

# Probiotics and non pathogenic microorganisms



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## Introduction

Probiotics are non-pathogenic microorganisms which when ingested exert a positive influence on host health or physiology [1]. The probiotic microorganisms are strains of Lactobacillus, Bifidobacterium, Streptococcus and Saccharomyces. They are mostly which are used in fermentation of dairy products and found in food, food supplements or in drugs. Microorganisms should be alive, in huge numbers more than a billion per daily ingested dose. [2]. Consuming probiotics is reported to have the benefits of enhanced immune response, balancing colonic microbiota, treating traveller's and antibiotic associated diarrhea, prevention of ulcers and many more.[3]. Probiotic products such as yoghurt and fermented milk have grabbed the attention as carriers of live probiotic cultures, whereas other dairy products likes cheese, frozen yoghurt and ice cream are on list of potential carriers. [5]. Criteria for ideal probiotic strain include: [2]

- Resistance to acid and bile
- Attachment to human epithelial cells
- Colonize the human intestine
- Produce an antimicrobial substance
- Good growth characteristics
- Beneficial effects of human health

These criteria helped in discovery of *L. rhamnosus* in 1985 and are adopted in the search for new probiotic strains.

Image 1: Probiotic drink

## **Mechanism of probiotics in the body**

Since probiotics differ highly in their clinical efficacy also differs showing infectious, inflammatory and allergic responses. Microbe-microbe and microbe-host interactions are then probiotic actions depending on the species. For host and microbe it becomes mutual competitive interaction. Microbe competes for essential nutrients and produces bacteriocins which prevent the overgrowth of pathogens. They also promote host defence by interacting with mucosal immune membrane and intestinal barrier. [1].

Probiotic bacteria attach to enterocytes. They inhibit the binding of enteric pathogens to intestinal mucosa by producing inhibitors like bacteriocins, lactic acid and toxic oxygen metabolites. They attach to cell surface receptors of enterocytes initiating cell signaling resulting in synthesis of cytokines. [3]

Host's innate immune response can differentiate signals from pathogens and commensals with the help of pattern recognition receptors or Toll-like receptors (TLR). Immune cells utilize number of TLRs to differentiate different features of the microbe at the same time. [1]

TLR2 can recognize lipoprotein and peptidoglycan and trigger host response to Gram- positive bacteria and yeast.

TLR4 mediates responses from lipopolysaccharide from gram- negative bacteria.

TLR1 and TLR6 activate macrophages by gram-positive bacteria

TLR5 and TLR9 recognise flagellin and bacterial DNA respectively.

## **Probiotics in Therapeutics**

### **Gastrointestinal**

Consumption of foods containing Lactobacillus GG (LGG) reduces the course of rotavirus infection, traveller's diarrhea and antibiotic-associated diarrhea. Intestinal permeability defects caused by cow's milk and rotavirus infection can be reduced by LGG fermented milk. [3].

LGG increases the number of IgA and other Ig secreting cells in intestinal mucosa thereby increasing intestinal immunity.

It stimulates local release of interferons.

It helps antigen transport to lymphoid cells.

It acts as an immunoadjuvant for oral vaccines.

### **Allergy and Resistance**

Consumption of probiotics may modulate gut microbial composition leading to better gut health. This helps people who are intolerant to lactose, improving lactose tolerance. This also improves the resistance to pathogenic bacteria. [5]

### **Cancer**

Lactic acid bacteria consumption reduces the incidence on the DNA damage as well as other changes related to carcinogenic process. They can decrease the activity of fecal enzymes which convert procarcinogens into carcinogens. [5]

## **Hypercholesterolemia**

Probiotic bacteria have been a proposed mechanism for reducing blood cholesterol concentrations in hypercholesteromia patients which is a risk factor for cardiovascular disease. Probiotic cultures have a preferential reduction in LDL component of cholesterol. [5]

## **Raw materials for cultivation of probiotics.**

Semidefined medium is used based on yeast nitrogen base without amino acids. Bactocasitone peptone is added at 1. 5% concentration. This formulation was developed by Kimmel and Roberts.

Components used are:

De Man, Rogosa, Sharpe Medium (MRS) medium,

Bacteriological agar,

Atmosphere generation system for solid-state incubation on petri plates (from Oxoid, England),

Others chemicals for semi- defined medium and buffers (from Sigma- Aldrich, Italy)

A kit containing acetic acid, lactic acid, succininc acid, oxalic acid, maleic acid (from Supelco, Italy)

A enzymatic kit to determine L(+) lactic acid (from Sigma- Aldrich, Italy)

## **Cultivation of probiotics**

Cultivation of *L. debrueckii* leads to production of lactic acid also, apart from biomass increase. Accumulation of lactic acid decreases cell specific growth rate and final yield. A suitable medium is very important for fermentation.

Semidefined medium is used based on yeast nitrogen base without amino acids, since the bacteria have limited self- synthesis capabilities of vitamins and amino acids. Microaerophilic or anaerobic conditions are used.

Microaerophilic environment leads to substantial growth as well as production of optically pure L(+) lactic acid. Fed batch cultivation keeps lactic acid concentration lower than 35 g/l which is toxic avoiding inhibition.

[4]

## **Market for probiotics**

Global market for functional foods is predicted to grow rapidly. Japan constituted half of this market in 1997. United States experienced high growth of rate in this market. Probiotic market (especially yoghurt and fermented milk) has experienced rapid growth in Europe. In 1997 these products constituted 65% of European functional foods market, valued at US\$ 889 million. [5]. Probiotics are marketed under a broad category called functional food which is defined as food products fortified with special constituents that possess advantageous physiological effects. Functional foods may improve the general conditions of the body (e. g. pre- and probiotics). Global market value of functional foods in 2004 was estimated as US\$ 61 billion with United States holding the largest market, followed with Europe and Japan. Three of them contribute 90% of the global sales. [7]

## **Conclusion**

Probiotics have beneficial health effects in overall aspect. However, there is a proper need for accurately designed, randomized, placebo- controlled studies in humans. This is in order to provide scientific proof for probiotic benefits. Since microorganisms are going into human body, all studies should be undertaken. Some health benefits may be strain dependent, requiring strain selection. [5]. A major problem arising with probiotics is the misuse coming with it. This happens when products are poorly manufactured or referred to probiotics without proper documentation. This results in ineffective products or products having no probiotics at all. [6]. Therefore, there should be a thorough check on probiotic products reaching the customers.