

Review on Lactic Acid Bacteria us Probiotics mechanisms and its Health Advantages

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ABSTRACT

Probiotic bacteria have turn out to be increasingly famous during the last two decades as a result of the continuously expanding scientific evidence pointing to their beneficial outcomes on human health. Against numerous enteric pathogens due to their unique capability to compete with pathogenic microbiota for adhesion sites, to alienate pathogens or to stimulate, modulate and alter the host's immune reaction by means of starting up the activation of precise genes in and outside the host intestinal tract. Probiotics have additionally been shown to regulate fats storage and stimulate intestinal angiogenesis. As result they have been implemented as numerous products with the food industry having been very energetic in analyzing and selling them. Within this marketplace the probiotics were incorporated in various products, specially fermented dairy ingredients. In mild of this ongoing trend and no matter the strong medical proof associating these microorganisms to numerous health advantages, further research is needed in order to establish them and compare their protection in addition to their dietary aspects. The purpose of this paper is to review the current documentation on the concept and the possible beneficial properties of probiotic bacteria in the literature, focusing on those available in food.

Keywords: Probiotics; Lactic Acid Ba; Health

INTRODUCTION

Industrialization of biotechnological transformation of the food stuffs has increased the monetary significance of lactic acid bacteria (LAB) because they play an important role inside the senatorial and protection factors of fermented foods. Similarly, hobby within the use of LAB has notably elevated globally due to their nutraceutical role (Leisner *et al.*, 1999). Lactic acid bacteria are broadly dispensed in nature and able to promote fermentation by way of utilization of foods vitamins and convey a variety of substances like organic acids, fragrant compounds, health gain-materials, and so forth (O'Shea *et al.*, 2012). *Lactobacillus*'s is one of the diverse and phylogenetically heterogeneous orders of lactic acid producing microorganism that consist of the sort genus *Lactobacillus*, as well as the genera *Facklamia*, *Granulicatella*, *Leuconostoc*, *Pediococcus*, and *Streptococcus*. They utilize carbohydrates fermentative and produce lactic acid as a primary end product (Aguirre and Collins, 1993). Lactic acid bacteria (LAB) are characterized as gram-positive, non-motile, non-sporulation microorganism that

produce lactic acid as a prime manufactured from fermentative metabolism. Generally recognized as safe and may be used well for clinical and veterinary programs (Hoque *et al.*, 2010). *Lactobacillus* is composed of over 170 species and 17 sub-species which might be validly published and have top status in nomenclature. In humans, they are indigenous inside the gastrointestinal tract and vagina. Within the human gastrointestinal tract, there's a spread of ecological niches and numerous lactobacilli inclusive of *L. fermentum*, *L. plantarum*, *L. casein*, and *L. rhamnosus* that have been removed from the gut. *L. antri*, *L. gastricus*, *L. kalixensis*, *L. reuteri*, and *L. ultunensis* were removed from the intestinal mucosa (Roos *et al.*, 2005).

Further, lactobacilli are critical microorganism in food microbiology and human nutrition because of their contribution to fermented food manufacturing and their use as probiotics in foods and prescription drugs (Bernardeau *et al.*, 2006). Probiotics have been defined as live microorganisms, which when consumed inadequate amounts as part of food; confer a

health benefit on the host (Joint and FAO/WHO, 2001.). A number of studies have examined the role of probiotics in prevention and/or control of intestinal infections, inflammatory bowel disorder and irritable bowel syndrome, respiration tract infections, urogenital infections, periodontal ailment, halitosis and hypersensitive reactions (Martinez *et al.*, 2015). Probiotics are beneficial bacteria which either imparts overall general wellbeing in the host or has intended specific applications such as treating selected health conditions viz: gut inflammation in humans, enhancing the feed conversion and body weight gain in livestock or suppressing transmissible disease in poultry (Ammor *et al.*, 2007). Though, regardless of the promising evidence, the position of probiotics in human health as well as the safety in their utility need to be similarly investigated as the modern-day knowledge of the traits which can be vital for their capability in the gut is not complete. The purpose of this paper is to review the current documentation on the concept and the possible beneficial properties of probiotic bacteria in the literature, focusing on health benefits, selection criteria and its mechanism.

REVIEW OF LITERATURE

Taxonomy of Lactic Acid Bacteria

Fundamental terms and ideas in bacterial taxonomy, Taxonomy or systematic can be described as the technique of cataloguing biodiversity, as it's miles the medical examiner of the diversity of organisms with the last intention of characterizing and arranging them in an orderly manner (Felis and Dellaglio, 2007). Class, identification and nomenclature are the three separate however related sub disciplines of taxonomy. Classification is the system of clustering organisms into taxonomic organizations (taxa) on the premise of similarities or relationships.

Nomenclature is the assignment of names to the taxonomic organizations in keeping with worldwide policies. Ultimately, identity is the system of figuring out the belonging of a brand new isolate to one of the hooked up and named taxa (Holt *et al.*, 1989). Bacterial taxonomy is an area of developing interest: it has implications for lots fundamental clinical and applied fields and therefore, in some way, it underpins all biological research (Tautz *et al.*, 2003). Therefore it's far taken into consideration to have a 'philosophical' root, derived from human desire to apprehend and understand the sector, which calls for a logical ordering of items (Rosselló-

Mora, 2005). Moreover it has a strong practical motivation classification schemes, if reliable, could be predictive and allow quick characterization of new isolates based on similarity with known taxa; identification procedures allow confirmation of the identity of strains used, for instance, in patented industrial processes; finally, correct nomenclature allows not only scientific communication but also unequivocal labeling of products containing microorganisms, providing customer and producer satisfaction. (Collinset *al.*, 1984)

Taxa inside the classification system are organized in a hierarchical way. At present, two prokaryotic domains are recognized: Archaea and Bacteria. Domains are divided into phyla and the levels below the phylum are classes, orders (or subdivisions, depending on the group), families, genera and species. Different taxonomic levels are characterized by different suffixes in the taxon names. As microorganisms have too simple a structure and too few informative characters compared with higher organisms (e.g. morphology), development in bacterial taxonomy has continually been dependent on advances in generation. Modern bacterial taxonomy is built mainly on molecular facts. Those data have been made to be had with the discovery of DNA as the depositary cloth of genetic statistics and the improvement of technique suitable to cope with the smallest components of cells. exceptional methods of evaluation have distinctive resolution power, consequently the whole investigation of the identity of a microorganism could be finished simplest through the comparison of effects of a massive number of strategies: that is the so-known as polyphonic approach to bacterial systematic, i.e. the greater facts you have and evaluate, the greater whole and correct the identification (Colwell, 1970; and Vandamme *et al.*, 1996)

Lactobacillus's is one of the various and phylogenetically heterogeneous orders of lactic acid producing bacteria that consist genus Lactobacillus, as well as the genera Facklamia, Granulicatella, Leuconostoc, Pediococcus, and Streptococcus. They utilize carbohydrates fermentative and convey lactic acid as a chief cease product (Aguirre and Collins, 1993). Lactobacillus spp are facultative anaerobic, catalase negative, Gram-positive, non-spore-forming rods that regularly develop better under microaerophilic environment. Their Gram stain morphology can vary, including as short, plump rods, long, slender rods, in chains or palisades.

Their colonial morphology can vary from small to medium gray colonies that usually exhibit alpha hemolysis on blood agar. Lactobacilli grow on a variety of other media including MRS (Man, Rogosa, and Sharpe) agar where they appear as white, usually mucoid colonies. Identification of Lactobacillus species is by molecular means (16S rRNA genes) as phenotypic identification is generally unreliable. More recent taxonomic methods have shown that a few Lactobacillus species had been erroneously assigned to the genus and had been reassigned to new or other genera inclusive of Atopobium (*A. minutum* and *A. rimae*), Eggerthia (*E. cateniformis*), Olsenella (*O. uli*), and Weisella (*W. confusus*). Lactobacillus is composed of over 170 species and 17 subspecies which are validly published and have appropriate standing in nomenclature. In humans, they are indigenous within the gastrointestinal tract and vagina but can be occasional opportunistic pathogens. Within the human gastrointestinal tract, there is a variety of ecological niches and various lactobacilli together with *L. fermentum*, *L. plantarum*, *L. casei*, and *L. rhamnosus* that have been removed from the gut. *L. antri*, *L. gastricus*, *L. kalixensis*, *L. reuteri*, and *L. ultunensis* had been remote from the belly mucosa (Roos et al., 2005)

Origin and Historical Development of Probiotics

Probiotics also known as ‘friendly bacteria’ in lay terms, are live, non-pathogenic microorganisms that benefit the consumer’s digestive system by restoring the naturally existing gastrointestinal micro flora, preventing the colonization of the intestine by pathogens, and consequently, improving the immune system. Although there is reference to sour milk or fermented cultures as far back as in the Bible, Elie Metchnikoff is regarded as the grandfather of modern probiotics. He made a landmark observation that the regular consumption of LAB in fermented dairy products, such as yoghurt, was associated with enhanced health and longevity in Bulgarian peasant population (Burns and Rowland, 2000). Later he was convinced that yoghurt contained the organisms necessary to protect the intestine from the damaging effects of other harmful bacteria. Bulgarian physician Stamen Grigorov demonstrated how healthy bacteria in yoghurt helped digestion and improved the immune system and discovered the ‘Bulgarian bacillus’ mentioned by Metchnikoff (Anukam and Reid, 2007). In his book “The Prolongation of Life”

published in 1907, Metchnikoff suggested that the dependence of the intestinal microbes on the foods makes it possible to adopt a measure to modify the flora in our bodies and to replace the harmful microbes by useful microbes (Metchnikoff, 1907). At the time of Metchnikoff, Henry Tissier, a French pediatrician observed that children with diarrhea had in their stools a low number of bacteria characterized by a peculiar Y shaped morphology. These Bifidobacteria were, abundant in healthy children (Anukam and Reid, 2007).

The term probiotics was first introduced into the scientific literature in 1965 by Lilly and Stillwell to represent ‘substances secreted by one organism which stimulate the growth of another. In 1974, Parker defined probiotics as: ‘Organisms and substances which contribute to intestinal microbial balance’. He described it as animal feed supplements which had a beneficial effect in the host animal by affecting its gut flora (Oyetayo and Oyetayo, 2005).

The Effects of Probiotics on Health

The human gastrointestinal tract is home to diverse and widespread groups of microorganisms representing over 400 cultivable species. The colonization of the gastrointestinal tract begins straight away after birth. The mode of delivery, use of antibiotics, and the level of hygiene are acknowledged to exert a substantial effect on the range and species of microorganisms that colonize the gut. At the beginning *Escherichia coli* and *Streptococcus* dominates, but in breast fed toddlers the quantity of bifido bacteria will increase while the ones of *E. coli*, *Streptococcus*, and *Clostridia* decreases (Holzapfel et al., 1998). A change to the adult flora occurs after weaning and by the second year of life the intestinal flora becomes similar to that of an adult and remains relatively stable throughout life (Bullen et al., 1977). The density and diversity of microbes will increase progressively from stomach (10²–3 colony forming devices (cfu)/g luminal contents) to colon (10¹¹–12 cfu/g luminal contents). In a healthy person, the gastrointestinal tract contains 10 times as many microorganisms (10¹⁴ microorganisms) as eukaryotic cells within the entire frame the blended genome of the intestinal flora is predicted to be 50–100 times the dimensions of the human genome (Hooper et al., 2001). As these organisms are metabolically active and interact continuously with their environment (including other bacteria, the gut epithel mucosal immune system, the central nervous

system, and the endocrine system), they are able to exert a significant influence on the postnatal development and the host physiology (Gill and Guarner, 2004). Though Probiotics play an critical role in the manager of irritable bowel syndrome and inflammatory bowel illnesses, suppression of endogenous/exogenous pathogens through normalization of the intestinal microbial composition, remedy of meals allergy signs and symptoms in babies with the aid of immune modulation, decreasing serum cholesterol, reducing blood strain, improving lactose tolerance, microorganisms and decreasing threat elements for colon cancer by means of metabolic outcomes (Wedajo 2015).

Lactose Intolerance

Most of human normally non-Caucasians become lactose intolerant after weaning. These lactose intolerant people can't metabolize lactose because of the lack of essential enzyme β -galactosidase. Once they devour milk or lactose-containing merchandise, signs and symptoms inclusive of stomach pain, bloating, flatulence, cramping and diarrhea ensue. If lactose passes through from the small gut, it is converted to fuel and acid within the huge gut through the colonic micro flora. Also the presence of breath hydrogen is a sign for lactose maldigestion. The research provide that the addition of certain starter cultures to exploit merchandise, allows the lactose intolerant people to devour those merchandise without the usual upward thrust of breath hydrogen or related signs (Fooks et al., 1999 and Scheinbach 1998). The beneficial effects of probiotics on lactose intolerance are explained by way of two approaches. Considered one of them is decrease lactose concentration within the fermented foods due to the excessive lactase activity of bacterial preparations used in the manufacturing. The other one is; accelerated lactase energetic lactase enzyme enters the small gut with the fermented product or with the possible probiotic bacteria (Salminen and Von Wright, 2004).

While the yogurt is as compared with milk, purpose the lactose is transformed to lactic acid and the yogurt consist of bacterial β -galactosidase enzyme; it is appropriate cease beneficial to devour by lactose intolerant. Moreover, the LAB which is used to supply yogurt, *Lactobacillus bulgaricus* and *Streptococcus thermophiles*, are not resistant to gastric acidity. Therefore, the products with probiotic bacteria are greater green for lactose intolerant human. Its far notion that the most important issue

improves the digestibility by hydrolyses of lactose is the bacterial enzyme β -galactosidase. Every other factor is the slower gastric emptying of semi-solid milk merchandise which include yogurt. So the β -galactosidase pastime of probiotic traces and different lactic acid microorganism used in dairy products is definitely essential β -galactosidase pastime within probiotics varies in a large variety. It has to be considered each the enzyme interest of probiotic pressure and the hobby left within the final product for their use in lactose illiberal topics (Salminen et al., 2004).

Immune System and Probiotics

Numerous useful effects of probiotics on the host intestinal mucosal defenses device had been recognized. Those consist of blocking pathogenic bacteria consequences by producing bactericidal substances and competing with pathogens and toxins for adherence to the intestinal epithelium. For intestinal epithelial homeostasis, probiotics promote intestinal epithelial cell survival, decorate barrier feature, and stimulate defensive responses from intestinal epithelial cells. Most importantly, modulation of the immune system is one of the maximum manageable mechanisms underlying the beneficial results of probiotics on human fitness. Probiotics have been determined to enhance the innate immunity and modulate pathogen-induced irritation through toll-like receptor-regulated signaling pathways. The unbalanced immune reaction leads to excessive irritation and uncontrolled tissue harm and sickness. Sensing of the intestinal microbiota via the host mucosal immune system performs good sized roles in preserving intestinal homeostasis and inducing systemic defensive responses. Accordingly, manipulation of the intestinal microbiota is a capacity alternative method for retaining fitness and stopping and/or treating diseases (Vanderpool et al., 2008)

Probiotics play a role in defining and keeping the delicate balance between necessary and immoderate protection mechanisms including innate and adaptive immune responses. Points of interplay with the immune law for probiotics include microorganism direct interaction with intestinal epithelial cells, or following internalization by using M cells thru interaction with dendritic cells and follicle-associated epithelial cells, beginning responses mediated through macrophages and T and B lymphocytes. Regulation of gene expression and signaling pathways inside the host cells are important

mechanisms underlying probiotic movement leading to immunomodulation. By way of host genes activity and immune cells response. The host genes genetic variability of the host contributes to variety of reaction to identical stimuli and this plays out in probiotic effects too. A double-blind, placebo-managed study become executed in wholesome volunteers to determine mucosal responses to *L. acidophilus* Lafti L10, *Lactobacillus casei* CRL-431, and *L. rhamnosus* GG. Transcriptomes clustered consistent with individual, now not according to intervention, which shows that individual-to-man or woman variation in gene expression was the biggest determinant of differences between transcriptomes. Similarly, these three probiotic microorganism prompted differential gene-regulatory networks and pathways inside the human proximal. Small intestinal mucosa, *L. acidophilus* regulated genes mediating immune reaction, hormonal regulation of tissue growth and improvement, and ion homeostasis. For instance, *L. acidophilus* modulated transcriptional regulation of the mucosal inflammatory bowel sickness-associated IL-23 signaling pathway. Wound recuperation, IFN response, and ion homeostasis were associated with *L. rhamnosus*. The primary altered transcriptional networks and pathways regulated by *L. rhamnosus* worried cellular boom, proliferation, and development, with important roles in JUN, JAK2 and STAT4, and IGF1. Mucosal responses to *L. casei* worried proliferation, Th1–Th2 stability, and hormonal regulation of blood pressure. *L. casei* promoted a shift of Th1/Th2 stability to a Th2 kind and/or Th17 kind, with up regulation of IL-17D and IL-21, which beautify the development of natural killer cells. for this reason, these complete analyses found out that probiotic regulation of mucosal immunity on the gene expression degrees in human beings is both host genetics-established and stress specific (van Baarlen et al., 2011). All through immune cells probiotics regulate host innate and adaptive immune responses by using modulating the functions of dendritic cells, macrophages, and T and B lymphocytes (Vanderpool et al., 2008 and Yanand Polk.2010). One of the mechanisms of probiotics regulating immunomodulatory functions is thru the activation of toll-like receptors. A latest have a look at verified how probiotics activated innate immunity to top the adaptive immune responses. A probiotics combination along with *L. acidophilus*, *L. casei*, *L. reuteri*, *B. bifidum*, and *Streptococcus thermophilus* stimulated regulatory dendritic cells that specific high stages of IL-10,

TGF- β , COX-2, and indoleamine 2,3-dioxygenase, which in flip promoted the technology of CD4+Foxp3+ regulatory T cells (Trigs) from the CD4+CD25- populace and expanded the suppressor pastime of obviously going on CD4+CD25+Tregs. Similarly, this probiotic aggregate caused both T-cell and B-cellular hypo responsiveness and down regulated T helper (Th) 1, Th2, and Th17 cytokines without inducing apoptosis. In vivo research discovered that this combination suppressed 2, 4, 6-trinitrobenzenesulfonic acid-brought about intestinal inflammation, which turned into associated with enrichment of CD4+Foxp3+ Trigs inside the inflamed areas. Hence, probiotics that enhance the generation of regulatory dendritic cells to result in Trigs constitute a capacity therapeutic method for inflammatory issues (Kwon et al., 2010)

Diarrhea

Diarrhea is many causes and many types so it is difficult to evaluate the effects of probiotics on diarrhea. But there are lots of searches and evidence that probiotics have beneficial effects on some types of diarrhea. Diarrhea is a severe reason of children death in the worldwide and rotavirus is its common cause (Scheinbach 1998). In the treatment of rotavirus diarrhea *Lactobacillus* GG is reported really effective. The best documented probiotic effect is shortened duration of rotavirus diarrhea using *Lactobacillus* GG. It has been given proof in several studies around the world by some researchers (Guandalinet al., 2000).

One of types of diarrhea is traveller's diarrhea (TD) which affects the healthy travellers not only in developing countries but also in Europe. Probiotics have beneficial effects in preventing some forms of TD. Evaluated the efficacy of *Lactobacillus* GG in preventing diarrhea in 820 people travelling from Finland to Turkey (Oksanen et al., 1990). Lyophilized bacteria (*Acidophilus*, *B. bifidum*, *L. bulgaricus*, *S. thermophilus*) were given to 56 Danish tourists on a 2-week trip to Egypt. The occurrence of diarrhea in the group receiving the lactic acid bacteria was 43% while it was 71% in the placebo group (Gismondo, et al. 1999).

Antibiotic therapy causes mild and severe outbreaks of diarrhea. The normal micro flora may be suppressed during the microbial therapy and resulting with filling with pathogenic strains. The changes of micro flora may also encourage the resistant strains at least *Clostridium difficile* which is the reason of

antibiotic associated diarrhea (ADD). Probiotics which are able to restore and replace the normal flora should be used. Also they should be used in high risk patients such as old, hospitalized or immune compromised. Studies with *Saccharomyces boulardii* proved that *Clostridium difficile* concentration is decreased in the presence of *Saccharomyces boulardii* (Gismondo, *et al.* 1999).

Anticancer Effects

There are in vitro and in vivo evidences not only from animal studies but also from human studies that probiotics have beneficial effects on suppression of cancer. Oral administration of lactic acid bacteria has been shown to reduce DNA damage caused by chemical carcinogens, in gastric and colonic mucosa in rats. Studies in human topics have also found out that probiotic remedy may additionally reduce the danger of colon most cancers by using inhibiting transformation of procarcinogen to energetic cancer causing agents, binding inactivating mutagenic compounds, generating antimutagenic compounds, suppressing the growth of pro-carcinogenic microorganism, reducing the absorption of mutagens from the intestine, and enhancing immune characteristic (Van't Veer *et al.* 1989)

The consumption of lactobacilli by healthy volunteers has been demonstrated to reduce the mutagenicity of urine and diarrhea associated with the ingestion of carcinogens in cooked meat. When it comes to epidemiological studies, they show an association between fermented dairy products and colorectal cancer. The consumption of a large quantity of dairy products especially fermented foods like yogurt and fermented milk with containing *Lactobacillus* or *Bifidobacterium* may be related to a lower occurrence of colon cancer (Rafter 2003, Hirayama and Rafter 2000). A number of studies have shown that predisposing factors (increases in enzyme activity that activate carcinogens, increase pro-carcinogenic chemicals within the colon or alter population of certain bacterial genera and species) are altered positively by consumption of certain probiotics (Yu and Li.2016). However, there is little 'direct experimental proof' regarding the anticancer effectiveness (tumor suppression) of probiotic remedy in humans. Additionally and co-workers verified the protecting effect of *L. casei* stress Shiota on the recurrence of superficial bladder most cancers in a randomized controlled, multicenter look at (Aso and Akazan. 1992).

Cholesterol Reduction

Hypercholesterolemia (extended blood cholesterol levels) is considered a primary danger issue for the development of coronary heart disease, and even though pharmacologic sellers are to be had to deal with this circumstance (e.g., statins or bile acid sequestrants), they may be frequently suboptimal and high-priced and can have undesirable aspect consequences (Schuster 2004). Oral administration of probiotics has been proven to seriously reduce cholesterol levels via as a whole lot as 22 to 33% (De Smet *et al.*, 1998 and Pereira and Gibson.2002) or prevent elevated cholesterol levels in mice fed a fat-enriched diet (Taranto *et al.*, 2000). These cholesterol -decreasing consequences can be partially ascribed to BSH activity (different viable mechanisms include assimilation of cholesterol by means of the bacteria, binding of cholesterol to the bacterial cellular walls, or physiological movements of the stop products of brief-chain fatty acid fermentation (Liong *et al.*, 2005). Deconjugated bile salts are much less successfully reabsorbed than their conjugated opposite numbers, which ends up in the excretion of large quantities of loose bile acids in feces. Also, loose bile salts are less efficient within the solubilization and absorption of lipids within the gut. therefore, deconjugation of bile salts ought to result in a reduction in serum cholesterol both by means of increasing the demand for cholesterol for de novo synthesis of bile acids to replace those misplaced in feces or through decreasing cholesterol solubility and thereby absorption of cholesterol through the intestinal lumen.

Allergy and Probiotics

Numerous studies have been performed to evaluate the effects of probiotics on allergy prevention and treatment. Results from animals and humans have shown promise for probiotics in the prevention and treatment of allergy. However, the contradictory results have been repeatedly reported. The heterogeneity of the research design, including probiotic strain dosage, administration time, and host genetic background, may contribute to the discrepant findings (Gourbeyre *et al.*, 2011). Recent studies showed that oral administration of VSL#3 to shrimp tropomyosin-sensitized mice significantly reduced symptom score and histamine release in the feces following allergen challenge, which was associated with the down regulation of IL-4, IL-5, and IL-13, and up-regulation of IL-10, TGF- β , and IFN- γ in the jejunum. The in-vitro

studies on mouse spleen cells indicate that the VSL#3 preparation has the capacity to shift a polarized Th2 response to a Th1/T regulatory-type profile (Schiavi *et al.*, 2011). By using a mouse model of polysensitization to birch and grass pollen allergens, mucosal application of *B. longum* NCC 3001 and *Lactobacillus paracasei* NCC 2461 at the time of sensitization and challenge led to significant suppression of airway inflammation and down regulated allergen-specific Immune responses. In contrast, in the mice treated with probiotics prior to sensitization and challenge, only *B. longum* displayed protective effects. These findings suggest that both the specific probiotic and the timing of the application are crucial for tolerance induction (Schabussova *et al.*, 2011). In a randomized controlled trial of 250 pregnant women carrying infants at high risk of allergic disease, LGG failed to reduce the risk of eczema, or any change in cord blood immune markers, but was associated with decreased breast milk soluble CD14 and IgA levels.

Thus, this study showed that prenatal LGG treatment was not sufficient to prevent eczema in infants. If probiotics are effective for preventing eczema, then a postnatal component to treatment or possibly an alternative probiotic strain may be necessary (Boyle *et al.*, 2011)

Virus Infection and Probiotics

Protection from viral infection has also been shown as a benefit of probiotic action. Intranasal inoculation of wild-type mice with live or heat-inactivated *L. plantarum* or *L. reuteri* completely protected against the virulent rodent pathogen, pneumonia virus lethal infection and resulted in diminished granulocyte recruitment and expression of multiple proinflammatory cytokines and reduced virus recovery.

Interestingly, these two probiotics also resulted in prolonged survival and protection against the lethal sequel pneumonia virus of mice infection in MyD88 gene-deleted mice, suggesting that these protective mechanisms may be TLR-independent (Gabryszewski *et al.*, 2011). Furthermore, a randomized, parallel, double-blind, placebo-controlled study showed that consumption of *L. plantarum* HEAL 9 and *L. paracasei* 8700 : 2 for a 12-week period could reduce the risk of acquiring common cold infections in healthy individuals. For example, the incidence of acquiring one or more common cold episodes, the number of days with common cold symptoms, and haryngeal symptoms were all reduced (Berggren *et al.*, 2011).

Vaccination and Probiotics

Potentiating the effects of vaccination by probiotics has emerged as a benefit of probiotics. A randomized, double-blind, placebo-controlled pilot study showed that LGG treatment for 28 days after administration of live-attenuated influenza vaccine increased protection rates against the virus with no side-effects reported for the participants. Thus, LGG shows potential as an important adjuvant to improve influenza vaccine immunogenicity (Davidso *et al.*, 2011). *Acidophilus* has been used as a live vehicle for oral immunization against chicken anemia virus. The AcmA-binding domains of *Lactococcus lactis* were used to display the VP1 protein of chicken anemia virus (CAV) on *L. acidophilus*. *L. acidophilus* carrying the CAV VP1 protein was used to immunize specific pathogen-free chickens through the oral route.

The vaccinated groups showed a moderate level of neutralizing antibody to CAV in the serum, a VP1-specific proliferative response in splenocytes and increased levels of Th1 cytokines, such as IL-2, IL-12, and IFN- γ . These studies suggest the exciting possibility that probiotics can be modified for delivery of vaccines (Moeini *et al.*, 2011)

Mechanism of Probiotics

Enhancement of the Epithelial Barrier the intestinal epithelium is in everlasting touch with luminal contents and the variable, dynamic enteric flora. The intestinal barrier is a main protection mechanism used to keep epithelial integrity and to defend the organism from the surroundings.

Defenses of the intestinal barrier include the mucous layer, antimicrobial peptides, secretory IgA and the epithelial junction adhesion complicated (Ohland *et al.*, 2010). As soon as this barrier feature is disrupted, bacterial and food antigens can reach the sub mucosa and can induce inflammatory responses, which may also result in intestinal disorders, consisting of inflammatory bowel disease (Hooper *et al.*, 2001 and Sartor, R. B. 2006).

Intake of non-pathogenic microorganism can make a contribution to intestinal barrier feature, and probiotic microorganisms were appreciably studied for their involvement inside the protection of this barrier. But, the mechanisms by which probiotics beautify intestinal barrier characteristic are not absolutely understood. Several studies have indicated that enhancing the expression of genes involved in tight

junction signaling is a likely mechanism to reinforce intestinal barrier integrity (Anderson *et al.*, 2010). As an example, lactobacilli modulate the regulation of numerous genes encoding adherence junction proteins, inclusive of E-cadherin and β -catenin, in a T84 cell barrier version. Furthermore, incubation of intestinal cells with lactobacilli differentially affects the phosphorylation of adherence junction proteins and the abundance of protein kinase C (β) isoforms, which includes β , thereby undoubtedly modulating epithelial barrier feature (Hummel *et al.*, 2012).

Recent information has indicated that probiotics might also provoke repair of the barrier feature after damage. *Escherichia coli* Nissle 1917 (EcN1917) no longer simplest prevents the disruption of the mucosal barrier through enter pathogenic *E. coli*; however it even restores mucosal integrity in T84 and Caco-2 cells. This impact is mediated by the improved expression and redistribution of tight junction proteins of the zonula occludens (ZO-2) and β ensuing in the reconstruction of the tight junction complicated (Zyrek *et al.*, 2007 and Stetinova *et al.*, 2010).

Similarly, *Lactobacillus casei* DN-114001 (Parassolet *et al.*, 2005) and VSL3 (a mixture of pre- and probiotics) (Otte *et al.*, 2004) are capable of sustaining the intestinal barrier function by similar mechanisms. A recent paper has reported that VSL3 protects the epithelial barrier and increases tight junction protein expression in vivo and in vitro by activating the p38 and extracellular regulated kinase signaling pathways (Dai *et al.*, 2012).

A link between altered levels of pro-inflammatory cytokines and intestinal permeability has been described in a number of intestinal diseases (Bruewer *et al.*, 2006). Using probiotics, the prevention of cytokine-induced epithelial damage, which is characteristic of inflammatory bowel disease (Hooper *et al.*, 2003) Mucin glycoproteins (mucins) are most important macromolecular ingredients of epithelial mucus and feature long been implicated in health and disorder. Probiotics may promote mucous secretion as one mechanism to improve barrier feature and the exclusion of pathogens. Several *Lactobacillus* species increase mucin expression in human intestinal mucosal traces. But, this shielding effect relies on *Lactobacillus* adhesion to the cell monolayer, which probably does not arise in vivo. (Mackett *et al.*, 2003 and Mattar *et al.* 2002).

Selection Criteria for Probiotics

The selection criteria can be categorized in four basic groups such as appropriateness, technological suitability, competitiveness, performance and functionality (Victor-Aduloju *et al.*, 2018). Many in vitro assessments are performed when screening for capability probiotic strains. The first step within the choice of a probiotic LAB strain is the dedication of its taxonomic classification, which may provide an indication of the origin, habitat and physiology of the strain. LAB is associated with habitats which can be rich in nutrients, such as diverse meals merchandise and plant substances. They may be discovered in soil, water, manure, sewage, and silage and might ferment or destroy food. Specific LAB is population of the human oral hollow space, the intestinal tract, and the vagina, and might have a useful impact on these human ecosystems. Most of these characteristics have essential outcomes on the choice of the unconventional lines. (Da Cruz Rodrigues *et al.*, 2019).

The initial screening and choice of probiotics consists of trying out of the following critical criteria: Phenotype and genotype balance, together with plasmid balance; carbohydrate and protein usage patterns acid and bile tolerance and survival and growth; intestinal epithelial adhesion homes; manufacturing of antimicrobial materials; antibiotic resistance styles; capacity to inhibit recognized pathogens, spoilage organisms, or each; and immunogenicity. The capability to adhere to the intestinal mucosa is one of the more important selection standards for probiotics because adhesion to the intestinal mucosa is taken into consideration to be a prerequisite for colonization.

So, the host should be immuno-tolerant to the probiotic. Alternatively, the probiotic pressure can act as an adjuvant and stimulate the immune device towards pathogenic microorganisms. It goes without announcing that a probiotic has to be innocent to the host: there have to be no nearby or preferred pathogenic, allergic or mutagenic /carcinogenic reactions provoked by means of the microorganism itself, its fermentation merchandise or its cell additives after decrease of the bacteria (Desai A .2008).

Acid and Bile Tolerance

Lactic acid bacteria used as probiotic lines are joined inside the food digestion with an adventure to the lower intestinal tract thru the mouth. On this system, probiotic bacteria must

be immune to the enzymes like lysozyme in the oral cavity. Then the journey may be going on within the stomach and input the top intestinal tract which comprise bile. In this degree traces have to have the capacity to withstand the digestion tactics. It is suggested that time at the first front to release from the stomach takes 3 hours. Strains want to be immune to the annoying situations of the belly (pH 1.5-3.0) and upper intestine which incorporate bile (Muhammad *et al.*, 2018)

Antimicrobial Activity

Antimicrobial activity is one of the most important selection criteria for probiotics. Antimicrobial activity targets the enteric undesirables and pathogens. Antimicrobial effects of lactic acid bacteria are formed by producing some substances such as organic acids (lactic, acetic, propionic acids), carbon dioxide, hydrogen peroxide, diacetyl, low molecular weight antimicrobial substances and bacteriocins (Yavuzdurmaz, 2007). Till today there are some researches on showing that different species produce different antimicrobial substances.

Here are some examples of these substances: *Lactobacillus reuterii*, which is a member of normal micro flora of human and many other animals, produce a low molecular weight antimicrobial substance reuterin; subspecies of *Lactococcus lactis* produce a class I bacteriocin, nisin A; *Enterococcus faecalis* DS16 produces a class I bacitracin cytolysin; *Lactobacillus plantarum* produces a class II bacitracin plantaricin S; *Lactobacillus acidophilus* produces a class III bacitracin acidophilucin A). Production of bacteriocins is highly affected by the factors of the species of microorganisms, ingredients and pH of medium, incubation temperature and time. Nisin, produced by *L. lactis* subsp. *lactis* is the well-known bacteriocin and it is allowed to use in food preparations (Quwehand and Vesterlund 2004).

Some milk products were used to isolate potential probiotic bacteria and determination of their possible antimicrobial activities. *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Serratia marcescens* and *Candida albicans* were used as indicator microorganisms. After the study, the results showed that, Yakult and Ski D' Lite probiotics inhibited all of the test indicator microorganisms, Nestle yogurt probiotics were bactericidal for *S.aureus* and *P. aeruginosa* but inhibitory for *S. typhi*, Neslac

probiotics killed *E. coli* and *S. typhi* while they were only inhibitory for *S.aureus* and *C. albicans*, Gain probiotics inhibited *C.*

Safety Aspects of Probiotics

Nowadays, there are evidences that probiotic strains used as industrial microorganism are safe to apply in applications. The safety of the probiotic merchandise is appraised with the phenotypic and genotypic traits and the records of used microorganisms. Lactic acid bacteria traditionally utilized in fermented dairy products have protracted records of safe use. But, as interest grows in using new strains, protection checking out becomes critical. *Lactobacillus GG*, one of the more modern strains, has undergone substantial checking out for the protection and efficacy of its use. It changed into accredited in 1992 by using the UK Advisory Committee on Novel foods and in 1996 through the Japanese practical food authorities (Salminen *et al.*, 1996).

Probiotic strains should be safe for human intake. Probiotic strains inclusive of *Lactobacillus* species, *Bifidobacterium* species, and *Streptococcus* species have lengthy records of safe use and are GRAS. But, there had been a few reports that have associated LAB with scientific pathological conditions inclusive of bacteremia and endocarditis. (LaraVilloslada *et al.*, 2007). Those reports raised concerns about the safety of probiotic bacteria. because there was no worldwide consensus on technique to evaluate performance and protection of probiotics, the FAO and WHO undertook work to compile and compare the clinical proof on useful and protection elements of probiotics (FAO/WHO. 2002).

Within the choice process of probiotic strains, safety factors consist of, amongst others, specifications which include. Origin, loss of harmful activities, and shortage of received antibiotic resistance. It is properly identified that probiotic consequences are strain, condition, and dose particular. Consequently, one of the first conditions documenting the microbiological safety of bacterial cultures intended for probiotic or nutritional use is the accuracy in their taxonomic identity. Potential probiotic strain need to be diagnosed by means of internationally well-known strategies and named consistent with the international Code of Nomenclature and lines ought to be deposited in an internationally recognized way of life series (FAO/WHO. 2002). Strain identity, that's completed via phenotype and genotype

strategies, is essential to link a strain to a selected health effect in addition to enable correct surveillance and epidemiological research. In LAB, latest studies highlighted that dependable identity and strain characterization can be received with the aid of molecular methods (Endo and Gueimonde, 2016).

Another key element for safety is the specification of the strain origin. Capacity probiotic cultures had been remote from a spread of sources together with animal, human, and food sources. however, there is now developing proof that strain are host unique and for this reason it's miles generally frequent that strain to be used for human programs must be human isolates (Hill *et al.*, 2018). However, many food-associated LAB, which include *L. (para) casei* and *L. plantarum*, which constitute the majority of the LAB species located in maximum cheese varieties, were decided on as candidate probiotics and a number of them are presently utilized in industrial probiotic product. (Singhal *et al*, 2019).

Whatever the origin of probiotic or the taxonomic identification, the candidate probiotic strain want serious of in vitro tests and animal trials to affirm the absence of β -hemolytic hobby and other harmful enzymatic activity consisting of β -glucosidase, N-acetyl- β -glucosaminidase, and β -glucuronidase sports, which all have been related to health problems or intestinal diseases (Chamseddine *et al* ,2019). For example, β -glucuronidases unlock pollutants and mutagens that have been glucuronated in the liver and excreted into the intestine with the bile.

This may cause high local concentrations of carcinogenic compounds within the intestine, as a consequence increasing the risk of carcinogenesis (Allegra *et al.*, 2019). Improved efforts had been dedicated in current years to gain extra insight into the diffusion of antibiotic-resistance phenotypes inside food-related LAB, with particular emphasis on those applied as starter cultures or probiotics. currently available literature records assist the view that, in antibiotic challenged habitats, LAB (specifically enterococci) like different bacteria are involved inside the switch of resistance tendencies over species and genus border, with important protection implications.

The superiority of such bacteria with received, genetically exchangeable, resistances is excessive in animals and humans which might be frequently handled with antibiotics (Alzubaidy *et al.*,2019).

This underlines the importance to include the antibiotic susceptibility profiles within the selection criteria of candidate probiotics.

CONCLUSION

There is scientific proof supporting the incorporation of probiotics in nutrition as a method of derivation of health advantages. This proof appears adequate regarding the prevention and remedy of sure situations at the same time as virtually promising or maybe controversial on the subject of others. Those microbes have proven nice responses to medical remedy towards numerous illnesses and issues, inclusive of diarrhea associated with rotavirus, IBS and. furthermore; the contribution of probiotics in preventing and remedy of diabetes, obesity, most cancers, food hypersensitive reactions and sicknesses associated with pathogenic microbes is an exciting and swiftly advancing studies area. Inside the equal time as applicable customer awareness grows, such products have become an increasing number of famous and tend to represent one in all the most important useful meals markets.

Dairy products, in particular yoghurt, remain the most vital motors for transport of probiotic microorganism to the purchaser with the nondairy area constantly evolving as nicely, because of food generation advances and the growing demand. Moreover, present clinical and nutritional opinions had been a success in exposing a few terrific capabilities of precise probiotic strains. Mainly, regulation of power in various catabolic and anabolic procedures, acid and bile tolerance, ability to adhere to gut epithelial cells, to fight in opposition to pathogens, together with positive different homes, like. Their protection enhancing property serviceability as foods and useful dietary supplements for human health consequently, present day awareness is on comparing new strain of probiotics and the applicability in biomedical/medical studies, paving a new route for exploration and exploitation of probiotics aimed at enhancing human health.

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