

## **Role of Probiotics in Health Improvement: Adaptations, Advantages and their Uses**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/AFSJ/2018/41026

#### Editor(s):

(1) Charalampos Proestos, Assistant Professor, Department of Chemistry, National and Kapodistrian University of Athens, Greece.

#### Reviewers:

(1) Lucian Ioniță, Romania.

(2) R. Prabha, Karnataka Veterinary, Animal and Fisheries Sciences University, Bangalore, India.

Complete Peer review History: <http://prh.sdiarticle3.com/review-history/24457>

**Review Article**

**Received 16<sup>th</sup> February 2018**

**Accepted 24<sup>th</sup> April 2018**

**Published 4<sup>th</sup> May 2018**

### **ABSTRACT**

The probiotics especially lactic acid bacteria (LAB) are usually found in human mucous layers, dairy items and on some plant surfaces. These are assumed to be a basic part for nourishment generation and welfare conservation for human beings. There is an expanding fervor for these species to uncover the numerous possible medical advantages related with them. The activities of LAB's are depend on species or strain particular, and rely upon the measure of the number of beneficial microscopic organisms accessible in the gastrointestinal tract. Probiotics are having beneficial effect on human health therefore, with this paper, probiotics are acknowledged as characteristic way to safeguard nourishment and advance welfare. The paper present to survey the brief and current information regarding probiotics in the safeguarding of nourishments, their role in the gastrointestinal tract, and its medical advantages.

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**Keywords:** Probiotics; immunomodulation; lactic acid bacteria; gastrointestinal tract; health.

## 1. INTRODUCTION

Probiotics are live miniaturized scale life forms that managed in satisfactory amount, into gastrointestinal tract confer a health benefit to the host' (FAO/WHO, 2002) [1]. Probiotics are described as microorganisms that are acknowledged to give restorative favourable circumstances when used. The genera that contain the LAB are at its core *Lactobacillus*, *Leuconostoc*, *Pediococcus*, *Lactococcus*, and *Streptococcus*, and in addition the more fringe *Aerococcus*, *Carnobacterium*, *Enterococcus*, *Oenococcus*, *Porolactobacillus*, *Tetragenococcus*, *Vagococcus*, and *Weissella*. Lactic acid bacteria (LAB) are Gram-positive, non-sporulating, anaerobic or facultative high-impact cocci, which produce lactic acid after hydrolysis of starch [2]. Increasing number of studies demonstrate that the imbalance of such probiotics microscopic organisms in our stomach can be related the development of various diseases and illness. LAB's are either utilized as normally or chose starters in nourishment maturations where they perform fermentation of glucose containing molecules to the lactic acids [3]. Atomic organic techniques have expanded the quantity of genera incorporated into this gathering [3]. The administration utilizing these probiotics enhances nourishing estimation of sustenance items expanding the amount, accessibility, absorbability and assimilability of supplements. The basic part of probiotic lactic acid bacteria is the development of control of diet waste and pathogenic microorganisms [4]. They can improve lactose digestion, play a role in preventing and treating diarrhea and positively act on the immune system, helping the body to resist and fight infections. Common antimicrobial substances are considered as suitable other option to anti-infection treatment and a superior pharmaceutical approach [5]. The agriculture application of probiotics with respect to creature, fish, and plants generation has expanded bit by bit. Nonetheless, various vulnerabilities concerning innovative, microbiological viewpoints exist. [6,7].

## 2. ADAPTATION AND IMPORTANCE OF PROBIOTICS

Microbes are not all very bad. Over and over again one can relate microscopic organisms to germs and harmful microorganisms that resident micro flora without infection. The fact of the matter is the human body is comprised of billions

of microscopic organisms without them human of which we would not survive [8]. The expression "probiotics" identifies with sustenance's and wholesome supplements that contain these same "great" microscopic organisms found in the body [9,10,11]. The mammalian digestive tract is colonized by 100 trillions of microorganisms (called "microbiota" of the gut) that are fundamental for welfare of human health [12,13]. The move from soil and plants to the creature gut has three zones of genomic adjustment imperviousness to host obstructions, grip to intestinal cells, and maturation of a few substrates in the gut. The layer lipid organization is influenced by low pH and acidity salts [14,15].

Along with being found in nutritional supplements there are many foods that contain probiotics such as: miso, yogurt, fermented and unfermented milk, and various juices and soymilks. The importance of various probiotics and their brief uses for sustaining life are described in following [16,17,18].

1. Probiotics can reduce symptoms of diarrhea, especially when it is caused by taking certain antibiotics
2. Probiotics may prevent and treat yeast infections and urinary tract infections (UTI)
3. Probiotics may be an effective treatment for irritable bowel syndrome (IBS)
4. Probiotics can minimize the occurrence of bladder cancers
5. Probiotics can lessen the severity and duration of intestinal infections
6. Probiotics have been shown to reduce inflammation following colon surgery
7. Probiotics can be used to treat eczema and asthma in children.
8. Reduce the effect of the first attack of harmful compounds, instead of our cells, by their biofilm, therefore protects our digestive system.
9. Reduce the amount of food needed by our bodies due to the correct digestion and metabolism of any amount of food.
10. In some cases Probiotics could complement the deficiency in our genetic materials by helping us to borrow the products of their genes (such as in case of the lactose fermentation deficiency).
11. Probiotics promote health while they:
12. Remove the side effect of the pathogens and other or the harmful microbes.
13. Supply the useful bioproduct to body.

14. Reduce the jobs of our digestive system.
15. Can mature our sustenance and advance our wellbeing in the wide range of organ system.
16. Sometimes probiotics working as Specific anti-toxic medicines, where they are required to be influenced seriously, in day to day life [19].

Here we should highlight that, Probiotics or anything in our lives should not exceed from a certain limit and should be used wisely to give the best expected results for human body [20,21,22].

Traditional *Chinese medicine* (TCM) are naturally known about the advantages of Probiotics for quite a long time, and regularly consolidate their utilization with conventional TCM herbology medications or modalities, for example, needle therapy. There is mounting proof for the utilization of such complimentary medicines. [23,24,25]. A current report distributed by two American doctors in the Journal of the American Academy of Asthma and Immunology reasoned that regulating the Chinese therapeutic herbs Gan Cao, Ku Shen, and Ling Zhi, alongside probiotics positively affected Asthma in kids [26,27,28,29].

### 3. NANOENCAPSULATION AND HEALTH BENEFITS OF PROBIOTICS

Nanoencapsulation is the biggest part of the nanotechnology prospective in the food industry based on nano technology [30,5]. Nanotechnology can reduce the amount of active ingredients Nanoencapsulation can be used to design the probiotic bacteria preparation of delivery at the specific part of the gastrointestinal tract [31,32,33,34]. Encapsulated forms of ingredients accomplish longer shelf life of realistic usability of the item [35,36,37,38]. Nanoencapsulation is desirable to create designer probiotic bacterial arrangements that could be conveyed to specific parts of the gastrointestinal tract where they collaborate with particular receptors. A starch-like nanoparticle can to stop lipids from oxidizing and therefore improve the stability of oil-in-water emulsions [39,40,41,42].

Nanoencapsulation of gainful probiotics microorganisms is advantageous as that focused on site particular of the gastro-intestinal tract for proper working of probiotics bacteria [26,43,44,45,46]. Furthermore, these nanoencapsulated creator bacterial

arrangements can be utilized as a part for immunization planning too to enhance the immunity (29) [47,48].

Probiotics can turn many health benefits to the human, animals, and plant. Some of these advantages have been very much achieved and built up, while the others have demonstrated a promising potential, with human examinations required to substantiate these cases [49]. The advantages of probiotic microscopic organisms are exceptionally strain particular; hence, there is no general strain that would give all proposed benefits and not all strains of similar species are successful against characterized wellbeing conditions [49]. The objective of probiotic food items is to have up to  $10^7$  CFU/g towards the finish of their time span of usability [50,51]. At present, a few very much described strains of Lactobacilli and Bifidobacteria are accessible for human use to decrease the danger of gastrointestinal (GI) diseases [47]. However probiotic lactic acid bacteria (LAB) must pass through a several growth inhibitor to guarantee they achieve the satisfactory numbers in the objective area to evoke their impact. The three significant areas of the human gastrointestinal tract are the stomach is essentially possessed by high-impact gram-positive microorganisms ( $<10^3$  CFU/g) [52,53,54,55,56]. The small digestive tract is occupied by the genera *Lactobacillus*, *Bifidobacterium*, *Bacteroides*, and *Streptococcus* ( $10^3 - 10^4$  CFU/g). Also, the large intestine is populated by the genera *Bacteroides*, *Fusobacterium*, *Lactobacillus*, *Bifidobacterium*, and *Eubacterium* in huge numbers ( $10^{11} - 10^{12}$  CFU/g). There are many reports of the probiotic impact of LAB [57,58,59,60,61]. A list of the major classes of probiotic bacteria listed in the following Table 1 [62,63].

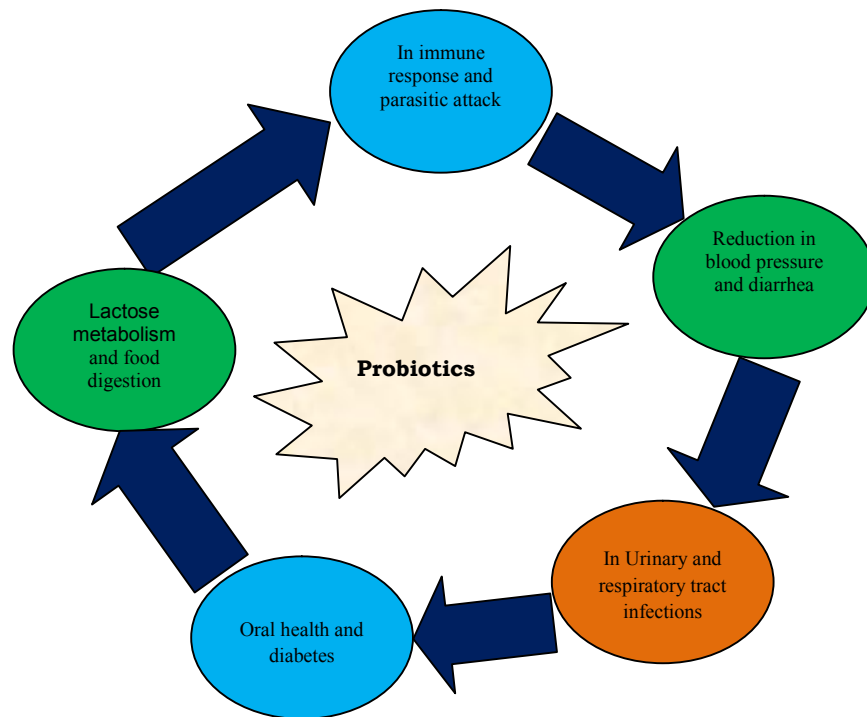
Probiotics probably apply a double impact, forestalling the intestinal colonization with pathogen microorganisms [26,8,64]. Or connecting with the gut-related lymphoid tissue (GALT) to forestall provocative reactions and advance a condition of resistance to themselves and potentially to sustenances [65]. The helpful impacts of probiotics are regularly dissimilar and strain-particular [66]. A few animal categories presented valuable impacts, for example, the treatment of intense looseness of the bowels related with rotavirus [67], ulcerative colitis [68,69]. *Clostridium difficile*-related loose bowels [70]. and *Helicobacter pylori* disease [71,72,73]. Probiotics which are traditional idea in the human food have been extended to animals by

developing fortified feed with intestinal microbiota to benefit the animals. Different impacts are on liver infection, hypersensitivity, or, then again AIDS. Previous studies [66,74,75]. Revealed a reduction of necrotizing enterocolitis in preterm newborn children if *Lactobacillus* and *Bifidobacterium* colonize the digestive system, or if bosom drain instead of recipe is utilized. Gewolb et al. [76], revealed that untimely babies conveyed by caesarian segment did not endure the ordinary procedure by which LAB are ingested by means of vaginal birth and spread by the mother's drain, enabling pathogens to build inside the early digestive tract [77,78]. There is no consistency in the sort or mix of probiotics utilized. In various reviews where just a single probiotic strain was utilized there was not huge factual change in the rate of necrotizing enterocolitis; yet when at least two probiotic

strains were utilized as a part of blend, a diminish in the occurrence was watched [79,80]. Furthermore, Studies recommend that probiotics can enhance the invulnerable framework capacities, for example, by diminishing upper respiratory tract infection (in grown-ups also), and by supplying the requirement for anti-infection agents. So also, de Silva et al. [81,82] played out a precise investigation of approaches to avert the improvement of nourishment hypersensitivity in youngsters and grown-ups. Among a few factors, probiotics did not appear to be defensive in babies at high or typical hazard [83]. done a learn about the adequacy and wellbeing of probiotics use in immunocompromised disease patients, as case reports distinguished a *Lactobacillus* strain utilized as a part of probiotic treatment to be required with bacteraemia and sepsis [84,85].

**Table 1. Families of probiotic microorganisms**

<b>Lactobacilli</b>	<b>Bifidobacteria</b>	<b>Other microorganisms</b>
<i>Lactobacillus acidophilus</i>	<i>Bifidobacterium bifidum</i>	<i>Bacillus clausii</i>
<i>L. acidophilus</i> La-1	<i>B. breve</i>	<i>Escherichia coli</i> Nissle 1917
<i>L. casei</i>	<i>B. infantis</i>	<i>Saccharomyces cerevisiae</i> (boulardi)
<i>L. reuteri</i>	<i>B. longum</i>	
<i>L. rhamnosus</i>		
<i>L. bulgaricus</i>		
<i>L. plantarum</i>		



**Fig. 1. Probiotics health beneficial application [86,87]**

At finally lactic acid bacteria (LAB) are great possibility to create novel oral vectors for mucosal conveyance systems, to cure the diseases and improve health benefits, more over for lessened pathogens constituting alluring other options to lessened pathogens. Bermidez-Humarán et al. [88,89]. Have focused in improvement of hereditary of *Lactobacillus lactis* for such improvements [44,90,91].

#### 4. FRUIT / VEGETABLE-BASED AND OTHER PROBIOTICS PRODUCTS

The fruits and vegetables are rich in the functional food components such as sugar amino acids. Fruit juices are already being used as carriers of probiotic bacteria in a limited amount [92]. Probiotic microorganisms found in such organic product items give a promising territory to investigation, particularly due of their capacity to endure acidic environment [93,94,95,96,97].

Yogurt and milk are the most well-known vehicles of probiotics among dairy items. In any case, alternative carrier, for example, cheese seems to be appropriate. Cheeses have various points of interest over yogurt and matured milks since they have higher pH (6.57–6.85) and buffering limit, , high vitality, more strong consistency, generally higher fat substance, and longer shelf life [83,84].

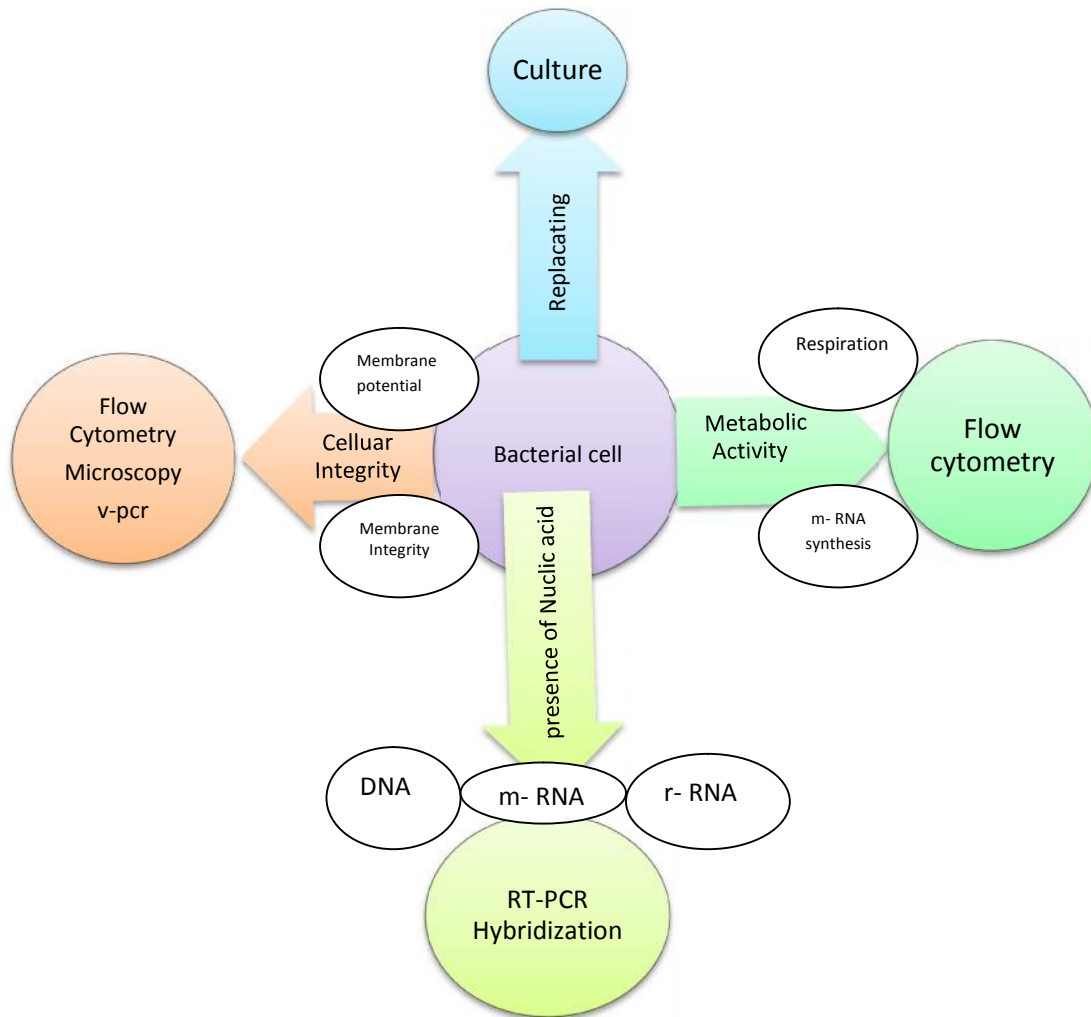
#### 5. TECHNIQUES FOR ANALYSIS AND QUANTIFICATION OF PROBIOTICS BOTH CULTURE AND NON CULTURE (METAGENOMIC) TECHNIQUES ARE BEING USED

*In situ* techniques are accessible certain dairy items, for example, from the International

Organization of Standardization (ISO) in regards to count models for *Lactobacillus acidophilus* (ISO 20128/IDF 192:2006) and *Bifidobacterium* (ISO 29981/IDF 220:2010) .No single culture-based procedure is appropriate to all probiotic microorganisms [98], due to the inconsistency among species or strains. The selective factors influencing the viability of seventeen LAB and probiotic strains were evaluated in the present study in order to optimize plating methodology. Latest new culture-free techniques have been used to precisely identify probiotic strains in view of practicality [99,100,101,102]. These strategies either utilize colours to separate live and dead cells, measure the cell layer uprightness, or describe some part of metabolic movement (blend of nucleic acids, or breath). Confocal filtering laser microscopy builds de affectability and empowers the perception of subsurface structures of nourishments in situ [103,104]. The utilization of this system in blend with the quantitative polymerase chain response (qPCR) has been utilized for the identification of probiotic strains in cheese cheddar [105,106]. Detection of nucleic acid sequence (DNA, mRNA and rRNA) is a molecular technique that can be connected to bacterial count. Most molecular investigations target amplification of nucleic acid to boost affectability. DNA amplification by PCR was researched for enumeration of live microscopic organisms in light of the suspicion that DNA would be degraded more quickly after cell damage than other cell components and that in place DNA sequence would demonstrate cell suitability [61,107,108]. Ethidium monoazide PCR or propidium monoazide PCR is developing procedures that farthest point identification to live cells and can likewise be alluded to as feasibility PCR (vPCR) [109,110]. Cell sorting techniques (Coulter counters and stream cytometry) were

**Table 2. The Fruit and Vegetable-based probiotic product [110]**

Category	Product
Fruit and vegetable based	Cranberry, pineapple, and orange juices
	Ginger juice Grape and passion fruit juices Cabbage juice
	Carrot juice
	Noni juice
	Onion
	Probiotic banana puree
	Nonfermented fruit juice beverages Blackcurrant juice
	Vegetable-based drinks
	Fermented banana pulp
	Fermented banana Beets-based drink
	Tomato-based drink
	Many dried fruits Green coconut water
	Peanut milk



**Fig. 2. Culture and non-culture based techniques to assess viability of probiotic strains [9,10,11]**

initially created for numbering red blood cells; however they have been redesigned and adjusted to break down substantially cell lifter is a tool for harvesting stem cell, for example, microorganisms [98]. Alternative methods, such as fluorescent in situ hybridization (FISH), nucleic acid amplification techniques such as real-time quantitative PCR (RT-qPCR or qPCR), reverse transcriptase (RT-PCR), propidium monoazide-PCR, and cell sorting techniques such as flow cytometry (FC)/fluorescent activated cell sorting (FACS) offer the potential to enumerate both culturable and Viable but nonculturable (VBNC) bacteria [108].

Stream cytometry permits the investigation of an expansive number of cells at once, recording, for every occasion (microscopic organisms) a few parameters [67,111,112]. Diverse fluorescent tests can be connected to analyze the physiological attributes of probiotic living cells, such cell film respectability, intracellular chemical action, cytoplasmic pH, and layer potential [113,114].

## 6. CONCLUSIONS AND FUTURE PERSPECTIVES

The desires of probiotic microscopic organisms have turned into the most requesting for any

bacterial gathering. Probiotics have turned into an essential component to ordinary well being sustenance items, and their worldwide market is assessed previously US\$28.8 billion by 2015 [55]. Purchasers are exceptionally worried of concoction additives and handled nourishments, despite the fact that it gives a review of well being and nourishment assorted qualities never observed. Be that as it may, shoppers acknowledge effortlessly lactic acid bacteria (LAB) as a characteristic approach to save nourishment and advance their well being. In the most recent decade the enthusiasm for bacteriocins created by lactic acid bacteria (LAB) has expanded drastically [40,34,43]. The applicability of probiotics in food items depends all in all on factors like water action, handling and capacity temperature, timeframe of realistic usability, oxygen content, pH, mechanical pressure, salt substance, also, substance of other destructive or essential ingredients. In any case, there are a wide range of sorts of pathogens in nature, so the particular utilization of a specific bacteriocin can't dispense with every single bacterial pathogen. Lately, the expanded number of multi-medication safe pathogens has turned into a difficult issue. The improvement of another era of antimicrobial operators is a troublesome assignment. Biotechnological techniques are been connected to make new or multi-functional bacteriocins, so they could be broadly utilized as a part of sustenance, creature cultivation, and prescription. Both conventional cell culture strategies, and in addition the option systems (coordinate imaging and visual list, nucleic corrosive based specification techniques, and stream cytometry and cell sorting), offer points of interest and confinements for specifying probiotic microorganisms [98]. The new strategies and methods indicate significant guarantee for evaluating live microorganisms in various metabolic states. In any case, the probiotic viability can't be anticipated exclusively on the premise of reasonable cells. [115,116,117]. Probiotic organisms are crucial for the maintenance of balance of human intestinal microbiota [118,119]. Numerous scientific reports confirm their positive effect in the host. Probiotics ingredients are one of the largest functional food. Resulting studies are expected to assess the well being advancing movement of probiotic microscopic organisms.

## ACKNOWLEDGEMENT

The authors are thankful to Department of Molecular Biology & Genetic Engineering

(MBGE), CBSH, GBPUAT, Pantnagar, Uttarakhand for providing necessary facilities for preparation of this review article.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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