REVIEW ON PROBIOTICS AND HUMAN HEALTH

ABSTRACT

Paediatric intestinal flora may alter as a result of taking probiotic supplements, which could then alter how reactive the immune system is. There is currently no conclusive suggestion for the use of probiotics in the prevention or treatment of allergic illnesses, including atopic dermatitis, due to the ongoing controversy around these effects. Variations in the timing, length of administration, and strain specificity all add to the diversity of this review's conclusions. Probiotics have been shown time and time again to be effective in reducing the length of acute infectious diarrhoea; however, controlled studies are required to determine the appropriate strain combination, dosage, and duration for individual patient groups. Probiotic use has also been studied in relation to gastrointestinal inflammatory disorders as ulcerative colitis, Crohn's disease, and irritable bowel syndrome.

Keywords:

Postbiotics; bioactivity; lactic acid bacteria; health promoting; metabolites;

INTRODUCTION

Over-the-counter probiotic use has surged globally in recent years as a means of promoting health and well-being. Though probiotic use has become very common among the general public, several probiotic strains and formulations have contradictory therapeutic outcomes. The assessment of probiotic gut colonization, strain-level activity, interactions with the host's native microbiome, safety, and host impacts is made possible by discoveries in microbiome research. Probiotics can also be linked to physiological effects and potentially beneficial medical indications. In this perspective, we highlight significant developments, obstacles, and constraints in the pursuit of an objective interpretation of the copious amounts of data pertaining to over-the-counter probiotics, and we suggest paths forward to enhance the caliber of evidence, openness, public knowledge, and regulation of their use^{1.}

Individuals are getting more and more interested in and willing to purchase healthier foods as they have become more aware of the importance of good nutrition and overall health. As a result, food products with functional claims are becoming more common. It's interesting to note that there isn't a universally recognised definition for these functional foods ². Nutraceuticals, probiotics, prebiotics, and symbiotics are some of the main types of functional foods, along with fermented traditional meals ³. Probiotics are live microorganisms that, when consumed, enhance or replenish the gut microbiota, hence offering various health advantages. The gut flora breaks down a type of nutrients called prebiotics ⁴. Considering the potential benefits of using prebiotics in instead of or in addition to probiotics to improve human health.

Defining the term probiotic

Live microorganisms which when administered in adequate amounts confer a health benefit on the host" is the definition of probiotics. Applications for probiotics can use a single strain, several strains, or even prebiotics and immunostimulants such symbiotics and symbiotism ⁵. and in both living and dead forms. It is the responsibility of editors and journals to ensure that the definition is used correctly, however this is rarely the case. Given that bacteria make up a sizable portion of the gastrointestinal system and other locations, it is critical that experts recognise their presence and take into account any potential roles they may play in both health and illness. Quick diagnostic instruments to learn about the microbiome's contents won't be around for long, and while instructions will come with them.

- Most common Probiotics
- > Bifidobacterium
- > Lactobacillus

Bifidobacterium : Because of the wide use of bifidobacteria, we have developed a bifidobacteria selective medium (BSM), available as an agar or a broth, as a standard for one of the most significant probiotic bacteria utilised in the dairy business is Bifidobacterium. These anaerobic bacteria are rod-shaped, non-motile, gram-positive, and frequently branching. Henry Tissier of the Pasteur Institute initially isolated them from a breastfed newborn. Tissier gave the organism the name Bacillus bifidus communis at that point. Bifidobacteria support gut pH regulation and have a beneficial impact on the immune system. Furthermore, bacteriocins and bacteriocin-like bacteria^{4.} Bifidobacteria hinder the of other inhibitory substances produced by growth Since bifidobacteria are commonly utilised, we developed a bifidobacteria selective medium (BSM), which is sold as an agar or a broth, as a standard for quality control. Bifidobacterium-prepared yoghurt combined with this medium offers easy and quick quality control. command. This medium can be used to manage the count of bifidobacteria and facilitate quick and simple quality monitoring of yoghurt prepared with bifidobacteria⁵. On this medium, strains of Lactobacillus and Streptococcus are suppressed while Bifidobacterium grows quite well. Colonies of Bifidobacterium grow in 24 to 48 hours, sometimes as long as three days due to their very selective environment ⁶.

LACTOBACILLUS: Lactobacilli are rod-shaped bacteria that are gram-positive, facultatively anaerobic or microaerophilic organotrophic. They usually form straight rods, though under some conditions spiral or coccobacillary forms have been observed. Usually, they create different-length chains. Members of this category, called lactobacilli, make up the bulk of lactic acid bacteria. As their name implies, they use a process called homofermentative metabolism to ferment lactose, glucose, and other carbohydrates into lactate, which provides

them with energy . 85–90% of the sugar utilised in fermentation produces lactic acid. This acid-producing process promotes the growth of lactobacilli, which prefer low pH environments and inhibits the growth of other species. Non-oxidative substrate-level phosphorylation generates ATP during the process ^{7.}

Without a doubt, drugs like Warfarin that are prescribed to reduce the risk of cardiac arrest interfere with the body's ability to form blood clots by blocking the synthesis of vitamin K-dependent clotting components.

Benefits of Probiotics

Some benefits were assumed of Probiotics for human health.





1)The development of probiotics for women's health

The idea that lactic acid bacteria could be used to treat and prevent recurrent vaginal infections was derided in the early 1980s. Bacteria were the bad guys that the new and current antibiotic classes were meant to eradicate. Thirty years later, probiotic microbes are widely administered globally, particularly for women's health related to the vagina and bladder. The scientific basis and clinical efficacy data for these and many other applications validate the concept's viability ⁸. The creation of this approach, the meaning of probiotics, and its application to further facets of women's health serve as the foundation for this review.

2)Intestinal infection treatments

One of the most well-established advantages of probiotics has been their ability to prevent and treat intestinal infections, which are a major source of morbidity and mortality in developing countries⁹. He noticed that women with recurrent urinary tract infections (UTIs) were colonised by coliforms that climbed and infected the bladder, whereas lactobacilli colonised the vagina of women who had never had a UTI ¹⁰.Bruce thus suggested that lactobacilli might provide protection to healthy women. Although other studies in the field chose to focus on the pathogenesis of Escherichia coli in UTI, namely the adherence of E. coli to the uroepithelium, we chose to investigate the health-associated bacterium ¹¹. We made the decision to investigate the microbes associated with health.

3)Lactobacilli properties and early evidence of benefits in humans

These showed that strains may block the adherence (and growth) of bacterial and fungal pathogens to uroepithelial cells and polymeric substrates, which are urinary devices known to increase the risk of UTI¹². Probiotics and human well-being Probiotics have been shown in numerous studies to have several benefits, such as the capacity to reduce infection, boost immunity, and aid in the prevention or treatment of atopic syndromes and other chronic intestinal inflammatory diseases. There are a lot of beneficial applications for probiotics, and researchers are still trying to determine how effective they are and how they function. However, because to direct-to-consumer marketing and a lack of regulatory control, the usage of probiotics has expanded. Current research is examining how probiotics can alter gastrointestinal immune function ¹³. Studies conducted on animal models show that probiotic treatments guard against

These demonstrated that strains could obstruct bacterial and fungal pathogens' adhesion (and growth) to polymeric substrates, which constitute urinary devices known to raise the risk of UTI, as well as uroepithelial cells¹⁴ colon inflammation by the upregulation of inflammatory cytokines or the stimulation of regulatory mechanisms. Research is currently ongoing to determine how probiotics affect dendritic cell activity and cytokine release. Recent studies conducted in Finland have discovered that cheese, which acts as a carrier of probiotic bacteria, supports and fortifies the immune system in the elderly. The study's conclusions showed that eating probiotic cheese on a regular basis helps older people's immunity. Cheese has been shown to be a dependable source of probiotics ^{15.}

USEFUL PROBIOTICS

There are some useful Probiotics used follows as under-



Fig.2. Useful Probiotics

1)SCFA SHORT CHAIN FATTY ACID

Probiotics and prebiotics enhance SCFA end products. The gastrointestinal tract's pH is lowered by an increase in SCFA synthesis, which improves pathogen resistance and encourages the development of epithelial cells. Because colonocytes favour butyrate as their primary SCFA, there's likely less chance of cancer and a healthy colonocyte population as a result. Quantifying the synthesis of SCFA can be done using intestinal modelling systems or gas chromatography analysis on faecal samples. However, since the colon absorbs 95% of the SCFA metabolites, stable isotope technology is a superior research method ¹⁶.

2)Exopolysaccharides

Exopolysaccharides (EPS) are branched, repeating units of sugars or sugar derivatives that are long-chain, high-molecularweight polymers and are produced by mostly lactic acid bacteria (LAB). EPS can be classified into two depending on the chemical composition as homopolysaccharides, which contain only one type of monosaccharide unit (examples include cellulose, levan, curdlan, pullulan, and dextran, etc.) and heteropolysaccharides which contain repeating units of several different monosaccharides (examples include xanthan, gellan, galactan, and kefiran, etc ^{17.}

3)Enzymes

Enzymes can be defined as proteins that catalyze biochemical reactions. Based on their activity or function, enzymes have been categorized into six broad groups: oxidoreductases, transferases, hydrolases, lyases, isomerases, and ligases [5Enzymes possess a variety of functions including physiological, biochemical, and regulatory. Enzymes are primarily derived from a small group of bacterial strains mainly *Bacillus* subtilis and Bacillus licheniformis; fungal strains mainly Aspergillus niger, and Aspergillus oryzea industrially ^{18.}

4)Cell Wall Fragments

Teichoic acids, lipoteichoic acids, and other compounds that can elicit an immune response are among the immunogenic components found in the cell walls of bacteria ^{19.} About 60% of the bulk of a Gram-positive bacterium's cell wall is made up of lipoteichoic and teichoic acids, which are the main components of the cell wall ^{20.}

5)Cell-Free Supernatants

Cell-free supernatants (CFS) are liquids that contain the metabolites left behind from microbial growth and any unabsorbed nutrients from the growth medium. CFS which are formed when microorganisms are fermented, have anti-inflammatory, antioxidant, and antitumor properties and are also used to treat diarrhoea^{21.}

6)Bacterial Lysates

The purpose of bacterial lysates, which are derived from broken-down bacterial cells, is to boost the immune system's capacity to identify and combat infections. They are obtained by chemically or physically breaking down both Gram-positive and Gram-negative bacteria. Due to their ability to reduce the frequency of recurrent respiratory tract infections in children and their beneficial effects on chronic obstructive pulmonary disease, bacterial lysates have garnered a lot of attention recently ^{22.}

7) Other Metabolites

Aside from phenolic-derived metabolites, vitamins and aromatic amino acids are also generated by bacteria. Humans are unable to synthesise vitamins; instead, they must get them from their food or from microbes. De novo synthesis of B group vitamins, such as B12, B2, B6, B9, and vitamin K (menaquinone) is possible in gut microbiomes ²³.

> Types of Bacterial Strains to fight bad Bacteria.

Sr	Types of Bacterial Strains to fight bad Bacteria.
No.	
1.	Lactobacillus Acidophilus
2.	Lactobacillus Plantarum
3.	Lactobacillus Paracasei

4.	Lactobacillus Brevis
5.	Lactobacillus Bulgaricus
6.	Lactobacillus Casei
7.	Lactobacillus Fermentum
8.	Lactobacillus Helveticus
9.	Lactobacillus Kefirano faciens
10.	Lactobacillus Kefirgranum
11.	Lactobacillus Rahmnosus
12.	Lactobacillus Kefir
13.	Lactobacillus Parakefir
14.	Lactobacillus Salivarius
15.	Brettanomyces Anomalous
16.	Bifidobacterium Bifidum
17.	Bifidobacterium Lactis
18.	Bifidobacterium Longum
19.	Bifidobacterium Breve
20.	Leucon Stoc Lactis
21.	Leucon Stoc Mesenteroides
22.	Leucon Stoc Cremoris
23.	Leucon Stoc Dextranicum
24.	Kluyvero myces Marxianus
25.	Debaryomyces Hansenii
26.	Saccharomyces Unisporus
27.	Saccharomyces Turicensis
28.	Saccharomyces Crevisiae
29.	Saccharomyces Exiguus
30.	Lactococcus Lactis Biovar
31.	Diacetylactis
32.	Lactococcus Lactis
33.	Lactococcus Cremoris
34.	Streptococcus Thermophilus

Table.1. Types of Bacterial strains.

The future

The personal objective of providing well-researched probiotics to everyone on the planet, regardless of their financial situation, remains a problem. The significance of helpful bacteria is being recognised in hospital settings, where probiotics are being used to lower low-birth-weight preterm babies' mortality and morbidity. The majority of microbiome research has been on the gut; nevertheless, women's reproductive tract health is a more crucial field of inquiry. Other developments must be pursued because pharmaceutical and diagnostic firms are unable to effectively handle urogenital tract anomalies. Although they are not miracle cures, probiotics and prebiotics can benefit the health of the mother and foetus. Given that nutrition and microbiota in infancy are essential for a lifetime health trajectory²⁴.

Postbiotics are non-viable microorganisms and bacterial-free extracts that have the potential to improve probiotics and benefit the host. Since postbiotics are created when bacteria feed on prebiotics, eating a diet rich in probiotic and prebiotic foods may help to guarantee that the gut has an appropriate amount of these vital substances. Postbiotics are substances created by live bacteria that have positive effects on the host, such as cell wall components and metabolites. Postbiotics have anti-inflammatory, anti-obesogenic, anti-proliferative, hypo cholesterolemic, antioxidant, and immunomodulatory properties among their bioactivities ²⁵.

Challenges and Safety Regulations

The ability of probiotics to provide positive health outcomes has increased consumer interest in healthy products, and this has increased scientific and commercial interest in microbial administration as a health-promoting strategy. Research on the interactions between food, microbiota, and host has advanced significantly in recent years, which has resulted in the microbiological administration of human microbiota or its modification through novel therapeutic approaches²⁶. These recent discoveries have given rise to a number of probiotic-related terminologies that have spread, but rather than improving communication between scientists, government authorities, and the food industry, these expressions have caused the term "probiotic" to be misused. The definitions of prebiotics and probiotics have recently been updated and evaluated.

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employed by host microorganisms to impart a health advantage. Probiotics and prebiotics are mentioned on the labels of a lot of foods and supplements. The increased consumer awareness of these terms has prompted many nations to mark them more frequently for regulatory reasons. Additionally, there is an increasing Even while the panel tentatively defined postbiotics as "preparation of inanimate microorganisms and/or their components that confers a health benefit on the host," many experts continue to dispute with this definition ²⁷.

Conclusion

The development of next-generation probiotics, which improve human health by mimicking the microbiota, has been spurred by recent perspectives on the significance of the microbiome in maintaining human health. NGPs are seen to be a remarkable advancement over conventional probiotics and have a safe history of use in humans²⁸. Newly developed NGPs for the treatment of disease include Faecalibacterium prausnitzii, Akkermansia muciniphila, Bacteroides fragilis, Eubacterium hallii, Roseburia spp., and others. Certain strains also benefit human immunological function and improve gastrointestinal and metabolic diseases. Currently, efforts to confirm the safety and efficacy of NGPs as biotherapeutics are being made worldwide by a number of research institutes, the pharmaceutical, and food industries²⁹. NGP therapeutic effects need to be carefully considered. As The negative impacts of these microorganisms, the detrimental effects of probiotic metabolites, gastrointestinal side effects, antibiotic resistance genes, skin responses, and aberrant immune system stimulation need to be carefully considered as extra supplementary active microbes³⁰.Regarding the metabolic processes, immunomodulatory impacts, and ecological functions of the next generation of health-promoting probiotic microbes, there is still much to learn ³¹.Based on the facts available thus far, there are plenty of grounds for optimism. Future thorough investigations into these NGPs' mechanisms of action will enable the application of these compounds as biotherapeutics to treat a range of illnesses.

. As additional supplementary active microbes, the adverse reactions of these microbes, harmful effects of probiotic metabolites, gastrointestinal side effects, antibiotic resistance genes, skin reactions, and abnormal immune system stimulation must be carefully evaluated³². Much remains to be understood about the metabolic activities, immunomodulatory effects, and ecological roles of next-generation health-promoting probiotic microorganisms ³³. Thus far, based on evidence to date, there are many reasons for optimism. Future in-depth studies into the mechanisms of action of these NGPs will allow their use as biotherapeutics for the treatment of various disorders.

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