

Health Benefits, Potential Applications and Mechanism of Action of Probiotics: A Review

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Abstract

From last ten years, popularity of probiotic bacteria is increased, as people are getting aware about benefits and various other advantages of probiotic bacteria. As scientific study has also proved that there are many advantages and health benefits, we can easily find probiotic products incorporated in various dairy products which are commonly fermented products, like for instance, yoghurt, cheese, curd and a probiotic drink yakult. A lot of research is being carried out by researchers across the globe to check health benefits, and to evaluate safety and nutritional value if consumed on a daily basis. Aim of this paper is to evaluate how probiotic microorganisms are helpful for keeping good health and boosting immunity of the individuals also helps the immune system to fight back against pathogenic bacteria that cause diseases such as diarrhoea, stomach bloating. Proved that there are many advantages and health benefits, we can easily find probiotic products incorporated in various dairy products which are commonly fermented products, like for instance, yoghurt, cheese, curd and a probiotic drink yakult. A lot of research is being carried out by researchers across the globe to check health benefits, and to evaluate safety and nutritional value if consumed on a daily basis. Aim of this paper is to evaluate how probiotic microorganisms are helpful for keeping good health and boosting immunity of the individuals also helps the immune system to fight back against pathogenic bacteria that cause diseases such as diarrhoea, stomach bloating.

Keywords: Probiotic; Lactic acid bacteria; Pathogenic bacteria; Health benefits; Immunity

Introduction

Probiotics are live, microorganisms ingested for the modification of the gastrointestinal greenery for medical advantages. They are regularly alluded to as great microscopic organisms in the stomach and contend with terrible living microorganisms to the body in laying out ideal assimilation and help immune system function. They can be found in yoghurt and other aged food varieties, dietary enhancements and cosmetic items. In spite of the fact that individuals frequently consider microbes and different microorganisms unsafe' 'microbes, many are really useful. There are only limited living microorganisms that are able to help in digesting processed food and that helps the body in eliminating unwanted dead and disease causing sick cells and also after digestion helps in producing nutrients that are required in the body for completing various requirements. A large number of the microorganisms in probiotic items are equivalent to or like microorganisms that normally live in our bodies. The probiotic word "pro" means and that mean and the word "biotic" signifies "profiles" or "life". The idea that gut flora can be changed and unsafe organisms supplanted with advantageous ones were first presented in 1907 by Russian researcher Elie Metchnikoff. He recommended that putrefactive or proteolytic microscopic organisms create poisons in the enormous entrail that cause "digestive auto-inebriation," which adds to the maturing system Guarner and Schaafsma showed the fundamental utilization of the fitting portion of probiotic organic entities expected to accomplish the normal effect.

Materials and Methods

The present explanation formed by food and agriculture organization in united states in year 2022 and world health organization was doing work on gathering specialists, expresses that probiotics are "live strains of stringently chosen microorganisms which,

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when managed in satisfactory sums, present medical advantage on the organisms that feed over other organisms for nutrition and their survival. The definition was kept up with probiotics, prebiotics (ISAPP) in year 2013. Numerous medical examinations have demonstrated the viability of probiotics for treatment of infections like weight, insulin opposition condition, diabetes, and nonalcoholic greasy liver illness. Besides, the constructive outcomes of probiotics on human wellbeing have reported expanding the body structure immunomodulation. Logical reports additionally show the advantages of the prophylactic utilization of probiotics in various kinds of malignant growth and incidental effects related with disease. Numerous clinical examinations have demonstrated the viability of probiotics and studies have suggested probiotic doses that are being used in particular demonstration. Remember that how probiotics work might depend upon strain used, portion and parts used to creating a probiotic item. Prebiotics were characterized in the year 1995 by Roberfroind and Gibson as not in the category of processed food parts that, through the feeling of development potentially movement of a solitary kind restricted measuring of microorganism in gastrointestinal parcel, further develop medical issue of a host in 2007, FAO/WHO experts described prebiotics as a nonviable food component that confers a health benefit on the host associated with modulation of the microbiota. Prebiotics might be utilized as an option in contrast to probiotics or as an extra help for them. Anyway, unique prebiotics will invigorate the development of various native stomach microorganisms. Prebiotics have tremendous potential for changing the stomach microbiota; however these adjustments happen at the degree of individual strains and species and are not effortlessly anticipated. Various studies over probiotics reported the advantageous impacts over human wellbeing. Roberfroind and Gibson presented the expression Synbiotic to portray a blend of synergistically acting probiotics and prebiotics in the 1995 well chosen part acquainted with the gastrointestinal parcel ought to specifically animate development and additionally enact the digestion of a physiological digestive microbiota, in this manner presenting a useful impact to the host's wellbeing. As synbiotic suggests collaboration, the term ought to be saved for those items wherein a prebiotic part specifically leans toward a probiotic microorganism. The chief reason for that sort of mix is the improved endurance of probiotic microorganisms in gastrointestinal parcels.

What are probiotics?

Living microorganisms that after consumption provide health benefits and also improves gut flora. These good bacterias are naturally present in our body. When any disease causing pathogenic bacteria attacks our immune system, these good bacteria gets activated and helps our body to eliminate harmful bacteria from the body and boost the immune system and increase immunity of individuals [2]. Trillions of microorganisms are present in our body. Each microbe is different from other. Even two different persons for instance even twins don't have the same microorganisms present in their body. Microorganism can only be called as probiotic if it can be isolated from the human body and has the capacity to survive in the intestine and also scientifically proved its benefits and can be safely consumed [3,4].

History of probiotics

Towards the start of twentieth century main principal functions of flora existed totally obscure. Towards the start of the twentieth century the principal functions of stomach flora were totally obscure. Ilya Ilyich Metchnikoff, the nobel prize victor in Medicine in 1908, at the Pasteur institute connected the wellbeing and life span, to ingestion of microorganisms present in yoghurt he accepted that the constitution of the human body presented a few disharmonies acquired from crude well evolved creatures, like guard hair, intelligence stomach, denticle vermiform addendum, and digestive organ. Fenster K, et al. he hypothesized that the microbes associated with yoghurt ageing, *Lactobacillus bulgaricus* and *Streptococcus mutans*, stifle the breakdown type maturations of gastrointestinal vegetation, that utilization of yoghurt assumed as part for keeping up with wellbeing. To be sure, he the long exists of bulgarian labourers to their admission of yoghurt containing *Lactobacillus* species. Specifically, Fenster K, et al. he revealed that the digestive organ, valuable to well evolved creatures in overseeing unpleasant food made out of cumbersome vegetables, is pointless for people. Additionally, it is the site of perilous gastrointestinal festering processes which can of perilous gastrointestinal festering processes as it may go against on bringing true bacteria into the body, uprooting poison creating microbes, advancing wellbeing also dragging out life. In the mid 1920 *Lactobacillus acidophilus* bacteria that is found in milk and curd was recorded for making impacts restorative, especially for setting impacts on processing [6]. The colonization makes it development trusted for these microorganisms in stomach that were very essential for their acceptability for the utilization of digestive private that was upheld. In mid 1930 Zeroed Shirota in his discovery on selecting the different types of intestinal microorganisms that may endure the section through stomach and utilization of strains for creating aged milk as for circulation in his facilities. His most memorable item contains *Lactobacillus acidophilus* (therefore titled *L.casei* Shirota) was major reason behind discovery of Yakult organization [7].

How do probiotics function?

Probiotics intake is essential for the wellbeing of a person through diet supplements and this is the easiest way of adding health beneficial good bacterias into the diet, with wide nutritional value, along with boosting the immune system. Probiotic products and supplements gained popularity in recent years. The way of action of probiotics consists of a microflora host for instance, with

improving the balanced microbial interchange of orally applying microorganisms along with microflora inside the digestive system. The regulation as for metabolic activation of the host for example, it stables enzymes design present in digestive system and of immunomodulatory for instance, by activating mucus associate regulations along with immune response. All these actions require strains for activation (Figure 1).

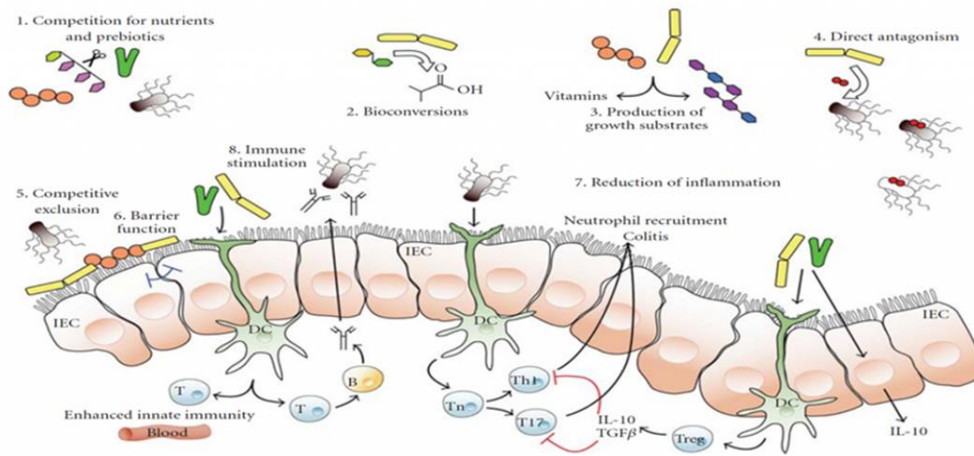


FIG. 1. Mechanism action of probiotics.

Describing the given picture above with known components where probiotic microorganism may have impact on microflora. 1. Competition is required in diet ingredients as it acts as growth substrate. 2. Bioconversion, for instance sugar that is needed in fermentation in food products. 3. Building growth substrate for instance, vitamins, EPS and other microorganisms. 4. Direct banning by bacteria. 5. Competitive binding sites. 6. Better barrier function. 7. Reducing inflammation hence, alters intestinal property. 8. Stimulates innate responses via dendritic cell T-Tells.

Results and Discussion

Some different kinds of probiotic bacteria: (four types of probiotic bacterias are explained below).

Lactobacillus: Over fifty different species of lactobacillus are found in genital, digestive and urinary tract naturally. There are varieties of fermented food products that are consumed as diet supplement, Broad varieties of diseases are treated and used to prevent diseases. *Lactobacillus acidophilus*, *Lactobacillus plantarum*, *Lactobacillus casei* has ability to fight against pathogenic disease causing microorganism that cause skin problems, certain kinds of infections, respiratory infection (Ziemer and Gibson, Amara and Shibl) (Figures 2 and 3).

Lactobacillus acidophilus: *Lactobacillus acidophilus* is probiotic bacteria naturally found in intestine. It has very important role in human life *Lactobacillus acidophilus* produces lactase enzyme that lactase enzyme helps in breakdown of lactose. Lactose is a kind of sugar present in milk. There are also various health benefits of *Lactobacillus acidophilus* in preventing diseases like diarrhoea, improves bowel syndrome and also reduce infections, flu and allergies [8,9].

Streptococcus thermophilus: A large amount of lactase enzyme is produced by bacteria, which helps lactose intolerance [10].

Enterococcus faecium: There are around 58 species discovered, this is present in gut and present in human beings and animals.

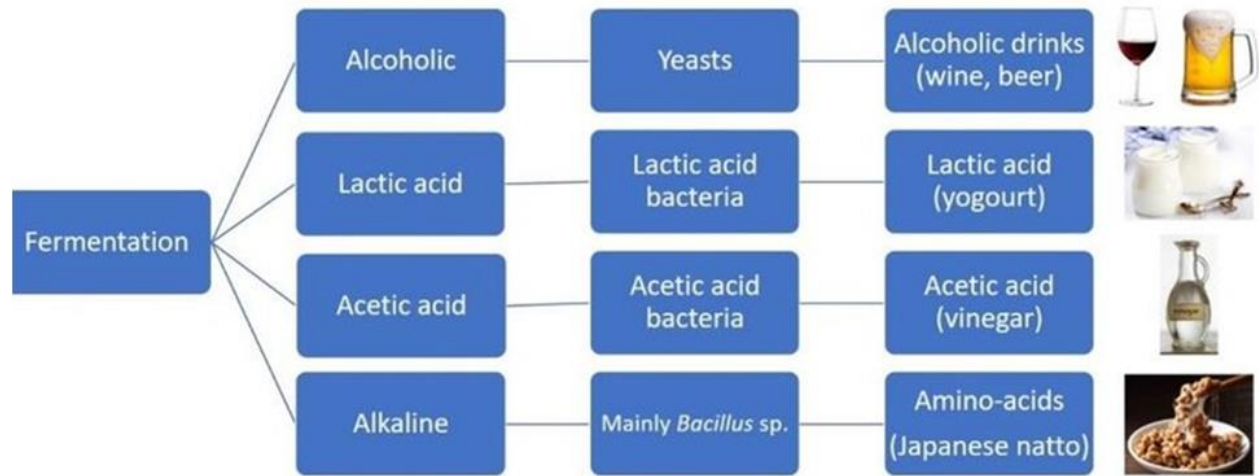


FIG. 2: Showing fermented food products.

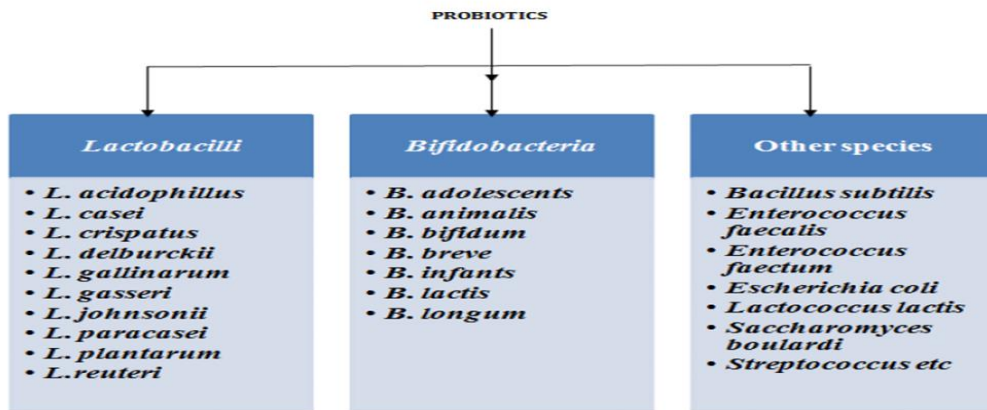


FIG. 3. Probiotic bacteria.

Nourishing effects of probiotics: Lactic corrosive microorganisms (LAB) most regularly age organic products, vegetables and grains. It influences taste and while maturing rice grain, fledglings of bean fledglings and buckwheat, likewise create bioactive parts that benefit incendiary, compromised insusceptibility, glycemic irregularity and weariness conditions.

Nourishing effects of probiotics in swelling: At present, individuals about profoundly worried about their wellbeing. Their expanding centre around sickness anticipation contrasted with fixes. The thought of probiotics and their medical advantages started about 100 years back. The fact that individuals of makes it found Russia and Bulgaria lives prolonged than different populaces since utilize sharp milk consists advantageous microscopic organisms. Probiotics assume a significant part in forestalling furthermore, further developing illnesses like sensitivities, liver issues, digestive infirmities and metabolic conditions prompting diabetes, cardiovascular infections, and stoutness. *E.coli* also, LAB is broadly used for treating incendiary entrail illness, diseases like colon, blockage in light of the fact that lactic corrosive microorganisms straightforwardly convey cytokines to the objective locales inside the host. Examiners demonstrated a critical hindering job of non-microorganism apoptosis acceptance inside cells of carcinoma that safeguards from colon disease.

Probiotics nourishing effects relating dental caries: LAB Probiotic inside butter cheese seemed to be reduced the *S. mutans* (bacteria present in our oral cavity) number in saliva and have vital advantageous effects over dental caries for decreasing the number of *S. mutans* in enamel removing minerals and plaque on teeth. When for decreasing number of *S. mutans* is not dependent over the strain, effects are never similar in each study [11]. There are latest reports on dental caries the wellbeing of person completely dependent over the present state of health microbes. Various diseases causing microorganism gives swelling that is for short duration of time, synbiotic microorganism regulates the immune system response for protecting host from such

diseases.

Healthful impacts of probiotics on diabetes, overweight related problems: Stomach microbes assume a fundamental part in the pathogenesis of bile infection. Probiotics additionally utilized for the treating the infection of liver. There are consequences of a concentrate over kid experiencing essential sclerosing cholangitis treated with mixing the medications over probiotics revealed improved side effects and research facility test experiencing essential expressing the infection of the liver with treatment and mixing of medications and probiotics relieved improved side effects in research facility tests. As per consequence of a concentrate gathering experiencing diabetes, yoghurt that contains probiotics (*L. acidophilus* and *B. lactis*) moved along level of glucose and cancer prevention agent capacity and it was along these lines reasoned that probiotic yoghurt decidedly affects patients diabetes [12]. *B. lactis* assume a part in the improvement of stoutness. Moms and people who are overweight bring forth youngsters with less degree of *B. lactis*. Less number of *Bifidobacterium* upon entering the world is related with overweight issues later in youth. The *Bifidobacterium* level in large grown ups is less when contrasted with slim individuals. Stomach microbe gives open doors to the maturation of non-absorbable mixtures like strands that help the microorganisms. They start producing shorten chain unsaturated fats and gas. The shorten-chain fructose oligosaccharides increment digestive assimilation of magnesium postmenopausal ladies in whose magnesium inadequacy prompts osteoporosis [13].

Probiotic food products and supplements: Functional foods include probiotics and food items which include probiotics are getting increased worldwide for the production of nondairy and dairy food items. Taking into consideration for commercial industrial consequences putting strains of probiotic bacteria become very important issue [14]. Probiotic microorganisms can be consumed in three unique ways that are through dairy food items that can be fermented as well as non-fermented available in market and through supplements that be used for curing minor diseases or fulfilling the deficiency of vitamins.

Dairy food products: There are several dairy food items, that are available in market like milk flavoured milk, flavoured milk, fermented milk, powdered milk, curd, yoghurt, various protein based drinks, cheese, ice cream and baby food products are the most popular and most sold out products on a daily basis. All dairy products available in the market require refrigerated temperature, because this set temperature stabilizes the environment of product to survive and also growth of the probiotic bacteria present in beverages and it also increases the shelf life of the product.

Lactose free food products: According to the available data on the internet more than 50% of people in world cannot tolerate lactose [15]. This major problem has given birth to nondairy based Lactose free probiotic products like cereals, these are fermented in the presence of Probiotic microbes for increasing its nutritional value and in oats cereals there is presence of beta glucans that gives correct value for growth. *L. acidophilus*, *L. casei* and *L. paracasei* are the most popular probiotic microorganisms and are also widely used by food industries for the production of probiotic fruit juices and drinks.

Medical implications of probiotics: Clinical implications of probiotics for gut wellbeing. An upset stomach microflora, brings about a wide scope of side effects compromising the stomach wellbeing and coming about in gastroenteritis. Gastroenteritis is brought about by a few microbes like *Shigella*, *Salmonellae*, *Escherichia coli* *Vibrio cholera* and *clostridium* which may first colonies and afterward fill in the gastrointestinal tract [16]. Then, at that point, they attack the host tissue, or may discharge poisons that upset the capacity of the digestive mucosa and typical stomach vegetation (both their action and equilibrium) causing sickness, retching and loose bowels. The run has turned into a principal worldwide medical issue of late. It could be named intense looseness of the bowels term is under 2 weeks. Tenacious loose bowels span changes from two to four week and 3. The running term is more than four weeks. In many agricultural nations, irresistible gastroenteritis like shigellosis, voyager's the runs TD, anti-infection related loose bowels AAD, intense the incendiary gut disorder and peevish gut condition are normal lethal sickness brought by over 50 different microorganisms that include infections and pathogenic microorganism rotavirus and entero pathogenic *E. coli* (EPEC) are the main sources of endemic pediatric the runs and traveler's looseness of the bowels [17]. They influence all aged gatherings. It has been assessed that serious intestinal pathogenic runs are the primary drive of grimness Furthermore, mortality every year overall. Proof proposes that oral utilization of microorganisms may have a few preventive as well as healing consequences for the stomach greenery. They have a long history of safe use in food sources also; apply hostile consequences for the development of intrusive sharp pathogenic microbes, for instance *Staphylococcus aureus*, *Salmonella typhimurium*, *Shigella*, *Yersinia enterocolitica*, *Vibrio cholera* and *Clostridium perfringens*. Irritable Bowel Syndrome: (IBS) is the most commonly gastrointestinal observed disorder with symbols like, stomach pain, bloating, Intestinal gas, incomplete evacuation. This microflora's can read to bile acid and increases the secretion of mucus resulting in diarrhea this disease is completely curable. About 20% of the adults suffer from this disease, mostly women's. *Bifidobacterium* infants, *E.coli*, L.GG and *Lactobacillus plantarum* are more efficient for IBS [18]. Travellers diarrhoea: Physically fit travelling individuals more commonly get hit with TD characterized that least three casual stools, excretion. This happens because of *E.coli*, thus

pathogenic bacteria, produces the toxic environment and affects the epithelial cells. Hence, decreases the intestine epithelial functioning of cells. *E.coli*, *Salmonella*, *Campylobacter* are the three main Pathogenic bacteria that are the real cause of TD and discomfort. Various scientific studies have found that *L. acidophilus*, *bulgaricus* and *Streptococcus thermophilus* have antimicrobial properties of probiotics against pathogenic microorganisms. Taking these proper strains in dose for about three weeks is very effective against TD [19].

Mechanism of probiotic strain: More than 11 trillion about 600-900 unique species of microbes are inside our gastrointestinal tract and they stay in equilibrium. These are *Lactobacillus clostridium*, *Escherichia* and *Vellonella*. These bacteria start forming colonies in the gut from our birth. These gut microbes gets exposed with pathogens, antigens through food. So, the intestine plays a very vital role between host and outside pathogenic agents. Disease known as asterixis caused with various infection causing pathogenic microorganisms, like *Eschericheia coli*, *Shigella* with a number of food has borne pathogenic microbes, like *Staphylococcus aureus*, listeria. Infections get started when two strains get attached to the surface of the intestinal epithelial wall of cells. Receptors like glycolipids, glycoproteins gives cytotoxic industry, at last gives tight junction in epithelial wall, which gives birth to mucosal infection. Probiotics stimulate the development of important gut microbes which inhibits the development of pathogenic microorganisms. So, probiotics are considered as the therapeutic agents for intestinal infection.

Antimicrobial impacts of probiotics: Probiotic microorganisms are capable of producing wide varieties of substance that are capable of inhibiting gram negative and gram positive bacterias. Hydrogen peroxide, organic acids are included by these bacterias. This combination reduces the counting of pathogenic microorganism along with affecting its metabolic activity through the production of lactic acid. Which leads to reduction of pH level? There are number of health beneficial microorganisms that fight against disease causing microorganisms in our intestine and keep fit and healthy.

Probiotic future studies:

Probiotics play a vital role in dealing with infections and treatment diseases, using various strains, dosage. So probiotic technology is showing increased interest in applications of agricultural science and the food industry. At present probiotic technology has developed within probiotic nano-encapsules.

- Probiotics for healthy pregnancy for women's.
- Type 2 diabetes that include metabolic disorders.
- Probiotic yeasts mechanism action.
- Infant development applications for probiotics and prebiotics.
- Spore former non lactic acid bacteria.

Conclusion

Probiotics got attention through food products, so, the application of the probiotics is that it keeps the gut healthy. Sending probiotics into the body food is the only vehicle. Clinical and scientific research has cleared that probiotics are good for both animal and human health. Consumption of both dairy and nondairy fermented food is beneficial for the gut microbiota. Various new technologies are used by food industries for increasing the shelf life without compromising with nutritional value. Probiotic bacteria through their antimicrobial property help in eliminating and fighting against pathogenic bacterias and boosts immunity. With invention and use of new technologies probiotics in upcoming years will for sure become an important ingredient in nutraceutical applications outside supplement and pharmaceutical industry.

References

1. Lourens-Hattingh A, Viljoen BC. Yogurt as probiotic carrier food. *Int Dairy J.* 2001;11(1-2):1-7.
2. Tamime AY, Saarela MA, Sondergaard AK, et al. Production and maintenance of viability of probiotic microorganisms in dairy products. *Probiotic Dairy Prod.* 2005;3:39-63.
3. Ouwehand AC, Lahtinen S, Nurminen P. *Lactobacillus rhamnosus* HN001 and *Bifidobacterium lactis* HN019. John Wiley and Sons, USA, 2009;473-477.
4. Cassani L, Gomez-Zavaglia A, Simal-Gandara J, et al. Technological strategies ensuring the safe arrival of beneficial microorganisms to the gut: From food processing and storage to their passage through the gastrointestinal tract. *Food Res Int.* 2020;129:108852.
5. Fenster K, Freeburg B, Hollard C, et al. The production and delivery of probiotics: A review of a practical approach.

- Microorganisms. 2019;7(3):83.
6. Gomez-Gil B, Roque A, Velasco-Blanco G, et al. Culture of *Vibrio alginolyticus* C7b, a potential probiotic bacterium, with the microalga *Chaetoceros muelleri*. *Aquaculture*. 2002;211(1-4):43-48.
 7. Hagi T, Tanaka D, Iwamura Y, et al. Diversity and seasonal changes in lactic acid bacteria in the intestinal tract of cultured freshwater fish. *Aquaculture*. 2004;234(1-4):335-346.
 8. Metchnikoff I, Chalmers Mitchell P. *Nature of Man or Studies in Optimistic Philosophy*. Putnam, New York, USA. 1910.
 9. Metchnikoff I. *The Prolongation of Life: Optimistic Studies*. Springer, New York, USA. 2004.
 10. Dekker J, Collett M, Prasad J, et al. Functionality of probiotics potential for product development. *Forum Nutr*. 2007;60:196-208.
 11. McMaster LD, Kokott SA, Reid SJ, et al. Use of traditional African fermented beverages as delivery vehicles for *Bifidobacterium lactis* DSM 10140. *Int J Food Microbiol*. 2005;102(2):231-237.
 12. Gionchetti P, Rizzello F, Venturi A, et al. Oral bacteriotherapy as maintenance treatment in patients with chronic pouchitis: a double-blind, placebo-controlled trial. *Gastroenterol*. 2000;119(2):305-309.
 13. Santos DD, Calaça PR, Porto AL, et al. What differentiates probiotic from pathogenic bacteria? The genetic mobility of *Enterococcus faecium* offers new molecular insights. *OMICS: J Integr Biol*. 2020;24(12):706-713.
 14. Satokari R. Modulation of Gut Microbiota for Health by Current and Next-Generation Probiotics. *Nutrients*. 2019;11(8):1-4.
 15. Heidebach T, Först P, Kulozik U, et al. Microencapsulation of probiotic cells by means of rennet-gelation of milk proteins. *Food Hydrocoll*. 2009;23(7):1670-1677.
 16. Taskın B. Evaluation of the Antimicrobial Effect of Kefiran Extract against Some Plant Pathogenic Bacteria'. *Turk J Agric Food Sci Technol*. 2020;8(4):889-894.
 17. Krishnakumar V, Gordon IR. Probiotics: challenges and opportunities. *Dairy Ind Int*. 2001;66(2001):38-40.
 18. Kulp WL, Rettger LF. Comparative study of *Lactobacillus acidophilus* and *Lactobacillus bulgaricus*. *J Bacteriol*. 1924;9(4):357-395.
 19. Weizman Z, Asli G, Alsheikh A, et al. Effect of a probiotic infant formula on infections in child care centers: comparison of two probiotic agents. *Pediatrics*. 2005;115(1):5-9.