

## ROLE OF PROBIOTICS FOR BETTER HEALTH -A REVIEW

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### ABSTRACT

Probiotics are live microbial food supplements or components of bacteria, which have been shown to have beneficial effects on human health. Traditional dietary sources of prebiotics include soybeans, insulin sources (such as Jerusalem artichoke, jicama and chicory root), raw oats, unrefined wheat, unrefined barley and yacon. Some of the oligosaccharides that naturally occur in breast milk are believed to play an important role in the development of a healthy immune system in infants, but these are not considered prebiotics, as they do not act through the intestinal microflora. "Probiotics can improve intestinal function and maintain the integrity of the lining of the intestines. These friendly organisms may also help fight bacteria that cause diarrhoea, may help prevent colon cancer and enhancing the host's immune response. Various food matrices available in market have been used with probiotics, which are briefly documented. In this review, the history of probiotics, their application in the health and food products are discusses.

**Key words:** probiotics, intestinal microflora, *Bifidobacterium*, *Lactobacillus*, Health benefits.

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## INTRODUCTION

The term prebiotics was introduced by Gibson and Roberfroid in 1995 to describe food supplements that are nondigestible by the host but are able to exert beneficial effects by selective stimulation of growth or activity of microorganisms that are present in the intestine (Maria Kechagia, 2013). A prebiotic is a no digestible component which beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of colonic bacteria, thereby improving the health of the host. Probiotics are mainly available in the form of dairy products or as supplements. As far as nutrition is concerned only the strains classified as lactic acid bacteria are of significance and among them the ones with the most important properties in an applied context are those belonging to the genera *Lactococcus* and *Bifidobacterium*. Lactic acid bacteria are Gram-positive, catalase-negative bacterial species able to produce lactic acid as main and crude protein is called bacteriocin (Oscariz, *et al.*, 2001, Puttalingamma, *et al.*, 2007, Allen *et al.*, 2014). Lactic acid bacteria contain biologically active components that improve health, such as probiotics. Prebiotic substances are not hydrolysed nor absorbed in the gastrointestinal tract, but they are living in the system. (Hirayam, *et al.*, 1999, Puttalingamma, 2010). Probiotics may also be used to help with other causes of diarrhea, in colon cancer, skin infections, prevent infections in the digestive tract and control immune response (inflammation), as in inflammatory bowel disease (IBD) (Nanji *et al.*, 1994, Ishibashi, *et al.*, 2001, Solga *et al.*, 2003, Harish, *et al.*, 2006. Gayathri, *et al.*, 2011) has reported that *Lactobacillus* *sp.* as probiotics for human health with special emphasis on colorectal cancer.

## MATERIALS AND METHODS

### Probiotic Strains:-

A total of 169 *Lactobacillus* strains from 12 species (*L. acidophilus*, *L. brevis*, *L. buchneri*, *L. casei*, *L. delbrueckii* subsp. *bulgaricus*, *L. delbrueckii* subsp. *delbrueckii*, *L. delbrueckii* subsp. *lactis*, *L. fermentum*, *L. helveticus*, *L. paracasei* subsp. *paracasei*, *L. plantarum* and *L. rhamnosus*) isolated from raw milk and various milk products. (Puttalingamma, 2008)

**Table 1:** Important probiotic strains identified worldwide

Strains	Source
<i>Lactobacillus acidophilus</i> NCFM @	Rhodia, Inc [Madison, Wis]
<i>L. acidophilus</i> DDS-S	Nebraska Cultures, Inc [Lincoln, Neb]
<i>L. acidophilus</i> SBT-2062 @	Snow Brand Milk Products Co. Ltd [Tokyo, Japan]
<i>L. acidophilus</i> LA-1 (Same as strain strains LA-5 sold in Europe)	Chr. Hansen, Ind. [Milwaukee, Wis]
<i>Lactobacillus casei</i> Shriota	Yakult [Tokyo, Japan]
<i>L. casei</i> Immunitas	Dannoe [Paris, France]
<i>Lactobacillus plantrun</i> 299.V	Probi. AB [Lund, Sweden]
<i>Lactobacillus lactis</i> LIA	Essum AB [Umea, Sweden]
<i>Lactobacillus Salivarius</i> UCC 118	University College [Cork, Ireland]
<i>Bifidobacterium longum</i> BB-536@	Morinaga Milk Industry Co. Ltd [Zama-City, Japan]
<i>Bifidobacterium brevis</i> strain Yakult	Yakult [Tokyo, Japan]
<i>Bifidobacterium lactis</i> Bb-12	Chr. Hansen, Inc. [Milwaukee, Wis]
<i>Bifidobacterium. longum</i> SBT-292B2	Snow Brand Milk Products Co, Ltd [Tokyo, Japan]

Yeung, *et al.*, (1999)

### Some fermented products containing similar lactic acid bacteria include:

- 1) Pickled vegetables,
- 2) Fermented bean paste such as tempeh,
- 3) Miso and doenjang
- 4) Kefir
- 5) Buttermilk or Karnemelk
- 6) Kimchi
- 7) Pao cai
- 8) Sauerkraut
- 9) Soy sauce
- 10) Zha ca.

*Lactobacillus* strains produce variety of secondary metabolites are called bacteriocins; they are crude proteins, and other compounds like Lactic acid, Acetic acid and Enzymes -Lactoperoxidase with H<sub>2</sub>O<sub>2</sub>,

### Characteristics of Effective Probiotics

- 1) Able to survive the passage through the digestive system
- 2) Able to attach to the intestinal epithelia and colonise
- 3) Able to maintain good viability
- 4) Able to utilise the nutrients and substrates in a normal diet
- 5) Non pathogenic and non toxic
- 6) Capable of exerting a beneficial effect on the host
- 7) Stability of desired characteristics during processing, storage and transportation
- 8) Anti-inflammatory, antimutagenic, immunostimulatory (Reid, 2002, Brady, *et al.*, 2012).

**Table 2:** Metabolic products elaborated by LAB and their antimicrobial properties

Products	Target organisms
Organic acids Lactic acid, Acetic acid	Putrefactive effect on Gram- positive and negative bacteria, clostridia, fungi and yeast.
Hydrogen peroxide	Pathogens and spoilage organisms in milk, meat and their products.
Enzymes Lactoperoxidase with H <sub>2</sub> O <sub>2</sub>	Pathogens and spoilage bacteria-Milk and dairy products.
Lysozyme	Spoilage microorganisms, mainly Gram-positive bacteria.
Low molecular metabolites – Diacetylcysteine Reuterin [3- <i>o</i> H -propionaldehyde]	Gram positive and negative bacteria, yeast and moulds, protozoa and pathogens.
Bacteriocin- Nisin	Food and water borne pathogens, Gram-positive bacteria and spore formers. Antagonistic effect on LAB.
Others	Gram positive bacteria, antimicrobial spectrum according to producer strains and bacteriocin type.

(Charumati Mishra, *et al.*, 1996)

### Bacteriocins: -

Bacteriocins are ribosomally synthesized heterogeneous group of anti-bacterial proteins that vary in spectrum of activity, mode of action, molecular weight and biochemical properties (Oscariz, *et al.*, 2001). Bacteriocins often contain unusual amino acids that are made by modifying the amino acids through genetic code. Nisin belongs to one such class of bacteriocin called lantibiotics. Bacteriocins, are heat stable compounds (Cleveland *et al.*, 2001). Table 1 provided the list of bacterial genera that produce bacteriocin.

Many people use probiotics to prevent diarrhoea, caused by antibiotics. Antibiotics kill "good" (beneficial) bacteria along with the bacteria that cause illness. A decrease in beneficial bacteria may lead to digestive problems. Taking probiotics may help replace the lost beneficial bacteria. This can help prevent diarrhea. A decrease in beneficial bacteria may also lead to other infections, such as vaginal yeast and urinary tract infections, and symptoms such as diarrhea from intestinal illnesses. Many

probiotic products commercially available, among them very few are listed below, they are widely available. However, tablets, capsules, powders and sachets containing the bacteria in freeze dried form are also available.

**Table 3:** Clinical Applications of LAB

<b>Applications in Humans</b>
In non-infectious disbacteriosis of GIT As antibiotic therapy, In radiation therapy
<b>Health Promotion</b>
Inhibition of carcinogenesis. Anticholestrolemic effects. Increased calcium desorption. Decrease of lactose intolerance. Destruction of anti-nutritional factors. Synthesis of vitamins. Pre-digestion of proteins.

(Puttalingamma, Ph.D,thesis, 2007)

**Industrial Use:-** Live probiotic cultures are available in fermented dairy products and probiotic fortified foods.

**Table 4 :** Use of lactic acid in food Industry

<b>Form of lactic acid</b>	<b>Food use</b>
L(+) Lactic acid	Antimicrobial agent, curing and Pickling, flavouring
Calcium lactate	Flavouring enhancer, flavouring agent, Leavening agent, stebelizer, and thickener.
Ferrous lactate	Nutrient supplement and in infant formula as source of Iron.
Potassium lactate	Flavouring enhancer, flavouring agent.
Sodium lactate	PH control, Flavouring enhancer, emulsifier
Lactylated ester of fatty acids	Emulsifier, Plasticizers, surface active agent in food.
Lactylated fatty acid ester of glycerol and propyl glycol	Emulsifier, Plasticizers, surface active agent in food
Sodium steroyl-2 Lactate	Dough conditioner in bakery products wipping agent, Conditioning agent in dehydrated potatoes. Stabilizer processing acids in milk or cream substitutes.

Code of Federal Regulations 1994.

**Table 5:** Best Commercial Probiotics available

<b>Probiotic</b>	<b>Manufacturer</b>	<b>Which strains?</b>	<b>Shelf stable</b>
Accuflora	Northwest Natural Products	<i>L acidophilus, L rhamnosus, B bifidum, L salivarius, S thermophilus</i>	No
Acidophilus XTRA	Sundown Naturals	<i>L acidophilus, B lactis, L bulgaricus, S thermophilus</i>	Yes
Adult Probiotic	CVS Pharmacy	<i>B breve, B longum, L acidophilus, L casei, L rhamnosus, L plantarum, L lactis, S thermophilus</i>	No
Advanced Acidophilus Plus	Solgar	<i>L acidophilus, B lactis</i>	No
Align Probiotic	Align	<i>Bifidobacterium infantis</i>	Yes
Colon Health	Phillips	<i>L gasseri, B bifidum, B longum</i>	No
Daily Probiotic	Ganaden Sustenex	<i>Bacillus coagulans</i>	No
Digestive Health	Culturelle	<i>Lactobacillus GG</i>	No
Enzyme Probiotic Complex	American Health	<i>L acidophilus, B bifidum, L bulgaricus, L brevis, B lactis</i>	No

(<http://www.thecandidadiet.com/list-of-probiotics/>)

## ADVANTAGES OF THE PROBIOTICS

1. Produce lactic acid- lowers the pH of intestines and inhibiting bacterial villains such as *Clostridium*, *Salmonella*, *Shigella*, *E. coli*, etc.
2. Decreases the production of a variety of toxic or carcinogenic metabolites.
3. Aid absorption of minerals, especially calcium, due to increased intestinal acidity.
4. Production of  $\beta$ - D- galactosidase enzymes that break down lactose.
5. Produce a wide range of antimicrobial substances -acidophilin and bacteriocin etc.
6. Help to control pathogenic bacteria.
7. Produce vitamins (especially Vitamin B and vitamin K).
8. Act as barriers to prevent harmful bacteria from colonizing the intestines.
9. Several mechanisms have been proposed as to how lactic acid bacteria may inhibit colon cancer.( Rafter, 2003).
10. Enhancing the host's immune response.
11. Altering the metabolic activity of the intestinal microflora.
12. Binding and degrading carcinogens.
13. Producing antimutagenic compounds.
14. Aaltering the physiochemical conditions in the colon.

## CONCLUSION

We must encourage novel functional foods consumption with multiple health benefits apart from basic nutrition. The link between food and health is growing stronger day by day. Healing an illness through particular food consumption to restore natural defence with fewer side effects than medicine is always appealing to all age groups (Reid, 2002). More than 2000 probiotic products were launched in the year 2008 (Jankovic, *et al.*, 2010), Probiotics may also be useful for patients with high blood pressure, coronary diseases, intestinal inflammatory diseases like irritated bowel syndrome, constipation, disordered growth of intestinal bacteria, bladder and cervical cancer, upper respiratory tract and urinary tract infections. Recent studies have shown that probiotics could have therapeutic effects on stress, anxiety and mood behaviour (Sartor, 2004, Jankovic, *et al.*, 2010). Probiotics in a food carrier must reach the gut effectively while they must withstand harsh acidic and bile environments and enzymes. Probiotic foods must be consumed regularly as the adverse conditions in the stomach may continuously deplete the number of live cells (Kearney, *et al.*, 2009). "Probiotics can improve intestinal function and maintain the integrity of the lining of the intestines," These friendly organisms may also help fight bacteria that cause diarrhoea. Probiotics have a long history of use but not as drugs numerous probiotics and reasons for use are very clear.

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