skin microbiota. Their gut microbiota is often lower in diversity with fewer *Bacteroides*, and typically colonised by *Clostridium* species.[3]

Feeding during early life can further influence the microbes that are present in an infant's gastrointestinal tract. Human milk contains oligosaccharides (HMO), which have a prebiotic effect as they are fermented by *Bifidobacterium* in the colon, resulting in the proliferation of a *Bifidobacterium*-rich infant microbiota.

Once an infant has begun **weaning** and solid foods have been introduced, their gut microbiota starts to resemble that of an adult. It is dominated by bacterial phyla such as *Bacteroidetes* and *Firmicutes*.[9] Once this stage has been reached it remains fairly stable, although there are factors which can affect it.[10,11]

ROLE OF THE GUT MICROBIOTA

Although it is not possible to define a healthy gut microbiota we know that it plays an important role in many metabolic, nutritional, physiological and immunological processes including;[12]

- Fermentation of non-digestible dietary fibre
- Production of short-chain fatty acids
- Vitamin K_2 production
- Prevention of colonisation of pathogenic microorganisms
- Modulation of intestinal epithelial cell proliferation
- Development and homeostasis of the immune system

FACTORS AFFECTING THE GUT MICROBIOTA

DIET

Food we eat that is not digested is available to the gut microbiota for fermentation; content and quality of our diet affect composition and function of the gut microbiota.[13]

MEDICATION

Antibiotics lead to imbalances between bacterial species and a decreased diversity in our gut microbiota.[14–16] Some other medications have also been shown to affect the gut microbiota, including; anti-depressants, laxatives, and proton pump inhibitors.[17]

LIFESTYLE FACTORS

There are several lifestyle factors that affect the gut microbiota such as smoking, stress and your environment.[18]

AGE

As we age digestion and nutrient absorption are altered and the immune system weakens, all of which can lead to a decreased diversity of the gut microbiota. Elderly people have been found to have a lower number of *Bifidobacterium* species and an increase in *Clostridium* and Proteobacteria compared to younger, healthy adults.[4]

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