

# Key facts about probiotics and antibiotics

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## Introduction

A diverse community of microorganisms (including bacteria, viruses, and fungi) live within our gastrointestinal tract and make up what is collectively called the gut microbiome. They are responsible for vital immune, metabolic, and nutritional functions and work together to keep the body healthy and prevent disease. For example, some bacteria help produce vitamins, digest food or destroy disease-causing cells. Everyone's microbiome is unique. No two people have the same microbial cells, even twins are different. Many gastrointestinal disorders have been associated with alterations in the gut microbiome. The role of bacteria in the human body has been studied extensively and identified as a means to improve health and prevent disease by balancing the gut microbiome using living microbial adjuncts, known as probiotics.

## Probiotics

The use of probiotics has become increasingly popular in recent years. However, evidence for their efficacy is varied. Probiotics are naturally present in fermented foods, may be added to other food products and are available as dietary supplements. Studies of selected probiotic species (given alone or in combination) have suggested efficacy in several gastrointestinal illnesses. Therapeutic benefit has also been suggested for other disorders, including antibiotic-associated diarrhoea (AAD).

## The role of probiotics

Probiotics are live microorganisms that are intended to have beneficial health properties for the host when administered in adequate amounts. Probiotics are used to restore microbial balance,

and for them to be effective, they must have certain characteristics, such as being able to withstand passage through the gastrointestinal tract (survive stomach acid and bile degradation), attach and adhere to the intestinal epithelium, colonise and reproduce in the gut, and stabilise the balance of the gut microbiome.

Probiotics are what many people call good bacteria or friendly bacteria. They are bacteria that live in the body and help it improve or normalise the microbial balance. Often, probiotics help defend the body from infections caused by unfriendly bacteria or other germs. The core benefit of probiotics is exercised by contributing to maintaining a balanced microbiome and, therefore, creating a favourable gut environment. Furthermore, probiotics support the health of the digestive tract and the immune system. Different types of probiotics have different effects. Since the effects of probiotics can be specific to certain probiotic species and strains, recommendations for their use in the clinic or in research studies need to be species- and strain-specific.

## The most common types of probiotic bacteria

Probiotics may contain a variety of microorganisms. Though there are many types of bacteria that may be considered probiotics, there are two specific types of bacteria that are common probiotics available commercially. These include:

- *Lactobacillus*
- *Bifidobacterium*

Probiotics are also made up of good yeast. The most common type of yeast found in probiotics is:

- *Saccharomyces boulardii*

## Mechanism of action

Probiotics may transiently colonise the human gut mucosa in highly individualised patterns, depending on the probiotic strain, baseline microbiota and gastrointestinal tract region. Although the exact way in which probiotics may be beneficial to humans is

**Table I:** Examples of probiotic/prebiotic products

Trade name	Ingredients
Combiforte®	Each capsule contains 1 billion viable cells of: <i>Bifidobacterium longum</i> <i>Bifidobacterium bifidum</i> <i>Lactobacillus acidophilus</i> Prebiotic: fructo-oligosaccharide
DualBalance™	Each sachet yields not less than 21 billion viable cells of: <i>Lactobacillus acidophilus</i> <i>Lactobacillus rhamnosus</i> <i>Bifidobacterium bifidum</i> <i>Bifidobacterium lactis</i> Prebiotic: fructo-oligosaccharide plus electrolytes
entiro™	Each capsule or chewable tablet and FastMelt sachet contains a minimum of 100 million colony-forming units (CFUs) of: <i>Enterococcus mundtii</i> <i>Lactobacillus plantarum</i>
Inteflora®	Each capsule contains: <i>Saccharomyces boulardii</i> 250 mg
Kiddie-forte™	Each chewable tablet contains in total 1 billion viable cells of: <i>Bifidobacterium longum</i> <i>Bifidobacterium bifidum</i> <i>Lactobacillus acidophilus</i> Prebiotic: fructo-oligosaccharide
Probiflora™ Adult Classic Bowel Support	Each capsule contains 5 billion CFUs of: <i>Lactobacillus acidophilus</i> <i>Lactobacillus casei</i> <i>Lactobacillus lactis</i> <i>Bifidobacterium lactis</i> Prebiotic: fructo-oligosaccharide fibre
Probiflora™ Adult Everyday Flora Balance	Each capsule contains 1 billion CFUs of: <i>Lactobacillus rhamnosus</i> <i>Bifidobacterium longum</i> Prebiotic: fructo-oligosaccharide fibre (Actilight™)
Probiflora™ Junior Everyday Flora Balance	Each chewable tablet contains 1 billion CFUs of: <i>Lactobacillus helveticus</i> <i>Lactobacillus rhamnosus</i> <i>Bifidobacterium longum</i>
Probiflora™ Rx Intestinal Flora Care	Each capsule contains 1 billion CFUs of: <i>Lactobacillus rhamnosus</i> <i>Bifidobacterium longum</i> Prebiotic: fructo-oligosaccharide fibre (Actilight™)
Reuterina™ daily	Each chewable tablet contains $1 \times 10^8$ CFUs of live <i>Lactobacillus reuteri</i>

incompletely understood, there are many proposed mechanisms by which probiotics may enhance intestinal health. The following general benefits of probiotics have been described and include the following mechanisms:

- Competing with harmful microbes in the gut for nutrients, thereby preventing growth or invasion by pathogenic bacteria in the gastrointestinal tract.
- Help support the cells that line the gut to prevent harmful bacteria that may have been consumed (through food or drinks) from entering the blood.
- Improvement of intestinal barrier function.
- Stimulation of the immune system.
- Help the body maintain a healthy community of microorganisms or help the body's community of microorganisms return to a healthy condition after being disturbed.

## Safety aspects of probiotics

Probiotics have an extensive history of being well-tolerated, particularly in healthy people. While probiotics are widely used in healthy individuals, there are potential risks when used by severely ill and immunocompromised patients.

**Table II:** Safety aspects of probiotics

Probiotics are measured in colony-forming units (CFUs), which indicate the number of viable cells. Amounts may be written on product labels as, for example,  $1 \times 10^9$  for 1 billion CFUs or  $1 \times 10^{10}$  for 10 billion CFUs. Many probiotic supplements contain 1 to 10 billion CFUs per dose, but some products contain up to 50 billion CFUs or more. However, higher CFUs counts do not necessarily improve the product's health effects.

Probiotics must remain viable for the entire shelf-life of the product and not have any pathogenic properties. Because probiotics must be consumed alive to have health benefits, and they can die during their shelf life, users should look for products labelled with the number of CFUs at the end of the product's shelf life, not at the time of manufacture.

Probiotics need to withstand acid and bile to reach the colon, where colonisation can occur.

Several probiotic strains are fragile and need to be protected from light, oxygen, heat and humidity.

Most commercial probiotics consist of a blend of strains with efficacy generally attributed to specific strains and their quantity. However, some probiotic products have been reported to contain microorganisms other than those listed on the label. In some instances, these contaminants may pose health risks.

The risk of harmful effects from probiotics is more significant in people with severe illnesses or with compromised immune systems. When probiotics are being considered for high-risk individuals, such as seriously ill hospitalised patients or premature infants, the potential risks of probiotics should be carefully weighed against their benefits. Possible harmful effects of probiotics may include the production of harmful substances, increased risk of infections and transfer of antibiotic resistance genes from probiotic microorganisms to other microorganisms in the digestive tract.

## Antibiotic-associated diarrhoea

Antibiotic medications are often needed to fight an infection. However, while antibiotics are killing the bad bacteria, they are also knocking out the good bacteria in the body. Antibiotic-associated diarrhoea (AAD) is a side effect frequently associated with the use of broad-spectrum antibiotics. AAD occurs in 5–39% of patients, from the beginning and up to two months after the end of treatment. The symptoms range from mild and self-limiting to severe diarrhoea. AAD occurs when the antibiotic disrupts the ecology of the intestinal microbiome by altering the diversity and numbers of bacteria in the gut and causing the excessive growth of normally harmless bacteria.

The positive effect of probiotics on gut health in various conditions, including AAD, has been evaluated by a number of clinical trials. Specific probiotic bacteria such as *B. longum* and *Lactobacillus rhamnosus* GG and the yeast *Saccharomyces boulardii* have been found to have beneficial effects on the prevention and/or incidence of AAD. Research has shown a positive connection between taking probiotics after an antibiotic and relief from diarrhoea. The thought behind adding probiotics back into the body after taking an antibiotic is that it can repopulate the good bacteria that were destroyed by the antibiotics. The probiotic may help repopulate the gut microbiome and fight off any remaining bad bacteria.

## Conclusion

Research has identified that a balanced gut microbiome is key to gastrointestinal health, the immune system and other health aspects. Probiotics offer a dietary means to support and maintain the gut microbiome. Probiotics have an extensive history of safe use, particularly in healthy people. Not all foods and dietary supplements labelled as probiotics on the market have proven health benefits. It is important to note that a probiotic's effect is strain-specific, and generalisation about the potential health benefits cannot be assumed across all strains. Each probiotic strain needs to be assessed on its own in controlled studies before specific claims are made.

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