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Review Article

# The role of probiotics in human health and prevention of disease: A review

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ABSTRACT

In recent year's lots of research has undergone on human intestinal microbiota, and we are beginning to extend our knowledge regarding role of bacteria, fungi, viruses and helminthes which are present in our gut and their role in human health and preventing diseases. Millions of live Microorganisms that present in gastrointestinal tract are called as probiotics that influence physiology, nutrition, metabolism and immunity of human beings. They are used in clinical settings to prevent certain diseases such as diarrhea, colon, cancer, hypertension, diabetes Helicobacter pylori infection. In this review article attempt has been made to review some significant recent studies to explain what are probiotics, their history, how they work inside human body as separate 'organ', mechanism of action, their beneficial aspects for health and future advancements in use of probiotics.



## 1. Introduction

The word probiotic derived from the Latin word 'pro' that means 'for' and the Greek word 'bios' means 'body' term proposed by Lilly and Still. According to The World Health Organization Probiotics are defined as live Microorganisms like bacteria and yeast and when they are administrated in a viable form and in proper amount than they are beneficial to human health.[1–3] In human body millions of bacteria are present as normal flora and naturally found in and on various parts of our skin and mucous membranes which are known as 'Commensals'. In new recent studies revealed that these 'Commensals" shows positive and beneficial effects on human body. Probiotics are the community of microbes and considered as a metabolic organ due to their beneficial impact on human including our metabolism and immune function. Probiotics are considered as functional foods which mean traditional food with physiological benefits.[3,4]

Previous studies shows that our gut microbiota has also evolved as human has undergone evolution and influence our physiology thus disruption of the gut microbiota can results in several infections and disorders in human body such as irritable bowel syndrome, inflammatory bowel disease, antibiotic induced diarrhoea, malnutrition, obesity and diabetes occurs due to deficiency of microflora and probiotics are helpful for overcome these disorders and infections.[3,4] Probiotics control some type of cancers and reduce blood cholesterol.Some strains from the genus *Bacteroides, Clostridium, Faecalis* bacterium as well as genetically modified bacteria are associated with gut health.[5] The use of probiotics has been recommended to improve immunity and general health of a person. Gut microbiota can be categorized into three categories which are symbiotic bacteria, opportunistic bacteria and pathogenic bacteria.[6]Probiotics bacteria exert an immune deficiency effect because they contain the ability to interact with epithelial and dendritic cells, with monocytes and macrophages.[7]

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## 2. History

The history of probiotics is as old as the human history, as it is closely related to the use of fermented food. In the ancient Indian Ayurvedic texts consumption of milk and dairy products is associated with a long and healthy life.[7] In 1899, Y shaped bacteria are detected in the intestine of breast fed infants by Henry Tissler and he called these organisms '*Bifidobacteria*'. He observed that babies with *Bifidobacteria* having less chances of diarrhoea. In the beginning of $20^{th}$century Elie Metchnikoff, first time reported that several bacteria Play a positive role in human health and noted that fermented milk products had anti-aging property which is beneficial for human health. He later on named the organisms *'Lactobacillus bulgaricus'*. Metchnikoff is called as the father of "probiotics'. After this during outbreak of *Shigella* diarrhoea Alfred Nissle found that soldier who carried *Shigella* did not suffered with the diarrhoea then he isolated a new strain of *Escherichia coli* in his feces and used this strain to treat diarrhoea in other patients. The term 'probiotics' was first used by Werner Kollath in 1953.[8]

### *2.1. Microorganisms considered as probiotics*

Human microbiota consists of bacteria, yeasts, fungi and viruses. Several recent studies revealed that this microbiome can changes very fast in the human gut and different diets create different gut flora. Plant based diet supports health giving probiotics.[9]the beneficial mirobiota called as hidden organ due to its important beneficial role in our body functions. Different types of probiotics have different functions and their health benefit observed mainly in specific probiotic strain.[8,9]

In case of bacteria most cases probiotics activity is strain specific. Zheng et al., studied that Lactic acid group bacteria such as *Lactobacillus, Streptococcus, Enterococcus, Lactococcus* and *Leuconostoc* are facultative anaerobic, non-spore forming and non-motile, they acquire their energy by sugar fermentation.[10] *Lactobacillus* genus was reclassified into 25 genera including two host adapted organisms such as *L. delbrueckii* and *Paralactobacillus* and rest 23 of them were as *Holzapfelia, Amylolactobacillus, Schleiferilactobacillus, Loigolactobacilus, Lacticaseibacillus, Latilactobacillus, Dellaglioa, Bombilactobacillus.* The most prevalent bacteria in the human gut are Actinobacteria comprise *Bifidobacterium, Firmicutes, Bacteroides.* Due to beneficial effects, some strains of *Bifidobacterium* are used as bioactive ingredients in nutritional foods, dairy products, food supplements and pharmaceutical products.[10]In fungi the genus Saccharomyces includes various yeasts such as *Saccharomyces cerevisiae, Saccharomyces bayanus* and *Saccharomyces boulardii* used in medicine as a probiotic. In case of viruses various plant derived viruses found in our gut and this gut virome can change the resident bacterial flora.[8,9]

### *2.2. Mode of action of probiotics*

Mode of action of probiotics defined as improving the host's microbial balance. Probiotics can taken orally and protects epithelial membrane from harmful microorganisms and their mechanism starts in body with production of antimicrobial products which targets infection site and then limit the adhesion sites for harmful microbes, compete for nutrients, destroy toxin receptors and modulate immunity.[10] These probiotics are helpful in several ways such as it produces inhibitory agent which prevents attachment of harmful pathogenic bacteria to the intestinal epithelium, it supress the growth of Pathogenic bacteria by direct binding to gram-negative bacteria. It Maintain normal level of short-chain fatty acid levels (SCFAs), this SCFAs provide energy to colonocyte, it act as signal molecules and regulate the balance between fatty acid synthesis, fatty acid oxidation and lipolysis in the liver and increase leptin expression for regulating appetite. These probiotic microbes repair intestinal permeability by colonocyte multiplication and increase electrolyte absorption in the intestine. It also enhances the immunological response in the intestine and regulate lipid metabolism.[11,12]

## 3. Therapeutic Application of Probiotics

1. *Helicobacter pylori infection:* Probiotics are useful for human health and can be used as supplement to remove bacteria found in luminal surface of stomach epithelium named *Helicobacter pylori.* It was observed that when *Lactobacillus* containing probiotics given to the patient suffering from peptic ulcer along with antibiotic therapy then it increases the rate of eradication of *H. pylori* and improve immune regulation functions.[13]
2. *Anti-Cancer:* Probiotics are also used as supplement for cancer prevention and treatment because they modulate intestinal micobiota and immune response. It was also tested in some studies that this probiotic act as carcinogenic agent.[14]
3. *Anti-Hypertension:* Hypertension has emerged one of the leading risk factor for cardiovascular and renal illness in the world. It was found that *Lactobacillus* and *Bifidobacterium* are added into soymilk which is supplemented with fructo-oligosacharides act as anti-hypersensitive so fermented soymilk can reduce the risk of hypertension.[15] Some studies also demonstrated that strains of *Lactobacilli* have ability to lower the serum cholesterol level. Probiotic yoghurt was seen to improve total cholesterol and LDL-C concentrations in diabetic patients and reduces the risk factors of cardiovascular diseseas.[16]

4. *Mineral Absorption:* Some studies revealed that the combination of probiotics and prebiotics known as synbiotics have positively affected mineral absorption, metabolism and composition of bones. Increasing solubility of minerals with short chain fatty acid releases phytoestrogens from foods and this phytoestrogen can modulate bone formation and architecture.[17]
5. *Atopic Dermatitis:* Weston studied that Proboitic *L. fermentum* is beneficial for treatment of Atopic Dermatitis in atopic children it reduces the severity of allergic dermatitis.[18]
6. *Rheumatoid arthritis:* In patients with Rheumatoid arthritis *Lactobacilli casie* supplementation reduced the rate of disease and inflammation by decreasing proinflammatory cytokines IL-6.[19]
7. *Clinical illness:* During the period of illness there is loss of beneficial flora in the gut therefore overgrowth of pathogenic bacteria occurs in gut and increase the chances of nosocomial infections. Probiotics are useful and effective in reducing infection by improving cellular wellbeing and accelerate the implementation of cells natural defence mechanism. Probiotics are helpful in acute and chronic infections and prevent postoperative infections in patients undergoing abdominal surgery, cancer surgery and liver transplantation. It also reduces ventilator associated pneumonias in critical illness.[20]
8. *Prevents Radiotherapy side-effects:* Ciorba et al., demonstrated that patients having cancer undergoing radiotherapy take probiotics before the therapy have less chances of suffering from radiation induced diarrhoea. They showed that patient had received a probiotics *Lactobcillus rhamnosus* before exposure get protected from radioactive damage of intestine.[21]
9. *Migraine treatment:* Probiotics may help to reduce migraine headaches by improving the function of the intestinal barrier. Serotonin appears to be a key link in the brain-gut axis, Several researches revealed that modifying the function of the intestine with the right probiotics could be a strategy to help migraine sufferers.[22]

### *3.1. Probiotics for Covid -19*

Probiotics may stimulate the immune response in gut which helps in neutralizing COVID virus. *L. rhamnous* could help in reduce risk of COVID-19 through improving gut barrier functions including antiviral defence and decrease the pro inflammatory cytokines.[23,24]

## 4. Conclusion

In this study many aspects of probiotics are reviewed from mechanism, mode of action, their clinical and therapeutic applications. Probiotics are important player in intestinal and oral health. The probiotics and their association with long life human is the basis of present research which are exploring the health promoting properties and defence action of gut microbes in several prevalent infections. Probiotics having anti-inflammatory properties because it interferes with cytokines, chemokines and other inflammation stimulating factors affect immune system and immunological functions. These gut microbes are directly associated with nutritional status of a person and help in the digestion and absorption of nutrients therefore it regulates cholesterol level and pancreatic functions. Probiotics also act by affecting the gut barrier and paly important defensive role in human health. The main aim of this review is to determine the role of probiotics in human health and prevention from severe diseases. Considering all these health benefits of probiotics now it has been applied to different food materials which are called as functional foods. The recent advancement in probiotics is its use as nutraceutical is very helpful for human health.

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None.

## 6. Conflict of Interest

None.

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