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Ekta Omkar Singh
Lovely professional university, Jalandar-Delhi, GT Road, Phagwara, Punjab, India

Corresponding Author:
Ekta Omkar Singh
Lovely professional university, Jalandar-Delhi, GT Road, Phagwara, Punjab, India

Probiotics: A fruitful approach to health improvement

Ekta Omkar Singh

Abstract
Live beneficial bacteria are referred to as probiotics. These probiotics may offer nutritional benefits due to their variety of beneficial properties. When properly controlled, they also contribute to health. Strong human health improvement is demonstrated by probiotic strains. Since humans have been consuming curd and buttermilk, among other fermented milk products, probiotics have been a staple in our homes. However, their link to health benefits didn't become clear until the turn of the 20th century, when Metchnikoff highlighted the positive effects of some gut micro flora on the host and proposed that consuming fermented milk products could lessen this alleged auto-intoxication. The most commonly utilized probiotic strains include *Lactobacillus, Bifid bacterium, Pediococcus, Lactococcus, Bacillus, and yeasts*. Probiotics have recently attracted a lot of attention in the field of microbiology, particularly in light of their function in healthy physiology and the effects they have on people's health when they are infected. The immunomodulatory, antilipidemic, antitoxin, antibacterial, and anti-allergic characteristics of probiotics are used on purpose. The benefits of probiotics are innumerable. Probiotic use has resulted in positive findings in a large number of carefully planned clinical investigations. As a therapeutic alternative, for instance, to treat, prevent, and manage a variety of problems and illnesses, such as gastrointestinal disorders, allergies, urogenital infections, Helicobacter pylori infections, inflammatory bowel syndrome, diarrhea and colon cancer. It raises IgA levels and other immunoglobulins secreted by intestinal mucosal cells and it stimulates interferons to be released locally. It makes it easier for antigens to be transported to the lymphoid cells beneath, increasing antigen absorption in Peyer's patches. Given that it has the potential to both prevent and treat both communicable and non-communicable human diseases, it has currently emerged as one of the most fruitful and alluring study fields. This concept is supported by various clinical trial results. The outcomes of such extensive research could show improvements in health and quality of life. Their future potential uses include the development of functional foods to improve societal nutrition and health. The facts on probiotics' use in human clinical qualities and their practical applications in the fields of health are all covered in this review. This article summarizes the information that is currently known on the potential health benefits of probiotics.

Keywords: Probiotics, diseases, health benefits, gastrointestinal track, lactic acid bacteria

Introduction
Microbes have existed ever since the dawn of time, possibly even earlier. While many microorganisms, like the coronavirus, are pathogenic and harmful to us, there is also a small subset of them that are helpful to us. It does appear that past civilizations intuitively recognized food that was naturally abundant in them before they could be accurately characterized by modern science. They have benefited from eating food that is high in beneficial bacteria, and they have gladly given their offspring priceless knowledge. With the development of microbiological techniques over time, these microorganisms were studied and given the name "probiotics" (Kaufmann SH, 2008) [1].

Probiotics are live, non-harmful microbes that are beneficial to the host's health when given in sufficient quantities. They also have nutritional benefits. To maintain a healthy balance of helpful germs in the gut flora, it is advised to consume foods containing probiotic microorganisms on a regular basis. Probiotic bacteria like Bifid bacterium and Lactobacillus strains, which are present in GIT and dietary supplements and are incredibly diverse and mind-boggling in their composition and number, belong here. A crucial role in maintaining human health is played by the gut flora (Carlos RS *et al*., 2010; Miriam BB *et al*., 2012 and Mohammad Mehdi SD *et al*., 2015) [2-4].

Additionally, according to FAO/WHO (2002, 2002) [5], probiotics are described as "live bacteria that, when provided in sufficient amounts, confer health advantages to the host." As an alternative, probiotics are described as live microbial feed supplements that enhance the intestinal microbial balance of the host animal (Fuller, 1989) [6]. Initially, probiotics were employed to enhance the health of both humans and animals by modifying the intestinal flora.

Several well-studied Lactobacilli and Bifid bacteria strains are already available for human consumption to either prevent or treat gastrointestinal (GI) infections (Salminen *et al*., 2005) [7]. Consuming probiotics can improve intestinal health by regulating the micro biota, stimulate the immune system's growth and function, increase the bioavailability of nutrients, lessen the symptoms of lactose intolerance, and lower the risk of developing a number of diseases (Fig. 1; Kumar *et al*., 2009a, b, 2010, 2011a, b; Nagpal *et al*., 2007, 2010, 2011; Yadav *et al*., 2007a, b, 2008) [8, 9, 10, 11, 13, 14, 15]

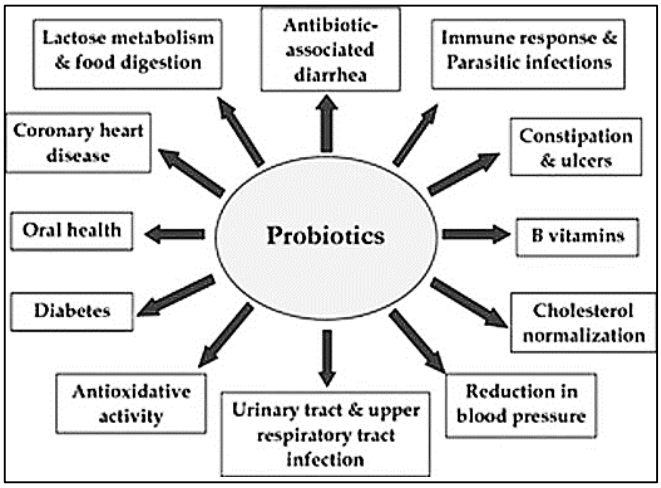

Fig 1: "Projected prospective health attributes of probiotics".

The main goals of probiotic microbiological therapies may be to restore or enhance the structure, composition, and function of the microbial communities within the body. Along with them, inhibit the invasion, colonization, and growth of pathogens. Probiotic microorganisms have been shown to increase vitamin availability in the human host, generate vitamins, and improve GIT all-around transit. Probiotics are more widely used in the food, feed, dairy, and fermentation industries as natural alternatives to pharmaceutical treatments for health management (Anandharaj M *et al*., 2014) [19].

In the human digestive system, probiotic products may have a specific purpose. particularly in lowering risk and treating existing identified human diseases. The most common method really involves ingesting probiotic organisms through dietary products. Consuming probiotics may also help lower the likelihood of developing certain diseases by easing both objective and subjective symptoms. Probiotic microorganisms are often sold as culture concentrates that can be added to a food matrix in dried or deep-frozen form. Probiotics' role in boosting the immune system overall has been thoroughly investigated (Moro García MA *et al*., 2013 and Stefania P *et al*., 2017) [20, 21]. The natural flora in the GIT plays a crucial role in maintaining health. These include enteric toxin reduction and cleansing that take place inside the body, structural and histological function, metabolic and defensive functions that are supported by bacteria.

Probiotics are typically added to foods, condiments, and drinks as a necessary step in the fermentation process. Due to their ability to serve a variety of purposes and lengthy lifespan. Based on the age class interval, multiple delivery methods for mechanisms are available. It can be consumed orally in the form of probiotic meals or capsules. Probiotic cells are always alive in food carriers and may adapt to the extremely hostile environment of the GIT in order to produce and supply health effects. On the other hand, it must maintain stability throughout gastrointestinal transit and achieve at least 10^6 CFU g-1 in terms of cell count. Despite the fact that dairy-based products are thought to be the main carriers of probiotics, various non-dairy-based products can also contain probiotics (Ravinder N *et al*., 2012) [22]. Each probiotic strain has a unique action, and the name "probiotics" encompasses a wide variety of bacteria and other microbes, including yeast. In this way, just because one strain has a certain medicinal benefit, it doesn't follow that all probiotics will also have that benefit. Each strain needs to be independently tested for a particular impact.

The purpose of this study is to advance further research into the use of probiotics and to outline the most recent studies on the impact of probiotics on human health.

The primary elements and information below serve as a summary of how probiotics relate to human health:

1. Probiotics are beneficial substances made of benevolent bacteria.
2. Probiotics can keep the human digestive system colonised and can combat harmful germs in any situation.
3. By fermenting food, probiotics help break it down into much smaller complexes and improve our health through a variety of processes.
4. There are numerous factors, including poor diet, alcohol consumption, ageing, and others, that might reduce or diminish probiotic quantity and quality.

They ought to be incorporated into our normal diet because of this

5. In situations when probiotics are especially susceptible to being negatively impacted, such as those following antibiotic therapy, they must be taken in the right quantities orally or with food in order to overcome the difficulty.
6. Probiotics actively promote health conditions since they:

A. Disintegrate the signs of pathogens or harmful microorganisms.
B. Feeds the body with beneficial by products.
C. Helps our digestive system by lightening its workload.
D. By protecting our digestive system with a biofilm, dangerous substances' initial attack is less likely to have a negative effect on our cells.
E. Because any amount of food is properly absorbed and digested, our systems require less food overall.
F. In some situations, probiotics may be able to make up for a genetic deficiency by allowing us to use their genes' by products, as in the case of a lactose fermentation deficiency. Here we should highlight the fact that anything in our lives, including probiotics, should not be used in excess and should be used wisely to provide the desired results (Salminen S *et al*., 1998) [23].

Probiotics: what are they?

The Food and Agriculture Organization/WHO (2010) defines probiotics as an oral supplement or food item that includes enough live microorganisms to change the micro flora of the host and has the potential to have positive health effects on the host when it is taken in sufficient levels (FAO).

Species used

Probiotics have been made from a wide variety of microbial species. They could be fungi, bacteria, or yeast. But bacterial

species predominate most frequently.

List of probiotic candidate:-

Microorganisms	Genus	Species
Bacteria	*Lactobacillus*	*L.acidophilus, L.brevis, L.reuteri, L.casei, L.rhamnosum, L.bulgaricus, L.cellobiosus, L.delbrueckii, L. fermentum.*
	Bifidobacterium	*B.thermophilus, B.infantis, B .longum, B.bifidum, B.animalis.*
	Streptococcus	*S.lactis, S.thermophilus, S.cremonis, S.alivarius.*
	Bacillus	*B.Coagulans*
	Pediococcus	*P.acidilactici*
	Leuconostoc	*L.mesenteroides*
	Enterobacter	*E.faecium, E.faecalis.*
Fungi	*Aspergillus*	*A.niger, A.oryzae.*
Yeast	*Saccharomyces*	*S.boulardii, S.cerevisiae, S.carlsbergensis.*

What makes a good probiotic?

Probiotics have been shown to have special potential in many research studies. Its safety, technological, and functional qualities must be sought after before being used and chosen as a probiotic. Additionally, the following requirements must be met:

1. Probiotics should be able to benefit the host animal by boosting its illness resistance.
2. Probiotics must originate from people.
3. Excessive cell viability was required for probiotics.
4. Probiotics should not be harmful or pathogenic.
5. It must be capable of interacting with or signaling immune modulator action.
6. It should be capable of affecting local metabolic activity.
7. It must be capable of surviving and digesting in the gut, including being resistant to organic acids and low pH.
8. Probiotics must be reliable, secure, efficient, and prepared to maintain viability in field and storage circumstances.
9. It must possess the ability to replenish and replace the intestinal micro flora.
10. It should be capable of reducing cholesterol, maintaining mucosal integrity, and enhancing intestinal motility in addition to having anti-mutagenic and anti-carcinogenic properties (Divya P, 2016) [26].
11. The digestive tract should be able to be colonized and maintained quickly.
12. They must be able to withstand bile acid exposure and stomach acids, which seems essential for oral delivery.
13. Adhesion to mucosal and epithelial surfaces, a crucial characteristic for effective immune regulation, pathogen competition exclusion, and pathogen adhesion and colonization avoidance.
14. Pathogenic bacterial antimicrobial activity
15. The activity of bile salt hydrolase (Adel MM *et al*., 2017, Mohammad Kazem SY *et al*., 2017 and Maria K *et al*., 2013) [27-29].

The following are the prerequisites for probiotic status

1. Evaluation of the strain's identification (genus, species and strain level).
2. Potential probiotics are tested in vitro for things like bile acid, digestive enzyme resistance, and antibiotic action against potentially dangerous microorganisms.
3. A probiotic strain must demonstrate that it is safe and that its administration mode is free of contamination.
4. *In vivo* research to support the target host's health effects.

Qualities needed for probiotics to be successful and effective

It is crucial that the probiotic strain endures in the location where it is thought to be active. The strain should be able to multiply and colonize at this site specifically for maximum activity. The immune system should also be able to withstand it. According to Toma and Pokrotnieks (2006) [94] and Ohashi and Ushida (2009) [95], it shouldn't be pathogenic, allergenic, or mutagenic/carcinogenic. Probiotics for people should be "generally recognized as safe," with a shown minimal risk of causing or contributing to the genesis of disease. The probiotic organisms must be able to resist low pH and high concentrations of both conjugated and DE conjugated bile acids. They should ideally be of human origin (Collins *et al*., 1998) and be able to survive and thrive in the *in vivo* conditions of the intended site of administration. The probiotic employed must also be technologically compatible with the technique used to manufacture foods in order to be successfully applied in foods. The probiotic bacteria-containing foods also need to retain the traditional food's distinctive sensory qualities.

Probiotics' Current Scenario

Bifid bacterium and Lactobacillus make up the majority of the microorganisms found in probiotics. Today's powerful probiotics include "*L casei, L acidophilus, L brevis, L sporogenes, L rhamnosus, L delbrukii, L plantarum, L fermentum, and B bifidus, B infantis B. longum and B. animalis. Leuconostoc, Propionibacterium, and certain Streptococcus"* species are also utilized as probiotics. *Aspergillus and Sacharomyces* are also used for their probiotic qualities (Gibson GR and Roberfroid MB, 1995; Jin LZ *et al*., 2000; Alvarez-Olmos MI and Oberhelman RA, 2001; Reid G, Burton J., 2002) [31, 32, 33, 34, 64].

Probiotics must be viable during usage and storage, be able to live and function in the gut, and have impacts on health that have been proven. The first probiotic, *L rhamnosus* GG (LGG), was the one that has, to this point, attracted the greatest clinical attention. By creating a list of the optimal characteristics for Probiotics, *L rhamnosus* strain GG was identified in 1985 because the Lactobacillus strain commonly employed for fermentation by the dairy sector was unable to implant the gut. Intestinal immunity has been shown to benefit from Lactobacillus rhamnosus strain GG. It raises the proportion of IgA and other immunoglobulin-secreting cells in the intestinal mucosa, induces the local release of interferons, and promotes the transport of antigen to underlying lymphoid cells, all of which increase the uptake of antigen in Peyer's patches (Saxelin M., 1997) [35]. Probiotics may be an oral vaccination candidate for a number of deadly diseases, including AIDS, malaria, trichmoniasis, ischemic heart disease, and infantile diarrhea, according to Amdekar *et al*. (2009) [63] Compared to the conventional immunizations previously used from 5 to 6 decades, oral vaccines are significantly better. Oral vaccinations are simple to administer, effective in treating thousands of people and remove the issue with injections (Amdekar S *et al*., 2010) [36].

Mechanism of action

There are now three main ways that probiotics work, while they have many other processes as well. The first one is now being regulated by the local anaerobic flora, which limits the concentration of potentially harmful flora in the digestive system. Probiotics can directly affect other microbes by preventing pathogen adherence, which is a crucial defense mechanism for maintaining internal health. It has been demonstrated that lactobacilli and bifid bacteria prevent a variety of diseases by colonizing pathogenic bacteria and then acting antagonistically against gastrointestinal pathogens. In many instances, this idea is essential for infection control, treatment, and gut microbial balance restoration. The second mechanism is responsible for "the synthesis of anti-microorganism compounds, bacteriocins, toxins, organic acids, formation of short chain fatty acids, and lowering of gut pH. These compounds are in charge of preventing the growth of other hazardous bacteria like foodborne pathogens and spoilage organisms in the GIT environment, which subsequently leads to the pathogen's death by establishing antagonistic conditions". This activity may also cause toxins to become inactive. According to microbial products, which are used to determine a specific probiotic action and its efficient application for the prevention or treatment of a particular disease by destroying the target cell, probiotic effects are carried out in a mode that is based on microbial products. The third mechanism involves "the stimulation/modulation of both specific and nonspecific immune responses by T-cell activation, to cytokine production/throughout immunomodulation by inducing phagocytosis and IgA secretion, modifying T-cell responses, enhancing Th1 responses, and attenuating Th2 responses". The treatment and prevention of infectious diseases will certainly benefit from this form of action (Maria *et al*., 2013, De Vrese M, Schrezenmeir J. 2008, Gueniché A *et al*., 2010, Soccol CR., 2010, Bendali F *et al*., 2011) [29, 37, 38, 39, 40]. A probiotic's ability to modulate the immune system. These bacteria can interact with dendritic cells (DCs), lymphocytes, monocytes/macrophages, and epithelial cells. They effectively interact with and affect the immune system through a variety of ways (Miriam BB *et al*., 2012) [3]. The immunological benefits of probiotics may result from changes in pro/anti-inflammatory cytokine profiles, activation of local macrophages and modification of IgA synthesis locally and systemically, or modulation of response to dietary antigens (Ghadimi D *et al*., 2008 and Kabeerdoss J *et al*., 2011) [41, 42].

Three steps make up the probiotics' activity mechanism

i. It increases immunological response and modifies it.
ii. It regulates irritable bowel syndrome and other inflammatory bowel illnesses while ensuring colonization resistance and normalizing intestinal micro biota.
iii. The last method also has metabolic consequences such as bile salt DE conjugation and secretion, lactose breakdown, a decrease in mutagenic and toxic reactions in the gut, and the supply of nutrients to the colon epithelium (Pranay J and Priyanka S., 2012) [43].

Source of probiotics

Probiotics mostly come from non-digestible carbohydrate compounds that have undergone fermentation, food supplements, dairy-based compounds, non-dairy fermented foods, and extra intestinal sources. From a variety of natural substrates, probiotic bacteria can be extracted, screened, identified, and described.

The sources of the current full strain of electricity are numerous, varied, and continually expanding. The research team named below concurs with this notion. People are also interested in living cell food since it has anti-oxidative properties and improves nutritive quality and micronutrient bioavailability. Anti-oxidant properties counteract oxidative stress, bolster the host's anti-oxidative defense system, and slow down the ageing process. The micronutrients' bioavailability also has anti-oxidative properties. Anti-oxidant properties counteract oxidative stress, bolster the host's anti-oxidative defense system, and slow down the ageing process. Consequently, a variety of probiotic meals can effectively satisfy the interests of people of all ages (Naeem M *et al*., 2013, Siddiqee MH *et al*., 2013, Ramirez-Chavarin ML *et al*., 2013, Pundir RK *et al*., 2013, Hamet MF *et al*., 2013, Tajabadi N *et al*., 2013, Babak H *et al*., 2016) [44-50].

Benefits of probiotics for health

Probiotic use has a wide range of positive health impacts. The following is a list of some of the main health advantages of probiotics and their theoretical mechanisms.

Immunomodulation

By influencing the development of gut associated lymphoid tissue (GALT) at a young age of 17 (Dugas B *et al*., 1999) [51], the micro flora in the gastrointestinal tract controls both the systemic and local immune reactivity. The human immune system matures as a result of microbial colonisation, especially when IgA and IgM-secreting cells are circulated. In mucosal immunity, the harmony of the various T helper (TH) subsets is crucial. Memory B and T cells go to effector locations after priming. Active proliferation, local cytokine induction, and the generation of secretory antibodies occur next (IgA). Immune cells of a host react to antigen exposure by releasing cytokines. Which demonstrates additional later immunological responses? Local cytokine modulation, particularly TGF-associated low-dose tolerance immunity, is one of the key ways by which the GALT maintains homeostasis. Immune system dysfunction has been linked to ageing, stress, infectious illnesses (including AIDS), and under nutrition. Immunomodulation can treat the aforementioned inadequacies by employing the appropriate synthetic and natural medicines, including probiotics. The immunostimulatory products that are currently accessible come with terrible adverse effects (Tahri K *et al*., 1996) [52]. For vast populations with compromised immune systems, it is crucial to produce natural compounds with immunomodulatory capabilities that are free of negative effects (Dietrich G *et al*., 2003) [53]. The macrophages can be activated by lactobacilli that stick to gut walls.

Anticancerous properties

Probiotics are potential anti-cancer agents. Some enzymes like nitroreductanse and Glucuronidase, which turn some procarcinogens into carcinogens, are produced by gut bacteria such Escherichia coli and Chlostridium perfrigens (Dicks LMT and Botes M, 2010) [54]. Additionally, lactobacillus may stop cancer from developing and spreading. The colon cancer-fighting agent lactobacillus has been employed. Changes in the physicochemical conditions in the colon, changes in the metabolic activity of gut microorganisms, and the breakdown

of potential carcinogens are a few possible methods by which Lactic Acid Bacteria suppress colon cancer (Rafter J., 2003) [55]. By producing end products, probiotics also promote apoptosis.

Probiotics have antilipidemic effects

There is evidence that probiotics can decrease cholesterol. Numerous research have been made, however the cause of probiotics' antilipidemic effects is still a mystery. The co-precipitation of cholesterol with DE conjugated bile salts at pH 6 is what lowers cholesterol (Klaver FAM and Van der Meer R., 1993) [56]. DE conjugation of bile salt lowers the level of serum cholesterol. Bile salt metabolism and cholesterol metabolism are strongly related. Bile salts are first created from cholesterol (water-soluble excretory end product). Bile salt hydrolase (BSH) DE conjugates bile salts during enter hepatic circulation (EHC) (E.C.3.5.1.24). Free bile acids, glycine, and turbine are also expelled in the faeces because they are not readily reabsorbed. Therefore, a decrease in bile salts causes an increase in the conversion of cholesterol to bile acids, which lowers cholesterol levels (De Smet, I. *et al*., 1994) [57].

Probiotics as antimicrobials

Probiotics have been shown to inhibit common organisms or prospective infections through a number of mechanisms after they are introduced into the intestine. These elements include bactericidal proteins (bacteriocins), a drop in luminal pH, and an inhibition of bacterial adherence to epithelial cells. Additionally, there is proof that probiotics prevent the intestinal crypts' ability to produce defensins, which are known to have antibacterial capabilities. The impact of the Lactobacillus species on Helicobacter pylori infection of the gastric mucosa is a significant illustration of the antimicrobial effect of probiotics (Gotteland M *et al*., 2006) [58]. In addition to bacitracin, other essential antimicrobials include hydrogen peroxide, lactic acid, and pyroglutamate. Probiotics are widely known for their antimicrobial activities against Salmonella typhimurium, Yersinia enterocolitica, and E. coli (Ajitha S *et al*., 2004, Sherman P *et al*., 2005, Frick JS *et al*., 2007, Jain S *et al*., 2009, Singh V *et al*., 2009) [59, 60, 61, 62, 63].
Additionally, probiotics create compounds that inhibit the development of viruses. Adenovirus and the vesicular stomatitis virus can be rendered inactive by *L. rhamnosus* GR-1 and L. fermentum RC-14 within minutes, according to studies (Cadieux P. *et al*., 2002) [64]. According to the results of research, Lactobacillus administered in high quantities is virucidal for HIV-1 (Sleator R D., 2010) [65].

Antitoxin effect

The toxin molecules are altered by probiotics via an enzymatic reaction (Michail S., 2005) [66]. It is widely known how they protect against Chlostridium difficile and the cholera toxin (Pothoulakis C *et al*., 1993, Brandao, R.L *et al*., 1998, Chen X *et al*., 2006) [67-69]. In order to eliminate the toxins and activate intestinal receptors to generate IgG and IgA, these hydrolases, such as lipases and proteases, were produced.

Probiotics in allergy

A molecule in our environment known as an allergen (a particle of a foreign nature) can cause an allergic reaction in those who aren't sensitive to it. Paediatric age groups frequently have allergic diseases. Although the specific cause is unknown, accumulating evidence points to environmental factors, an abnormal gut flora, and a shift in the Th1/Th2 balance in favour of a Th2 response. This results in the release of interleukin-4 (IL-4), IL-5, and IL-13 as well as the synthesis of IgE and the activation of Th2 cytokines. The immune system is modulated by probiotics to return to a Th1 response. Their potential use in the treatment of allergic diseases has been highlighted by several in vitro investigations. Probiotics have been used in human studies to treat and prevent atopic dermatitis with varying degrees of success (Winkler P *et al*., 2007) [70].
It has been demonstrated that probiotics lower inflammatory cytokines (IL-6, TNF-), enhance intestinal permeability, and have therapeutic promise in allergic illnesses. It is possible to cure allergy illnesses with such results. The effectiveness of probiotics in treating a variety of allergic disorders, including eczema, allergic rhinitis, asthma, and food allergies, has thus been the subject of numerous research. (Prescott SL, *et al*., 2007, Taylor AL, *et al*., 2006, Flinterman AE *et al*., 2007) [72, 73].

Probiotics and Blood Pressure

Probiotics and the compounds they produce have also been found to lower blood pressure by raising levels of both total cholesterol and low-density lipoprotein cholesterol. Blood glucose levels and insulin resistance are reduced, the renin-angiotensin system is under control, and a considerable drop in blood or serum cholesterol occurs when levels of cholesterol are high (Patel AK *et al*., 2010 and Guo Z *et al*., 2011) [74, 75]. Interestingly, supplementing with probiotics may assist hypertensive patients lower their blood pressure. *"Lactobacillus helveticus, Saccharomyces cerevisiae, Lactobacillus rhamnosus GG, Lactobacillus casei, Lactobacillus acidophilus, Lactobacillus rhamnosus, Lactobacillus bulgaricus, Bifidobacterium breve, Bifidobacterium longum Streptococcus thermophiles, Lactobacillus delbrueckii ssp. Bulgaricus, Lactobacillus kefiri are the common one used for anti-hypertension"* (Rerksuppaphol S *et al*., 2015 and Golnaz E *et al*., 2017) [76, 77].

Probiotics and Liver Diseases

Hepatocyte function is significantly influenced by the intestinal lumen micro flora. "Cirrhosis, non-alcoholic fatty liver disease, alcoholic liver disease, and hepatic encephalopathy" are examples of serious and damaging liver dysfunctions that can arise from changes in the type and quantity of microorganisms that reside in the digestive system. Utilizing a method of regulation, restoration, and transformation of gut micro flora and immune function, probiotic is used as a novel treatment strategy against liver disease (Lunia MK *et al*., 2014 and Leila J *et al*., 2017) [78, 79].
By strengthening the intestinal barrier, probiotics are helpful in the treatment of chronic liver illnesses because they prevent germs from entering the bloodstream and ultimately the liver (Cesaroa C *et al*., 2011) [80].

Probiotics and Dental Caries

Corrosive demineralization of the tooth enamel is one symptom of the multifactorial illness known as dental caries, which is caused by bacteria.

It appears that modifications to the oral environment's homeostasis caused the biofilm of bacteria to multiply, with the mutans group of streptococci playing a major role. To be helpful in reducing or preventing dental caries, a probiotic must be able to cling to dental surfaces and integrate into the bacterial communities that make up the dental biofilm. In order to stop the cariogenic bacteria from multiplying, it must also outcompete and conflict with them. The probiotic should produce little acid as a result of the food-grade carbohydrates it is metabolising (Haukioja, 2010 and Tandon V *et al*., 2015) [81, 82].

Probiotics and Voice Prosthesis

Probiotics significantly reduce the presence of harmful bacteria in the biofilms of voice prosthetics. Removes biofilm growth on inserted vocal prostheses, which may be caused by the presence of Lactobacillus bulgaricus and Streptococcus thermophiles (Divya P, 2016) [26].

Probiotics and Oral Health

Lessening of inflammation is one of the most important benefits of probiotics in the oral cavity. Probiotics can battle against harmful oral microorganisms to help eliminate them, and they also support the maintenance of strong teeth and healthy gums. Probiotics shouldn't have any negative effects because they are an entirely natural medication (Chitra N., 2013) [83]. Both Bifid bacterium lactis and Lactobacillus acidophilus have well-known antifungal properties (Dhawan R, Dhawan S., 2016 and Lesan S *et al*., 2017) [84, 85].

Probiotics and HIV

Probiotics seem to help maintain a healthy gut epithelia layer, improve the function of the gut barrier, and boost innate immunity, which acts as the body's first line of defence against the spread of bacterial and viral illnesses. A robust immune system has the ability to block the spread of HIV and the development of AIDS in the host. When consumed regularly over an extended period of time, probiotics can increase CD4 counts in HIV-positive individuals. Saliva samples from a number of participants were screened, and the results showed that some Lactobacillus strains produced proteins that were suitable for tying the mannose sugar, which is a particular sort of sugar present on the HIV envelope.

The microscopic organisms (bacteria) are given the ability to cling to and colonise the mucosal lining of the mouth and stomach tract thanks to the binding properties of sugar. One of the strains released a lot of mannose-binding protein into the air, and these proteins bound to the sugar coating to neutralise HIV. Additionally, immune cells that are caught by lactobacilli form clumps that render any immune cells that are HIV-positive immobile and prevent them from infecting additional cells (Pranay J, Priyanka S., 2012) [43].

Probiotics and Irritable Bowel Syndrome

By reducing the production of regional pro-inflammatory cytokines, probiotic bacteria can help the gut mucosa's immunological barrier remain stable. Ulcerative colitis, Crohn's disease, and Pouchitis are inflammatory bowel diseases that are treated with probiotics. The synthesis of antimicrobial compounds, enhanced epithelial barrier function, epithelial binding and invasion inhibition by pathogenic bacteria, and immunoregulation are examples of potential pathways. Probiotic effects may vary depending on the strain and dosage (Momir MM *et al*., 2014) [86].

How Do Probiotics Shorten Diarrhea and Stomach Disorders' Duration?

To shorten the duration of diarrhoea and relieve stomach diseases, a number of putative strategies have been put up. That cannot be attributed to a single mechanism, and we may anticipate that a combination of responses will either aid the patient or prevent it.

Probiotic bacteria prevent pathogens by engaging in competitive blocking of the receptor site (Bernet M F *et al*., 1994) [87]. This adhesion is caused by surface layer proteins from probiotic bacteria (Johnson-Henry KC *et al*., 2008) [88]. The entire gut epithelium has a layer of goblet cells as a lining. To prevent bacterial and viral infections, these cells have glycosylated mucins on top of them (Yolken RH *et al*., 1994) [89]. MUC2, one of the 18 glycosylated mucins, is widely distributed on the gut epithelium. The mucins are given hydrophobicity and proteolytic resistance by these. While acting as a lubricant for intestinal movement, this layer shields the gut from potentially hazardous foreign particles and chemicals. The mucus is the initial barrier that gut bacteria encounter, and during an infection, pathogens must pass through it to get to the epithelial cells. The mucus discharge was boosted by probiotic microorganisms (Suzuki K *et al*., 2007) [90].

The improvement in immunological response is another significant factor. Mucosa is where 80% of plasma cells are located. Payer's patches are the critical location for sIgA. By attaching to pathogen antigens, sIgA defends the intestinal epithelium from colonisation or invasion. In order to preserve gut homeostasis, this is crucial in limiting enteric bacteria expansion. By attaching to and neutralising bacterial or viral components during the transcytosis of the epithelium, sIgA can defend against intracellular infections (Fernandez MI *et al*., 2003) [91]. The immunomodulatory features controlled by probiotics include opsonisation, bactericidal superoxide production, pro-inflammatory and anti-inflammatory cytokine signalling, and antibody-mediated cell-mediated cytotoxicity (Otte JM and Podolsky DK., 2004) [92].

Need in the world today

The modern world is all about efficiency, and most people think that cooking takes a lot of time. Since people rely on processed meals to quell their hunger, regular consumption of these foods over time depletes the body's stores of important nutrients and raises sugar and fat levels to harmful levels. While it is inappropriate to require individuals to sit down and cook every meal they consume, a far better choice is to adapt nutritious meals in a way that make them efficient and quick to prepare and eat with also providing all the health advantages they store in them.

Probiotics' prospects in the future

The issue of probiotic stability and viability is now resolved thanks to technical advancements. In order for enough cells to go through the gastro intestinal tract and reach the intended location of action, pure and active viability of cells is very important. Because of the low pH environment of the stomach and the high bile salt conditions in the intestine, probiotics often lose their efficacy and viability along with their function. The only ways to get beyond the challenge are to use encapsulation, sub lethal shock, and food matrix/carriers.

By isolating a potentially sensitive material and constructing a barrier of protection from the environment, encapsulation is a mechanical or physicochemical process. Through the development of novel microencapsulation technologies and processes, bacteria are now protected against damage brought on by the outside environment. Probiotics may be incorporated into a variety of food products thanks to microencapsulation, which allows for the storage of live bacteria at room temperature. Well-known encapsulating procedures for the creation of probiotic microcapsules include spray-drying, emulsion, and extrusion (Ranadheera CS *et al*., 2015) [93]. The application of genetic engineering to the area is the future mindset with regard to enhancing the strain's general characteristics and obtaining a powerful desired trait.

Conclusion

Consuming probiotics promote a healthy lifestyle. This is currently a widely accepted idea and a promise for the coming generation. Probiotics are frequently used to treat and mitigate specific diseases. Future research should place a strong emphasis on developing and carrying out further in vitro and *in vivo* tests to determine which probiotics are genuine and which ones are most suited for disease prevention and therapy. Finally, urge additional practical investigations to confirm the impact on human health through high-quality analysis and carefully planned clinical trials.

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