Probiotics and Prebiotics

Introduction

- **Probiotics** are defined as "live micro-organisms that confer a health benefit on the host when administered in adequate amounts." The major source of probiotics for humans is dairy-based foods containing intestinal species of *Lactobacillus* or *Bifidobacterium*. The most common type used is *Lactobacillus acidophilus* (also known as one of the “friendly bacteria”), a species of Gram-positive, rod-shaped bacteria often found in the intestinal tract of humans and animals, the human mouth and vagina. It is an anaerobic organism that produces lactic acid which reduces the pH. This may have an inhibitory effect on other organisms, especially candida. The yeast *Saccharomyces cerevisiae* and some *Escherichia coli* and *Bacillus* species are also used as probiotics.

- **Prebiotics** are defined scientifically as "selectively fermented ingredients that result in specific changes in the composition and/or activity of the gastrointestinal microbiota, thus conferring benefit(s) upon host health." They are non-digestible carbohydrates (mainly oligosaccharides and non-starch polysaccharides) which act by promoting the growth and/or activity of probiotic bacteria in the gut. The most common are fructo-oligosaccharides (FOS), inulin and galacto-oligosaccharides. They are found in various vegetables and fruit such as tomatoes, onions, garlic, leeks, asparagus and bananas. Prebiotics are relatively stable and, unlike probiotics, can be relied on to arrive relatively unchanged in the gut despite the presence of digestive enzymes.

- **Synbiotics** contain prebiotics and probiotics in the same preparation.

Possible uses of probiotics

Many commercially available products (eg, yoghurt) are classed as foodstuffs. This means that they escape the rigorous testing for efficacy which is applied to medicines. They have biologically plausible modes of potential action as displacers of pathogens, immunomodulators or local antimicrobial agent secretors. Initial scientific investigation indicates some evidence of usefulness of probiotics in some areas and a definite impetus to continue research into their effects. Doses and recommendations/guidelines for their routine use, however, have yet to be established, pending ongoing research findings. Most benefit has been demonstrated, naturally, for gastrointestinal disorders.

Gastrointestinal disorders

- **Acute infectious diarrhoea.** There is some evidence that probiotics shorten duration of acute diarrhoeal illness, and improve symptoms, but the latest review concluded studies varied and more research was needed.[2]
- **Prophylaxis of antibiotic-associated diarrhoea.** Studies vary, and ongoing research into the dose of probiotics continues, but there is evidence that probiotics may prevent some antibiotic-associated diarrhoea.[3, 4]
- **Prevention of traveller’s diarrhoea.**[5, 6]
- **Prevention of *Clostridium difficile* diarrhoea.** There is evidence that probiotics are safe and effective in preventing *C. difficile* diarrhoea.[7] Public Health England guidelines on *C. difficile* management, however, do not yet recommend their routine use.[8]
- **Induction or maintenance of remission in Crohn's disease.** Evidence suggests little benefit and further research is needed.[9, 10, 11]
- **Induction and maintenance of remission in ulcerative colitis.** There is possibility of benefit, but evidence is equivocal and further research is needed.[12, 13]
- **Pouchitis in patients who have undergone surgical resection.** Probiotic VSL#3® has been shown to prevent pouchitis, and maintain remission.[14, 15]
- **Irritable bowel syndrome (IBS).** There is some evidence that probiotics may improve symptoms of IBS, although ongoing studies are needed to identify which patients benefit, and optimal regimens.[1, 16] The National Institute for Health and Care Excellence (NICE) recommends that if patients wish to try probiotics they should take them at a dose recommended by the manufacturer for a minimum of four weeks.[17]
Eradication of *Helicobacter pylori*. A meta-analysis concluded that fermented milk-based probiotic preparations increased eradication rates in patients on standard eradication therapy by 5-15%. [18]

Necrotising enterocolitis. Probiotic therapy reduced both the incidence and severity of this condition in a study of very low birth weight infants. [18, 20]

**Other possible uses**

Many studies are ongoing into the possible benefits of probiotics in areas including:

- Infantile colic.
- Bacterial vaginosis.
- Vulvovaginal candidiasis.
- Prevention of preterm labour.
- Prevention of recurrent urinary tract infections.
- Prevention of infant eczema. However, the evidence suggests probiotics are not beneficial in the treatment of eczema. [21]
- Allergic rhinitis. [22]
- Fibromyalgia.
- Treatment of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis. [23]

There is some evidence that probiotics can affect immune response, and therefore could have potential benefit in any number of clinical scenarios. [24]

**Possible uses of prebiotics and synbiotics**[1]

There is much interest in the potential for use of prebiotics and synbiotics. Research is being undertaken to look at possible benefit for an enormous number of areas, including:

- Hepatic encephalopathy. Prebiotics such as lactulose are often used. Minimal hepatic encephalopathy has been shown to be reversed by a synbiotic preparation of probiotics and prebiotics. [25] However, evidence remains equivocal. [26]
- Immune response. There is some evidence that a prebiotic such as oligofructose in combination with probiotics may boost the immune response.
- Obesity.
- Reduction of risk of cardiovascular disease.
- The metabolic syndrome.
- Type 2 diabetes mellitus. [27]
- Reducing the risk of colon cancer. In the experimental setting, one study found the prebiotic inulin reduced the risk of colon cancer. [28]
- Prevention of eczema and food allergy in infants. [29]

**Cautions**

Evidence suggests probiotics are safe in the vast majority. However, there is a small risk of adverse effects, such as sepsis. It is therefore recommended that use of these agents be avoided in those who are immunocompromised, severely debilitated, critically ill or postoperative, as this population is most at risk. [30] There are differences between probiotic/prebiotic agents and regimens both within clinical trials and the way they are used, and these are not likely to be equivalent. Therefore, there is much work to be done before specific clinical guidelines and recommendations can be made.

Meanwhile probiotics and prebiotics exist in everyday food products on supermarket shelves, as well as in capsules, powders and sachets, from a bewildering array of sources. As doctors, we are not yet in a position to give specific evidence-based advice on exactly which product patients should take in which situation.
Future research

There is no doubt that prebiotics and probiotics are an interesting group that warrants further investigation. Guidelines were produced in 2010 to guide ongoing research.[31] Studies on one strain of micro-organism cannot be assumed to apply to others, and experimental studies have often not been extended to humans. Many brands of commercially produced probiotics and prebiotics exist, which are not standardised, and there is concern about the applicability of meta-analyses which extend to such heterogeneous groups of subjects, conditions and treatments. The reader should note that this is a fast developing area and new research is published regularly.

Further reading & references


1. Probiotics and Prebiotics - Global Guidelines; World Gastroenterology Organisation, October 2011
7. Updated guidance on the management and treatment of Clostridium difficile infection; Public Health England, May 2013
16. Irritable bowel syndrome in adults; NICE Clinical Guideline (February 2008)

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