Probiotics and gut health

Jacqueline van Schoor
Amayeza Information Services

It is by now well-known that humans have more bacterial cells in the body than human cells. Bacteria live on the skin, in the nose and ears, and, most of all, in the gut. The gut is host to over 100 trillion bacteria from 500 different species of microbes, most of which are non-pathogenic and help to protect the body against disease and maintain well-being.

The stomach and small intestine contain only a few species of bacteria. In contrast, the large intestine (colon) contains high densities of living bacteria. At the level of species and strains, the microbial diversity of the gut microflora between individuals is large and each individual harbours his or her own distinctive pattern of microbes determined partly by the human (host) genetics, initial microbial colonisation of the gut at birth (colonisation of the GI tract of newborn infants starts immediately after birth and occurs within a few days), age, gender, health/disease conditions, socio-economic factors (e.g. urban or rural, sanitation) and diet.

The gastrointestinal (GI) microflora make up an extremely complex ecosystem that normally exists in harmony with its human host. When this harmony is disrupted, however, disease may follow. Research has linked disharmony of the microflora to GI disorders such as antibiotic-associated diarrhoea, ulcers, inflammatory bowel disease, irritable bowel syndrome and colon cancer.

The gut and immunity

The gut microbes help maintain the stability and functioning of the intestinal tract. The gut microbes play a role in digestion of food, production of vitamins, destruction of pathogenic microbes and maintaining the immune system.

The gut plays a key role in the body's immune system. The intestine is the largest immune organ of the body, providing a protective interface between the human body and the antigens and microbes that enter from the external environment.

In order for the intestine to function optimally, the 'balance' of the microflora must be maintained. This appears to be increasingly difficult as modern lifestyles and an increase in stress make demands on the immune system, which, in turn, can disrupt the balance of microflora in the gut. Another contributory factor is the consumption of antibiotics, which by design destroy bacteria, and therefore can have a harmful effect on the balance of the gut microflora. All these factors combine to shift the balance of the gut microflora away from potentially beneficial or health-promoting bacteria, towards an increase in harmful microbes.

What are probiotics?

Bacteria can be used to improve human health. Attempts have been made to improve health and prevent disease by modulating the intestinal microflora using living microbial adjuncts called 'probiotics'.

Probiotics are live microbes that can confer a health benefit on the host when administered in adequate amounts. Probiotics, which are regulated as dietary supplements and foods, consist of yeast or bacteria. They are available as capsules, tablets or powders and are also contained in various fermented foods e.g. yoghurt. Probiotic products may contain a single microbe or a mixture of several species. The most widely used probiotics include lactic acid bacteria, specifically *Lactobacillus* and *Bifidobacterium* species. Yeasts such as *Saccharomyces boulardii* are also used as probiotics.

It is important to note that probiotic effects tend to be specific to a particular strain, so a health benefit attributed to one strain is not necessarily applicable to another strain, even within the same species. Therefore, generalisations about potential health benefits of probiotics cannot be made.

The rationale for using probiotics involves restoring microbial balance. In order for probiotics to be successful, however, they must possess certain characteristics. Probiotics must be able to:

- withstand passage through the gastrointestinal tract i.e. survive stomach acid and bile degradation,
- colonise and reproduce in the gut,
- attach and adhere to the intestinal epithelium, and
- stabilise the balance of the gut microflora.

Furthermore, probiotics must remain viable for the shelf-life of the product, be absolutely safe for human consumption and not have any pathogenic properties. The Complementary Medicines - Health Supplements Safety and Efficacy guideline (2016) requires probiotic supplements to contain at least 1 x 10^9 colony forming units (CFUs) per dosage unit. Commercial products have not always been found to contain the probiotic strains listed on the label, and in some cases, the bacteria may not be viable.

When selecting a probiotic product, it is important to check that the product labelling includes:
- Genus and species identification.
- Strain designation.
- Viable count of each strain at the end of the shelf-life.
- Recommended storage conditions.
- Safety under the conditions of recommended use.
- Recommended dose, which should be based on the demonstrated effects of that probiotic in human studies.
- An accurate description of the effects of the probiotic.

What are prebiotics?

Prebiotics differ from probiotics in that they contain no live microbes but stimulate their growth in the intestine. A prebiotic is a non-digestible food ingredient which beneficially affects the host by selectively stimulating the growth, activity or both of certain bacterial species already in the colon. Examples of prebiotics include fructo-oligosaccharides, galacto-oligosaccharides, inulin and lactulose.

Uses of probiotics

Although other potential uses for probiotics are under investigation e.g. for allergic rhinitis, most studies have used probiotics as dietary supplements for the prevention and treatment of gastrointestinal disorders, particularly gastrointestinal infections.

The exact way in which probiotics benefit humans has not been confirmed, but it is thought they benefit the gut in the following ways:

- Competing with harmful microbes in the gut for nutrients, thereby preventing harmful microbes from growing.
- Producing growth inhibitors.
- Influencing intestinal immunity by stimulating the immune response.

Diarrhoea in infants

Rotavirus is a common cause of diarrhoea in infants. Several studies have highlighted the ability of different probiotics, including various *Lactobacilli* and *Bifidobacteria*, to reduce the duration of rotavirus and watery diarrhoea. Oral administration of these probiotics has been shown to shorten the duration of acute diarrhoeal illness by approximately one day.

Antibiotic-associated diarrhoea

Disturbance or destruction of the gut microflora caused by antibiotic treatment as well as a subsequent excessive growth of normally harmless bacteria often leads to diarrhoea. 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 antibiotic-associated diarrhoea.

Travellers' diarrhoea

Travel is a risk for infectious gastroenteritis. A number of studies have assessed the potential of probiotics to prevent travellers' diarrhoea, with varying results depending on the species used, vehicle and the dosage schedule. Benefits have been reported particularly with *Lactobacillus GG* and *B. bifidum.*

Conclusions

The area of gut microflora modulation seems to hold much promise for the prevention and/or treatment of gut disorders as mediated by pathogenic microbes. Probiotics offer dietary means to support the balance of the gut microflora. Many promising studies have been published, but it is important to remember that studies on a particular strain may not necessarily be relevant to probiotics of a different strain. Each probiotic strain needs to be assessed on its individual merits. Specific agents with proven efficacy and specific doses of such agents need to be studied in controlled studies before specific claims are made because not all probiotics behave similarly.

Bibliography

1. Mason P. Probiotics and prebiotics. Pharm J 2001;266:118-121.
2. Czerucka D, Piche T, Rampal P. Review article: yeast as probiotics – Saccharomyces boulardii. Aliment Pharmacol Ther 2007;26:767-778.
3. Guarner F, Sanders ME, Eliakim R, et al. Probiotics and prebiotics. WGO Global Guidelines. 2017.
4. Williams NT. Probiotics. Am J Health Syst Pharm 2010;67(6):449-458.
5. Elliott E, Teversham K. An evaluation of nine probiotics available in South Africa, August 2003. S Afr Med J 2004;94(2):121-124.
6. Muntingh GL. Ok, so who wants to colonise my gut? – Overview of probiotics in certain gastrointestinal disorders. S Afr Fam Pract 2017;59(5):29-34.
7. Fooks LJ, Gibson GR. Probiotics as modulators of the gut flora. Br J Nutr 2002;88(Suppl 1):S39-S49.
8. Steyn L. A matter of the gut. SA Pharmacist's Assistant 2017;Summer:15-16.
9. Medicines Control Council. Complementary Medicines - Health Supplements Safety and Efficacy. 2016.