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# FERMENTED FOODS, IBS AND THE MICROBIOME

**The gut microbiome contains 10 times more microbial cells than all the human cells in the body.[2] It is a vast and diverse array of bacteria, arachea, viruses and unicellular eukaryotes.**

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Firmicites and Bacteroidetes (gram-negative) and Actinobacteria (gram-positive) make up 90% of the bacteria in the gut, the most abundant site being the colon.[2] Although there are more than 1,000 species of bacteria that could be present, it is estimated that only 150-170 predominate in a person.[3]

## HOW DOES THE BALANCE OF BACTERIA AFFECT THE MICROBIOME AND THUS HEALTH?

- **Gut barrier integrity** - bacteria can increase tight junctions and decrease permeability, so decreasing the leakage of endotoxins into the bloodstream.[1]
- **Immunity maintenance** - the right balance of micro-organisms can suppress pathogens, suppress pro-inflammatory factors and stimulate immune cell proliferation.[1]
- **Fermentation by-products** - Humans lack the enzymes to digest fully the bulk of dietary fibre, so these pass into the large intestine for fermentation. The major group of by-products are short chain fatty acids (SCFA) of which acetate, propionate and butyrate are the most abundant.[2] The right balance of bacteria can lead to by-products that decrease luminal pH, inhibit pathogen growth, simulate mucin production and the production of immune fighting cytokines.[1]
- **Direct competition for nutrients** - resulting in pathogenic bacteria decreasing in numbers.[4]

## PREBIOTICS AND PROBIOTICS

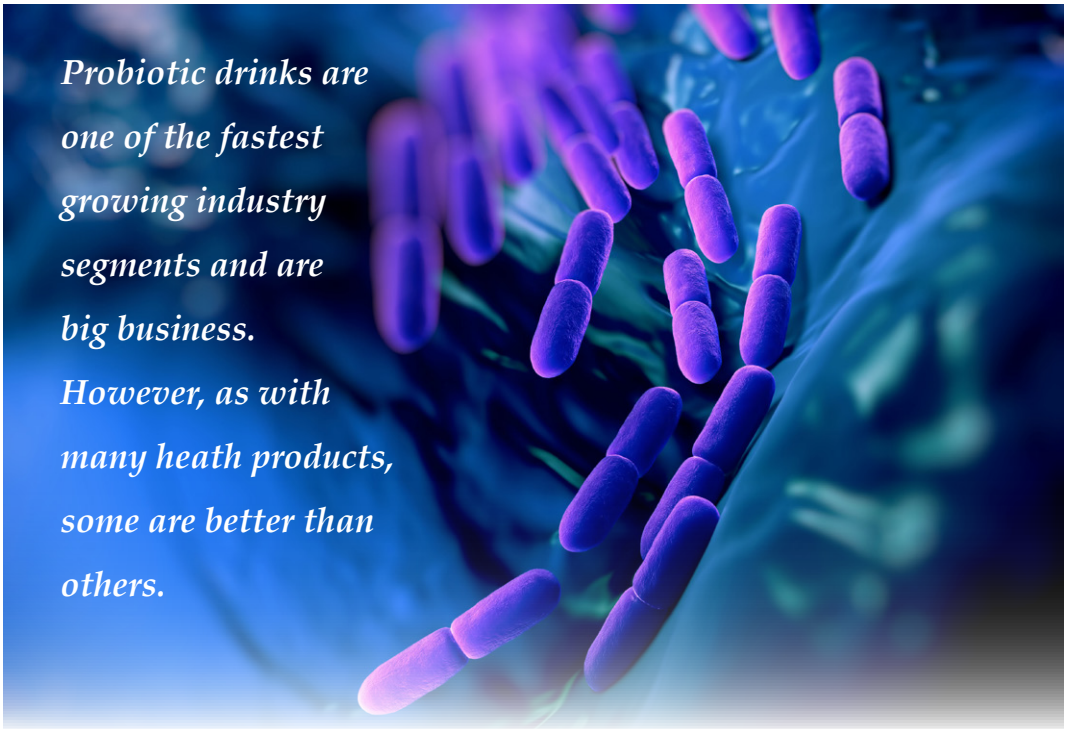
Prebiotics are substrates that provide a health benefit by selectively promoting the growth of beneficial bacteria in the intestine.[6]

Probiotics are 'live microorganisms which when administered in adequate amounts confer a health benefit on the host.' World Health Organisation (WHO).[7]

Prebiotics and probiotics are bacteria that can affect the balance of the microbiota; they are beneficial to health and could affect disease states. There are many probiotics on the market and so this has become another area of confusion. Who benefits from taking a probiotic and which one is the best choice? When advising a patient to take probiotics, it makes sense to choose one which is appropriate for their symptoms, rather than giving general "take a probiotic" advice. Probiotics are also rapidly evolving and, as we learn more about the microbiome, they are likely to become more specific.

When trying a probiotic, it is advisable to take it daily in adequate amounts for one month and monitor symptoms.[6] This is currently a hot topic of research, with probiotics being incorporated into an array of foods, drinks, supplements and pharmaceutical products. Probiotic drinks are one of the fastest growing industry segments and are big business. However, as with many heath products, some are better than others.

It is important to look at the specific bacterial strain being used in the probiotic and check this has evidence. A good place to look for a summary is the World Health Organisation (WHO)




Lactobacillus bulgaricus bacteria

Table 1: Summary of bacterial strains and dosage[7]

| | | |
|---|---|---|
| L.plantarum | 5 x 107 CFU billion once daily | improvement in abdominal pain |
| E.coli | 107 CFU three times daily | - |
| L.rhamnosus, L plantarum, L. acidophilus and E.foecium | 10 billion bacteria | improvement in IBS score |
| B.coagulans and fructo-oligo saccharides | 15 x 107 three times daily | Decreases pain, improves constipation |
| L.animalis subsp, lactise BB-12, L.acidophilus, L.delbruekii subsp, bulgaricus, Strept thermophilus | 4 billion CFU twice daily | Improvement in pain and bloating |
| Sacc.boulardii | 109 CFU of 250mg twice daily | Improvement in IBS QOL score |
| Bifido.animalis in fermented milk with (Strept thermophilus and L.bulgaris) | 1010 CFU twice daily | Improvement in global assessment of IBS symptoms |
| L.acidophilus | 1010 CFU once daily | Improvement in HRQOL in IBS-C |
| L.rhamnosus, Propionbacterium freudemreichii, shermanii, Bifido animalis subsp. lactis | 1010 CFU once daily | - |
| Short chain fructo-oligo saccharides | 5g daily | - |
| Galacto-oligosaccharide | 3.5g daily | - |
| B.coagulans | 2 x 109 CFU once daily | - |

Table adapted from WHO Global Guidelines[7]

*Sauerkraut, kimchi, dry fermented sausage, live yoghurt, cheeses, kombucha and miso are other examples of fermented foods*

Gastroenterology Guidelines (Table 1).[7] This shows that different formulations need to be taken at differing amounts and frequencies. Some, such as Bacillus coagulans, need to be taken three times daily while others are taken once daily.

Popular UK formulations include OptiBac containing Saccharomyces boulardii, a yeast with some benefits in IBS-D and in improving quality of life scores. Alflorex contains a live culture and is suitable on a low FODMAP diet. Symprove contains a good range of the bacteria (including L.Rhamnouose, E.faecium, L.acidophils and L.plantarum), noted as helpful in the research studies. Educating patients to take the right strain at the right dosage for the right length of time is, therefore, important.

## IBS

IBS is one of the most common intestinal disorders in the industrial world, affecting 10-15% of the population.[5] The research shows that IBS-C and IBS-D patients have different types of microbes that predominate and that alterations in gut microbiota may be a cause or a consequence of altered gut symptoms.

A systematic review of 37 studies on mainly IBS (but 10 antibiotic-associated) diarrhoea cases showed that specific probiotics help to reduce symptoms and pain in some IBS-D patients.[6] This worked out as five studies on a total of 1,313 patients with IBS, taking five different strains of probiotics. The review found a significantly beneficial effect against placebo, with three studies showing no effect.

The probiotics used in the studies predominantly contained lactobacilli and/or bifidobacteria, a few were Saccharaomyces. 18 studies of 15 probiotics looked at abdominal pain in 1,806 patients with IBS, with a high agreement of evidence, suggesting that there was a reduction in pain scores. Bowel habits (urgency, incomplete evacuation and frequency) were found to be moderately improved with probiotics. A moderate effect was seen on bloating and no effect on wind.

Looking specifically at 152 patients with IBS-D, there was very low evidence for any probiotic effect, with some patients even reporting a worsening of diarrhoea symptoms. There was also little evidence for any effect on IBS-C, so more research is needed in this area.[6,7] It may be that prebiotics are more helpful than probiotics for constipation dominant IBS, or that the right research is yet to be conducted in this area.

## WHAT WE EAT CAN ALTER OUR GUT MICROBIOME

Fermented foods are seeing a resurgence in Western countries. These are foods that are made through controlled microbial growth and the enzymatic conversion of food components in a natural process.[10] Although there are thousands of these foods around the world, industrialisation has decreased the range eaten frequently in Western diets. As the health benefits of these

foods become a media focus, they are likely to increase in popularity.

Fermentation changes the taste profile of a food and lowers the pH which prevents contamination by potential pathogens.[7] Fermentation can also remove toxins such as phytic acid from cereals and can make some foods more tolerable, such as reducing the FODMAPs in sourdough bread. Studies show benefits of fermented foods on weight maintenance, Type 2 diabetes, CVD, obesity and more.[6,8,9]

## EXAMPLES OF FERMENTED FOODS

### Milk based

One of the most common is Kefir. This contains yeast and a range of different bacteria which can differ depending on the environment it is made in and the culture used. Drinkable yoghurts are popular and have some research to back up their health claims, but it is worth checking the strain of bacteria added to these against the evidence.

### Water based

For those preferring a non-milk option, or who have a cows' milk protein allergy/lactose intolerance/vegan diet, there are probiotic waters made using kefir grains. Live Kombucha soda is a fizzy brew with <0.5% alcohol content, but with very little research to back up its use.

### Foods

Sauerkraut, kimchi, dry fermented sausage, live yoghurt, cheeses, kombucha and miso are other examples of fermented foods that are on the rise in popularity.

Some of these products, such as Kefir milk and water, are easy to make at home. Making and eating fermented foods could help to introduce new microbes into the body and be a cheaper alternative to buying a pharmaceutical formulation. However, it can be difficult to know what species of bacteria the food products contain and there is very little research currently to show how they affect the microbiome. The potential is there, but they are unlikely to make long lasting effects unless taken daily and more research is definitely needed before dietitians can use these foods as specific probiotic treatments. They could, however, be used as an addition to any products taken.

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