

J. Sci. Trans. Environ. Technov. 2019, 13(1): 37-39

Scientific Transactions in Environment and Technovation

The known and unknown facts on probiotics – A review

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https://doi.org/10.56343/STET.116.013.001.008 http://stetjournals.com

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Abstract

Micro organisms are ubiquitous and play a vital role in the sustenance of life. Various biogeochemical cycles are mediated by the microorganisms. Similarly the animals including human beings harbour millions of micro organisms. The microbiota of the gastrointestinal tract influences health and well being of human and animals. The beneficial microorganisms are called probiotics. The probiotic microorganisms include Lactobacillus, Biofidobacterium, Exterococus, Leuconostoc and Lactococcus, etc., such organisms should have the specific properties to survive in the gut environment and should have beneficial effect and should not cause any harm to the host.

Key words: Biofidobacterium, Exterococus, Gut, Intestinal tracts, Microorganism, Probiotics, , Leuconostoc and Lactococcus

Received : March 2018

Revised and Accepted : January 2019

INTRODUCTION

Many microorganisms are non-pathogenic and are useful and even essential for the existence of life on earth. One such group of beneficial microorganisms are those which inhabit the gastrointestinal tract of animals. The microbiota of the gastrointestinal tract influences health and well-being of humans and animals. A beneficial association of microorganisms on the human host was probably first suggested by Doderlein *et al.* (1892) who proposed that vaginal bacteria produced lactic acid from sugars to prevent or inhibit the growth of pathogenic bacteria. Such lactic acid bacteria were also found in association with fermented milk products and were advocated for their health benefits by Metchnikoff in 1908.

It has been considered that the long life span and good health of the Bulgarian people to be related to their intake of fermented milk products which could prevent "fouling" in the large intestine and as a result, if consumed regularly, would lead to a longer and healthier life (Metchnikoff, 1908). The author suggested that the substitution of gut microbes by Yoghurt bacteria might be beneficial to the human. This paved the idea of using microbes to promote good

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health and to prevent diseases. These friendly microorganisms are called 'probiotics', meaning 'for life'.

Elie Metchnikoff, a Russian physiologist and Nobel Prize winner is credited for inventing probiotics in 1907. This concept was developed further through the decades, and today, especially in Europe and Japan probiotic-focused research, product development and marketing are at an all-time high.

Before knowing about how probiotics works, it is important to know about the microbiology and physiology of human gastrointestinal tract. It has been estimated that there are about 10¹⁴ bacterial cells that make their homes in humans, especially 400 different species of bacteria are found in the gut, In fact it even exceeds the human population, Based on this fact it is very clear that the microbes have been found to play an important role in human health.

Most of these bacteria are not harmful and it facilitates the normal human growth and development. But some of these bacteria can have negative effects on the host. So it is important to maintain the balance of microbes to favour the beneficial bacteria over the potentially, harmful one. The composition of gut microflora varies with age, diet, environment, stress and medication of the host.

The microbes present in the gut provides various benefits to the host such as bringing out the complete digestion of any food components that are not digested in the small intestine, such as lactose in lactose

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intolerant people or fibers resistant to the enzymes they encounter in the small intestine .

Prebiotics are defined as non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and or the activity of one or a limited number of bacteria in the colon (Gibson and Roberfroid, 1995).

Similarly some intestinal microbes produce vitamins, such as biotin, pantothenic acid and vitamin B12 and it is important for the maturation of the immune system, the development of normal intestinal morphology and in order to maintain a chronic and immunologically balanced inflammatory response. It also helps in the prevention of the attachment of pathogenic microorganisms and the entry of allergens to the gut.

Probiotics is originally defined as "Microorganism promoting the growth of other microorganism" (Lilly and Stillwell, 1965). Probiotics according to present day interpretation refers to viable microorganisms that promote or support a beneficial balance of the autochthonous microbial population of the gastrointestinal tract (GT). Such microorganisms may not necessarily be constant inhabitants of the GT, but they should have beneficial effect on the general and health status of man and animal (Parker 1974; Fuller, 1989).

In the recent years, Probiotics have been defined more precisely as "mono or mixed cultures of live microorganisms which, when applied to animals or humans beneficially affect the host by improving the proportion of the indigenous microflora (Havenaar *et al.*, 1992). In relation to food, Probiotics are considered as "viable preparations in foods or dietary supplements to improve the health of humans and animals (Salminen *et al.*, 1998).

According to these definitions an impressive number of microbial species and genera are considered as probiotics. However only those strains that are classified as Lactic acid bacteria (LAB) are considered of importance with regard to food and nutrition. Among the numerous intestinal microbes, those that are expected to beneficially affect the host by improving the intestinal microbial balance, and hence are selected as probiotics and include species of genera Lactobacillus, Bifidobacterium and Enterococcus (Fuller 1991, Goldin et al, 1992). Bifidobacterium sp. that specifically inhabits the intestinal tracts of animals such as Bifidobacterium thermophilum and Bifidobacterium pseudolongum, are used in animal probiotics (Abe et al., 1995). Some bacteria that do not normally inhabit the intestinal tract may also come under the category of probiotics. They are used as starters in dairy products and include mainly Lactobacillus bulgaricus, Streptococcus thermophilus and

Leuconostoc and *Lactococcussp*. However, these bacteria do not colonize the intestinal tract and their effect on intestinal microbial balance is expected to be small (Alm, 1991).

Organism other than lactic acid bacteria, which are being used in probiotic preparations, include *Bacillus* sp. Yeasts (*Saccharomyces cerevisiae,S. boulardii*) and filamentous fungi (*Aspergillusoryzae*) (Green *et al.*, 1999).

According to Steinkraus (1995) the traditional fermented foods contain high nutritive value and developed a diversity of flavors, aromas and textures in food substrates.

Probiotic preparations may be presented in the form of powders, tablets, capsules, pastes or sprays.Most probiotic foods in the markets worldwide are milk based and very few attempts are made for the development of probiotic foods using other fermentation substrates such as cereals. The development of non-dairy probiotic products is a challenge to the food industry, to utilize the abundant natural resources such as dietary fibre, proteins, energy, minerals and vitamins, for producing high quality functional products. But now a days Cereals such as malt, rice, corn, wheat, sorghum, milk, oats and soya are used as substrate for lactic acid fermentation based on their availability of nutrients such as carbohydrates, amino acids, peptides, salts, vitamins, minerals, etc., as these nutrients are required for the growth of probiotic microbes. Other than the cereals, brined olives, salted gherkins and sauerkraut contain high concentration of *Lactobacilli* (Molin, 2001).

Currently, there are wide ranges of probiotic products commercially available to consumers. Such products are, animal feeds, dairy foods, infant and baby foods, fruit juice based products, cereal based products and pharmaceuticals.

Probiotics must meet several basic requirements for the development of marketable probiotic products. The most important requirements include (i.) The organism should survive in sufficient number in the product. (ii) Their physical and genetic stability during storage of the product be guaranteed, (iii) all of their properties essential for expressing their health benefits after consumption be maintained during manufacture and storage of the product, (iv) it should not have adverse effects on the taste or aroma of the product and, (v) it should not enhance acidification during the shelf life of the product.

Microbial probiotics should have a beneficial effect and shouldn't cause any harm to the host. So all the strains have to be checked prior to use in humans or animals and thus are given GRAS (Generally Regarded as Safe) status.

E - ISSN 2393 - 9249

July to September 2019

P - ISSN 0973 - 9157

Every strain which is going to be used as probiotics should undergo safety evaluation test such as ability of the cells to produce metabolites and enzymes, interactions with host, especially in pathogenicity, resistance to gastric acidity and bile toxicity, adhesion to gut epithelial tissue, ability to colonize the gastrointestinal tract, production of antimicrobial substances and ability to modulate immune response, viability etc.,

Eventhough probiotics have a lot of beneficial effects on humans, on rare occasions, they may develop a pathogenic relationship with a host, and illness or death of the host can result. Negative influences on human health occurs only when there is an abnormality in the host such as chemoteraphy, lower immunity, imbalance in the normal flora, presence of excessive amount of Lactobacilli, etc., So proper care must be taken to maintain the balance of microflora for the beneficial effects and to prevent the negative impacts.

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