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Mini Review

Health Benefits of Probiotic Bacteria

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ABSTRACT

Probiotics are the live microorganisms, which give reliefs from the gastrointestinal disorders and much more benefits to the human health when taken in required amounts. Probiotics are the good companion to human health and friendly microorganisms to trillions of microbiota which are colonized in the human intestine.

Probiotics are mainly bacterial, belongs to the group lactic acid bacteria. Consumption of probiotics during the period of pregnancy may improve the metabolic parameters like insulin levels and cholesterol concentrations. After the pandemic situation it is very common that incorporating the nutritious food in their diet. Many doctors suggest that keeping our gut healthier will boost our immune system.

Keywords: Probiotics; Microorganisms; Gastrointestinal disorders; Immune system

INTRODUCTION

In the year 2022, the global probiotics market was 68.56 billion USD. There is a high chance of increase in the market estimated over 133.92 billion USD. Every year it is expected to grow at a CAGR (Compound Annual Growth Rate) of 7.7%. Probiotics are generally taken through oral to reach the gastrointestinal tract, which is their target organ. They grow at 37 degrees celsius and can survive at unfavorable conditions in the intestinal tract [1].

Probiotics have antipathogenic properties and interaction with the host systems. One has to focus on the viability of the probiotics while processing, because the survivability and the amount levels of probiotics are two most important factors which show effect on the efficiency of the probiotic [2].

Even though the yogurt or yogurt drinks are rich in probiotics they show the minimum viability of probiotic bacteria in them and that can be increased by incorporating the combination of prebiotics and hydrocolloid stabilizers. Among the bacterial probiotics the most important properties related to the genera *Lactococcus* and *Bifidobacterium*. Other two commercially important species in the food industry are *Streptococcus thermophilus* and *Lactococcus lactic*.

Bacteria by adapting themselves tolerance to the unfavourable conditions of the intestinal tract and by health promoting activities developed as a probiotic.

Most common and general properties of probiotic bacteria are:

- Natural part of human gastrointestinal system.
- Nonpathogenic to the host.
- Pass on antibiotic resistance.
- Stable against oxygen, bile, gastric acids and enzymes.
- Safe for consumption.
- Effective in producing health benefits.

The minimum recommended level given by US FDA and the food industries at that time for consumption of probiotic foods is 10^2 CFU mL^{-1} to achieve probiotic action in human gut.

The oldest method of bio preservation of food products is fermentation associated with lactic acid bacteria. Strains of the LAB (Lactic Acid Bacteria) can promote the host health and by preventing the food borne issues [3].

LITERATURE REVIEW

The bioconversion of glycoside into bioactive compounds is mediated by the LAB (Lactic Acid Bacteria) in the fermentation process. Gut microbiota maintain the haemostatic balance that is associated with the host health and the main structural changes of the microbiota will come from the food habits and

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the life style of the host. When there is a noticeable change in the balance of the gut microbiota that leads to the metabolic syndrome and Irregular Bowel Movements (IBL) as such.

LAB (Lactic Acid Bacteria)

LAB are gram-positive, non-spore-forming and incapable of producing catalase Bacilli and Cocci. They are classified among relative or obligatory anaerobes and they can tolerate the acidic pH of the environment [4].

LAB are Generally Regarded as Safe (GRAS) and are widely used in the food industry; rather than, they form the natural microbiota of human intestine. Most of the LAB species are homo fermenters and the main product is lactic acid production in the sugar fermentation. The known and main function of LAB is to maintain the acid-base equilibrium in the colon of the large intestine.

Lactiplantibacillus plantarum is the important member of Lactobacilli, has been widely used as probiotics with noticeable properties including immunomodulation, antioxidation, cholesterol-lowering ability, efficient nitrite degradation capacity and antimicrobial activity against other bacteria.

The early literature says that LAB has an ideal property of producing the conventional chemical antifungal preservatives which act as bio preservatives against spoilage and toxic elements in food. A combination of calcium propionate with the sourdough which is fermented by *L. plantarum* is assessed to bread formulation shows the strong synergistic activity.

Apart from the probiotic lactic acid bacteria also consists of a wide range of bacteriocins. It is an inhibitory proteinaceous substance produced from the initial stage of development as a primary metabolite. Focusing on the pest control, LAB (Lactic Acid Bacteria) as well work as a biological control agent against the potato pathogens. The strain *Lactiplantibacillus plantarum* KB2 LAB 03 was finally selected against the phytopathogens on seed potatoes. The strain KB2 LAB 03 has the widest spectrum of activity when compared to the other strains of LAB [5].

Another study concluded that the strains *L. brevis* Lu35 and *L. reuteri* 5529 with the supply of WFH (Wheat Flour Hydrolysate) media, 2.5% olive oil and 150 mm glycerol increases the antifungal activity.

As a natural fertilizer, LAB can promote the biodegradation of soil, increases the soil organic content and produce the organic acid.

LAB as probiotic

Probiotics are mainly lactic acid bacteria such as *Streptococcus*, *Enterococcus*, *Lactobacillus* and *Bifidobacterium* which produce beneficial effects to the host. Most commonly and widely used method to improve the safety and nutritional value of foods is lactic acid fermentation.

The health-promoting properties of LAB are based mainly on the increase in the bioavailability of nutrients, antioxidant activity, the biosynthesis of vitamins and the degradation of antinutritional ingredients.

Among lactobacilli, the most popular pharmaceutical probiotics contain *Lactobacillus acidophilus*, *Lacticaseibacillus casei*, *Lactobacillus gasseri*, *Limosilactobacillus reuteri* and *Lactobacillus helveticus* and the most common species used in the production of functional foods are *L. amylovorus*, *Lactiplantibacillus plantarum*, *Lacticaseibacillus paracasei*, *Lactobacillus johnsonii*, *Lactiplantibacillus pentosus* and *Lactiplantibacillus rhamnosus*.

LAB fatty acid derivatives consist's of antimicrobial properties which protect the host against the infections. In aquaculture use of antibiotics, vaccines and other form of drugs are replaced by probiotics to improve the quality of the fish based products and also improves the fish health.

It is important to note that the probiotic effects depend on the strain. So that different probiotic strains have different health claims and the prospective of bacterial strains within the same species varies significantly [6].

Thus, strain identification is recommended to characterize the functions of each probiotic to the specific strain. This could be done through genetic recognition using molecular techniques like DNA-DNA hybridization, 16SRNA sequencing and pulsed-field gel electrophoresis for strain typing.

DISCUSSION

Moreover, it has been established that there are many probiotic products that contain a single strain may exhibit a different benefit when it is used individually and in combination. Every individual is endowed with unique gut microbiota that takes part in various functions like nutrient metabolism, continuation of structural coherence of gut mucosal barrier and immunomodulation (Table 1) [7].

Table 1: Health benefits of different strains of the bacteria.

Genus name	Species	Health benefits
Lactobacillus	*Acidophilus, Plantarum, Crispatus, Gallinarum, Crispatus, Bulgaricus*	They adhere to the intestinal epithelial cells and mediate immune stimulation
	Rhamnosus, Paracasei, Fermentum	
	Reuteri, Johnsonii, Breves, Casei	
	Delbrueckii gasseri, Salivarus	

Enterococcus	*Faecium, Faecalis*	Treat irritable bowel syndrome, infectious diarrhea, decreasing cholesterol levels and enhancing host immunity
Streptococcus	*Thermophilus, Salivarius, Sanguis*	It has been found to have anti-inflammatory effects, antimutagenic properties and the ability to produce antioxidant compounds. It have a positive impact on skin health and alleviate GI symptoms
Lactococcus	*Lactis, Reuteri, Rhamnosus, Casei, Acidophillus*	Proliferation of good bacteria in the gut, suppress the growth of harmful bacteria and improve intestinal health. These benefits can lead to a reduction in blood cholesterol levels and an enhancement of the immune system
Bifidobacterium	*Breve, Bifidum, Infantis, Longum Thermophilus, Animalis*	Ability to improve digestive health. These bacteria help to break down complex carbohydrates and fibers that are difficult for the body to digest, which can help to improve bowel regularity and reduce symptoms of digestive disorders

Gut health and digestion

Whether there are different external factors that have potential to influence the composition of gut microbiota of individual, each individual has unique patterns in composition. The stable dominant microbial composition of intestine is observed during the adulthood age of a human being.

The intestinal microbiota is defined as an "active organ" of the human body. During or immediately after the birth of infant, the microorganisms from the environment as well as from mother, start colonize in the gastrointestinal tract of infant [8].

Due to the increased basic pH in the terminal ileum of the small intestine (7.5) have high chances of creating the favourable environment to the SI microbiota to convert the complex carbohydrates into simpler ones to utilize the energy.

Some of the earlier studies noted that consuming the lactobacillus strains have an important role in maintaining the stability, structure and the pathogen defence of cell.

Infants fed with the fermented milk consists of heat-killed L. paracasei CBAL74 probiotic strain showed higher amounts of microbiota and specific other type of bacteria which results in the secretion of Ig A antibodies.

Lactobacillus and *Bifidobacterium* have more than 20 different enzymatic activities. In the persons who are treated with the L. *gasseri* CECT5714 and *L. coryniformis* CECT5711 having high production of propionic acid and acetic acid is observed after the 2 weeks of treatment and also increased production of faecal butyrate.

Due to the presence of acidic conditions in the stomach there is a high chance of inducing the cellular modifications phenotypically and morphologically such as change in the composition of the cellular membrane, damage to the DNA and the other components respectively.

Effect of probiotic on immune system

The important cells of the innate immune system are macrophages, neutrophils, dendritic cells, monocytes, natural killer cells and mast cells. It is demonstrated that consuming the fermented foods like yogurt with *Lactobacillus bulgaricus* OLL1073R-1 increased the activity of NK cells and reduced the risk of colds in the old people.

Earlier studies have noted that *L. bulgaricus* OLL1073R-1 and its secretory polysaccharides enhance the activity of the immune system, which in turn activates the NK cells.

Respiratory infections caused by viruses or influenza is controlled by using *L. bulgaricus* OLL1073R-1 or its products. Probiotics in the small intestine may induce the metabolism of vitamin A to retinoic acid which is an important immune regulating activity performed by the dendritic cells of the small intestine [9].

Disorders in the gut

It is noted that 60% of the world's population is suffering from the *Helicobacter pylori* Infection (HPI) and it can also lead's to various gastroenterological disorders including conditions associated with dyspepsia, peptic ulcer and stomach cancers. Studies have shown that using probiotics with other treatments may have a chance in eradication of helicobacter pylori infection. When combined with a triple therapy of omeprazol, clarithromycin and amoxicillin, pre-treatment of patients with *L. acidophilus*, *S. faecalis* and *B. subtilis* for two-weeks improved the eradication rate by 18.7% compared to the control. Irritable Bowel Syndrome (IBS) is an abdominal discomfort and pain, bloating and stool alterations varying between constipation and diarrhea. *Lactobacillus acidophilus* CL1285, *L. casei* LBC80R and *L. rhamnosus* CLR2 have been identified as potential treatments to relieve the symptoms associated with IBS [10].

CONCLUSION

Probiotics are the good companion to human health and friendly microorganisms. As pandemic situation has created a wave towards the nutritious food, the share of probiotic products in the market has increased globally. Probiotics are mainly lactic acid bacteria such as *Streptococcus*, *Enterococcus*, *Lactobacillus* and *Bifidobacterium*.

The health-promoting properties of LAB are based mainly on the increase in the bioavailability of nutrients, antioxidant activity, the biosynthesis of vitamins and the degradation of antinutritional ingredients. Gut microbiota maintain the haemostatic balance that is associated with the host health. Different probiotics have different health benefits that mainly depends on the strain used in the probiotic. Not only the health benefits it as well used as a treatment for many disorders like helicobacter pylori infection, irritable bowel syndrome.

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