



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP1: 30-32

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(Special Issue- 1)
2nd International Conference
**“Food Security, Nutrition and Sustainable Agriculture -
Emerging Technologies”**
(February 14-16, 2019)

Probiotics and prebiotics: Health and nutritional properties

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Abstract

Probiotic products have been used worldwide in the last decades by consumers and in clinical practice. These consist of microbial cells that provide a health advantage to their human host by improving its intestinal balance. The beneficial effects of probiotic foods on human health and nutrition are increasingly recognized by health professionals as they play an important role in immunological, digestive and respiratory functions. These have been used for the prevention and treatment of a wide range of diseases from acute gastroenteritis to intestinal neoplasia. Probiotics in the form of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* in fermented milk have been ingested by humans for thousands of years. These are ingested either as a food (in yoghurt or other fermented foods) or through a supplement or medical food. Prebiotics, on the other hand, are non-digestible carbohydrates delivered in food to the large intestine to provide fermentable substrates in order to promote the growth of specific bacteria. The most common are fructo-oligosaccharides (FOS), inulin and galacto-oligosaccharides. This paper presents about probiotics and prebiotics and their impact on human health and diseases.

Keywords: Probiotics, Health and nutritional, clinical practice

Introduction

Probiotics (i.e., living microbial food supplements) and prebiotics (i.e., non-digestible carbohydrates which stimulate the growth of intestinal probiotic bacteria) considered as functional foods, have received much attention and they target the gastrointestinal microbiota.

Probiotics

A probiotic is “a live microbial feed supplement which beneficially affects the host by improving its intestinal microbiota balance”. This was the first generally accepted definition given by Fuller in 1992. Probiotics can also be defined as live microorganisms that, when administered in adequate amounts, confer a health benefit on the host. These are nonpathogenic organisms in foods that can exert a positive influence on the host’s health and modulate the GI tract. Fermented milk products such as yoghurt are the most familiar probiotic. The most common probiotics currently used, belong to the genera *Bifidobacterium* and *Lactobacillus*. *Lactobacillus* are the most common probiotic found in yoghurt and other fermented foods. These can help with diarrhea and may help with people suffering from lactose intolerance. *Bifidobacterium* is also found in some dairy products. Naturally present in the large intestine, *bifidobacteria* fight harmful bacteria in the intestines, prevent constipation and give the immune system a boost. Evidence indicates that bifidobacteria help reduce intestinal concentrations of certain carcinogenic enzymes. Kefir, a milk drink that has been fermented using kefir grains, is an especially potent source of probiotics. According to *Jeannette Hyde*, a nutritional therapist, and high-profile advocate for kefir, “it contains lactobacilli and bifidobacteria in high doses.” More than 50 different types of bacteria can be found in kefir. For use in foods, probiotic micro-organisms should not only be capable of surviving passage through the digestive tract but should also have the capability to proliferate in the gut.

Characteristic features of probiotics

Indu *et al.*, 2001; Harish *et al.*, 2006 reported following characteristics of probiotics

1. It should have a beneficial effect on the host,
2. It should be non pathogenic in nature,
3. It should be non toxic,
4. It shouldn't have any adverse effects on humans and animals,
5. It should be able to survive in the gastro intestinal tract environment,
6. It should retain the stability during the intended shelf life of the product,
7. It should contain adequate number of viable cells to confer the health benefit,
8. It should be compatible with product storage containers to retain the

Importance of probiotics

1. Managing lactose intolerance: Lactose is the main sugar found in milk which is composed of two molecules: glucose and galactose. To split lactose into glucose and galactose, an enzyme Lactase is produced by infants, children, and some adults. However, some humans don't have the ability to produce this enzyme. If these people consume *dairy products with lactose*, they can develop gastrointestinal symptoms such as abdominal bloating, pain, flatulence, and diarrhea. Some bacteria such as *Streptococcus thermophilus* and *Lactobacillus delbrueckii* subsp. *Bulgaricus* can also produce lactase, and are used as starter cultures in yoghurt. So if people consume dairy products such as yoghurt can improve their lactose digestion and symptoms. A number of studies have demonstrated better lactose digestion, as well as a decrease in gastrointestinal symptoms, in people with this condition who consume yogurt with live cultures.

2. Diarrhea control: Diarrhea is a common side effect of taking antibiotics. It occurs because antibiotics can negatively affect the balance of bacteria in the gut. Researchers found that taking probiotics reduced antibiotic-associated diarrhea by 42%. The best effect of probiotic is shortened duration of rotavirus diarrhea using *Lactobacillus* GG. Other strains can also be used such as *Lactobacillus acidophilus*, *Bifidobacterium lactis* and *Lactobacillus reuteri* on shortening the diarrhea.

3. Prevention of cancer: Probiotics having anti tumor action work through following mechanisms:

- a) Carcinogen/procarcinogen are suppressed by binding, blocking or removal
- b) Probiotics suppress the growth of bacteria with enzyme activities that convert the procarcinogens into carcinogens
- c) They alter colonic transit time to remove fecal mutagens more efficiently
- d) They change the intestinal pH thus alter microflora activity and bile solubility
- e) And stimulate the immune system.

4. Cholesterol reduction: Bile salt hydrolysis enzymes deconjugate the bile salts resulting in increased cholesterol breakdown.

5. Hypertension: Dietary recommendations accompany more aggressive strategies to control hypertension, and some preliminary evidence suggests that food products derived

from probiotic bacteria could possibly contribute to blood pressure control.

6. Food allergy. Food allergy is caused by the antigens present in food and is associated with inflammation of intestine. Probiotic are helpful in reducing the symptoms of food allergy as they enhance gut defence by two mechanisms (nonimmunologic and immunologic). First is carried out by normalizing the gut microflora and decreasing membrane permeability. Second mechanism involves the enhancement of immunological defense system of host by boosting the IgA action. This leads to enhanced degradation of food antigens and food allergy is reduced.

Prebiotics

A prebiotic is a substrate that is selectively utilized by host microorganisms conferring a health benefit. These are indigestible food ingredients that beneficially affect the host by selectively stimulating the growth and activity of one or a number of health-promoting probiotic bacteria and thus improve host health. These are selectively utilised in the gut to increase healthy bacteria and aid digestion and enhance the production of valuable vitamins. These are also resistant to the body's enzymes and gastric acids, which means that they are not destroyed, digested, or absorbed as they travel through digestive system. Galactooligosaccharides (GOS) are the most advanced form of prebiotics. They belong to a group of particular nutrient fibres that feed and encourage the growth of good bacteria in the gut. Prebiotics alter the colonic microbiota in favour of a healthier composition. These goes through the small intestine undigested and is fermented when it reaches the large colon.

Important benefits of prebiotics

- Boosting overall digestive health
- Improving the barrier function of the gut
- Strengthening the immune system
- Reducing the inflammation and symptoms associated with Irritable Bowel Syndrome (IBS)
- Minimising the risk of developing diarrhoea
- Enhancing body's nutrition by allowing better mineral and nutrient uptake
- Contributing positively to mental health
- Increasing absorption of calcium to improve bone density
- Lowering some risk factors for cardiovascular disease

Prebiotics are naturally found in some plants, such as onions, garlic, bananas, chicory root and Jerusalem artichokes, but typically are present at low levels. About 65% of the chicory root is fiber by weight and is an extraordinarily rich source of prebiotic fiber.

Commonly known prebiotics are

1. Oligofructose
2. Inulin
3. Galacto-oligosaccharides
4. Lactulose
5. Breast milk oligosaccharides

Lactulose is a synthetic disaccharide used as a drug for the treatment of constipation and hepatic encephalopathy. The prebiotic oligofructose is found naturally in many foods, such as wheat, onions, bananas, honey, garlic, and leeks. Oligofructose can also be isolated from chicory root or synthesized enzymatically from sucrose.

Importance of prebiotics

1. Heart Health

Prebiotics have been shown to moderate cholesterol and triglyceride levels- both indicators of heart disease. Specifically, one study shows that inulin can reduce atherosclerosis, or hardening of the arteries by 30%. As heart disease becomes more widespread among men and women, new approaches to treatment and prevention that do not involve medications are proving to be effective and have the added benefit of being side effect free, unless you count improved health as a side effect.

2. Immunity

In preliminary research, prebiotics boost white blood cells and killer T cells, and may even improve your body's response to vaccinations.

3. Chronic Illness and Digestion

Because prebiotics act in your intestines, they have a profound effect on the pathogens and bad bacteria in your body that can cause disease. Prebiotics are being used to treat Irritable Bowel Syndrome and Crohn's Disease, and may also prove useful for treating cancer, osteoporosis and diabetes.

Synbiotics

In practice, combined mixtures of probiotics and prebiotics known as synbiotics are often used because their synergistic effects are conferred onto food products. Synbiotic food is defined as "a mixture of probiotics and prebiotics that beneficially affects the host by, i) improving the survival and implantation of live microbial dietary supplements in the gastro-intestinal tract, and ii) selectively stimulating the growth and activity of one or a limited number of health-promoting bacteria, and thus improving host health and welfare."

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