

## A REVIEW ON PROBIOTICS

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### ABSTRACT

Probiotics are harmless bacteria that help the well being of the host animal and contribute, directly or indirectly to protect the host animal against harmful bacterial pathogens. They are also called "friendly bacteria" or "good bacteria". Probiotics are available to consumers mainly in the form of dietary supplements and foods. They can be used as Complementary and alternative medicine (CAM). In controlled clinical trials probiotic bacteria have demonstrated a benefit in treating gastrointestinal diseases, including infectious diarrhea in children, recurrent *Clostridium difficile* induced infection, and some inflammatory bowel diseases. This evidence has led to the proof of principle that probiotic bacteria can be used as a therapeutic strategy to ameliorate human diseases. Scientists have found that probiotic bacteria can thrive and function in the human digestive tract along with the existing microorganisms. There currently exists good evidence for the therapeutic use of probiotics in infectious diarrhea in children, recurrent *Clostridium difficile* induced infections and postoperative pouchitis. The possible benefit in other gastrointestinal infections, prevention of postoperative bacterial translocation, irritable bowel syndrome and inflammatory bowel disease continues to emerge. The field of probiotics is developing rapidly as evidenced by expansion of research and increased familiarity of probiotics to the general public. Probiotic bacteria have been shown to influence the immune system through several molecular mechanisms.

**KEY WORDS:** Probiotics, dietary supplements, friendly bacteria.

### INTRODUCTION

Probiotics are live microorganisms thought to be healthy for the host organism. According to the currently adopted definition by FAO/WHO, probiotics are: "Live microorganisms which when administered in adequate amounts confer a health benefit on the host". Lactic acid bacteria (LAB) and bifidobacteria are the most common types of microbes used as probiotics, but certain yeasts and bacilli may also be helpful. Probiotics are commonly consumed as part of fermented foods with specially added active live cultures, such as in yogurt, soy yogurt, or as dietary supplements. At the start of the 20th century, probiotics were thought to beneficially affect the host by improving its intestinal microbial balance, thus inhibiting pathogens and toxin producing bacteria. Today, specific health effects are being investigated and documented including alleviation of chronic intestinal inflammatory diseases, prevention and treatment of pathogen-induced diarrhea. Urogenital, infections, and atopic diseases. At birth, the gastrointestinal tract is sterile and incapable of digesting food. Within hours, bacteria ingested during the birthing process rapidly colonize the gut. The gastrointestinal tract soon contains about 10 times as many bacteria as there are cells in the body. Hundreds of species are present, many of which are uncultivable and remain

unidentified. It is these bacteria that are responsible for priming the gastrointestinal immune system. This gut flora includes 100 trillion bacteria, some three pounds, which are intimately linked to the body's natural defense system<sup>1</sup>.

The concept of probiotics arose at the turn of the 20<sup>th</sup> century from a hypothesis first proposed by Noble Prize winning Russian scientist Elie Metchnikoff, who suggested that the long, healthy life of Bulgarian peasants resulted from their consumption of fermented milk products. He believed that when consumed, the fermenting *Bacillus* (*Lactobacillus*) positively influenced the microflora of the colon, decreasing toxic microbial activities. The historical association of probiotics with fermented dairy products, still true today, stems from these early observations. Investigations in the probiotics field during the past several decades, however, have expanded beyond bacteria isolated from fermented dairy products to those of intestinal origin. There is some debate about whether or not yogurt starter bacteria should be considered probiotics. The yogurt starter cultures *Lactobacillus bulgaricus* and *Streptococcus thermophilus* are used to ferment milk and turn it into yogurt<sup>2</sup>. But these cultures are not very resistant to conditions in the stomach and small intestine and generally do not reach the gastrointestinal tract in very

high numbers. Therefore, they cannot mediate some probiotic effects. But these starter bacteria have been shown to improve lactose digestion in people lacking lactase and have demonstrated some immunity enhancing effects. For these reasons, they are often considered probiotic.

The World Health Organization defines probiotics as "live microorganisms which when administered in adequate amounts confer a beneficial health effect to the host". Probiotics are microorganisms that include many "good" bacterial and yeast strains such as *Lactobacillus*, *Bifid bacterium*, and *Saccharomyces cerevisiae*. Gut Bugs some, but not all, probiotics are similar to the natural bacteria that thrive in the digestive system. The lower small intestine and colon are home to about <sup>100</sup> trillion bacteria, or about 3 pounds of hard-working microorganisms. These gut bugs play an important role in our digestive health, immune health, and synthesis of some vitamins. Scientists have found that probiotic bacteria can thrive and function in the human digestive tract along with the existing microorganisms. There is concern, however, that some probiotic organisms do not survive the harsh environment of the stomach. However, cultured dairy foods may provide these bacteria some protection from stomach acid, allowing the bacteria to travel to the lower intestine where they can thrive<sup>3</sup>.

### **HISTORY OF PROBIOTICS**

Probiotics have been used for centuries. Eli Metchnikoff, a Russian scientist, first observed the positive role that certain bacteria played in the gut. While working as a professor at the Pasteur Institute in Paris in 1907, he suggested that the aging process is a result of putrefactive or proteolytic microbes in the large bowel. Metchnikoff believed that the physical changes that we associate with old age were caused by a process he called "intestinal auto-intoxication". Metchnikoff also observed that certain rural populations in Europe, who lived largely on milk fermented by lactic-acid bacteria, were exceptionally long lived. Based on these facts, Metchnikoff proposed that consumption of fermented milk would decrease the intestinal pH and that this would suppress the growth of proteolytic bacteria. He subsequently introduced a diet of sour milk fermented with bacteria that he called *Bulgarian Bacillus*. After Metchnikoff's death in 1916, the study of good bacteria seemed to lag. It wasn't until 1953 that the term "probiotics" was first introduced. In the following decades several intestinal lactic acid bacterial species with alleged health beneficial properties have been introduced as probiotics. It took some time for doctors to grasp that, when antibiotics were given, they destroyed the beneficial bacteria as well as the harmful, thus

making the body more prone to secondary infections. Later, doctors came to realize that taking probiotics keeps the intestinal flora in proper balance. Today scientist continues to study probiotics. These good microbes are being utilized in a wide variety of applications, including but not limited to:

- Reducing allergens caused by dust mites.
- Cleaning surfaces by breaking down the biofilm that traps bacteria.
- Providing an antagonistic environment for pathogens.
- Bolstering the immune system.
- Restoring normal bacterial flora on unhealthy skin.
- Decreasing the incidence and duration of diarrhea.
- Demonstrating anti-carcinogenic, anti-mutagenic, and anti-allergic properties.
- Helping alleviate food, chemical, and/or environmental sensitivities.
- Improving digestion and balancing cholesterol metabolism.
- Influencing better intestinal and Urogenital flora.
- Maintaining mucosal integrity.
- Preventing and reducing intestinal tract infections<sup>4</sup>.
- Promoting a feeling of well-being.
- Regulating gut motility, thereby reducing such conditions as constipation.

During an outbreak of shigellosis in 1917, German professor Alfred Nissle isolated a strain of *Escherichia coli* from the feces of a soldier who was not affected by the disease. Methods of treating infectious diseases were needed at that time when antibiotics were not yet available, and Nissle used the *Escherichia coli* strain in acute gastrointestinal infectious salmonellosis and shigellosis. In 1920, Rettger demonstrated that Metchnikoff's "*Bulgarian Bacillus*", later called *Lactobacillus delbrueckii* subsp. *Bulgaricus*, could not live in the human intestine, and the fermented food phenomena petered out. Metchnikoff's theory was disputable (at this stage), and people doubted his theory of longevity. After Metchnikoff's death in 1916, the centre of activity moved to the United States. It was reasoned that bacteria originating from the gut were more likely to produce the desired effect in the gut, and in 1935 certain strains of *Lactobacillus acidophilus* were found to be very active when implanted in the human digestive tract. Trials were carried out using this organism, and encouraging results were obtained especially in the relief of chronic constipation.

The term "probiotics" was first introduced in 1953 by Kollath. Contrasting antibiotics, probiotics were defined as microbially derived factors that stimulate the growth of other microorganisms. In 1989 Roy Fuller suggested a definition of probiotics which has been widely used: "A

live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance". Fuller's definition emphasizes the requirement of viability for probiotics and introduces the aspect of a beneficial effect on the host. In the following decades intestinal lactic acid bacterial species with alleged health beneficial properties have been introduced as probiotics, including *Lactobacillus rhamnosus*, *Lactobacillus casei*, and *Lactobacillus johnsonii*<sup>5</sup>.

#### **TYPES OF PROBIOTICS**

Intestinal micro flora is important for maturation of the immune system, the development of normal intestinal morphology, and maintenance of a continued and immunologically balanced inflammatory response. The micro flora reinforces the barrier function of the intestinal mucosa, helping it to prevent attachment of pathogenic microorganisms and the entry of allergens. Some members of the micro flora may contribute to the body's requirements for certain vitamins, including biotin, B-complex vitamin and vitamin B12. Alteration of the microbial flora of the intestine, such as may occur with antibiotic use, disease, and aging, can reduce its beneficial role. **Lactobacilli**

Lactobacilli are located throughout the digestive tract but are especially abundant in the small intestine. Some of the main human varieties are:

*Lactobacillus acidophilus*,  
*Lactobacillus rhamnosus*,  
*Lactobacillus plantarum*,  
*Lactobacillus brevis*,  
*Lactobacillus salivarius*.

#### **Bifid bacterium**

Bifidobacteria are located in the entire digestive tract but are especially abundant in the large intestine. The system's first inhabitants, these species evolve according to age, diminishing progressively towards the end of life. Some of the main varieties are:

*Bifid bacterium breve*,  
*Bifid bacterium in infants*,  
*Bifid bacterium longum in children*,  
*Bifid bacterium bifidum in adults*.

It is known that microbes in the large intestine complete the digestion process on any food components that were not digested in the small intestine, such as lactose in lactose intolerant people or fibers resistant to the enzymes they encounter in the small intestine. There is evidence of non-digestive microbial activities as well. Certain intestinal microbes are known to produce vitamins. Also, in studies done with special microbe-free a laboratory animal, evidence is strong that without normal microbial populations, the immune system functions poorly, and resistance to pathogenic bacteria is

greatly reduced. Other evidence suggests that intestinal microbes might act on pre-carcinogenic or Mutagenic (capable of inducing genetic mutation) compounds. Depending on the specific Microbe, mutagenic or carcinogenic activity can be either increased or decreased. There are obvious advantages in skewing the balance of bacteria toward beneficial ones both lactobacilli and bifidobacteria are normal inhabitants of the healthy intestine. Although they are not the dominant genera in either the small or large intestine of adults (bifidobacteria are generally the dominant flora of breast-fed infants), they are non-Pathogenic and their presence is correlated with a healthy intestinal flora. The metabolic end products of their growth are organic acids (lactic and acetic acids) that tend to lower the pH of the intestinal contents, creating conditions less desirable for harmful bacteria. The probiotics that are marketed as nutritional supplements and in functional foods, such as yogurts, are principally the Bifid bacterium species and the *Lactobacillus* species. Probiotics are sometimes called colonic foods. Most of the presently available probiotics are bacteria. Some beneficial effects of lactic acid bacteria consumption include:

- (i) improving intestinal tract health;
- (ii) enhancing the immune system,
- (iii) synthesizing and enhancing the bioavailability of nutrients;
- (iv) reducing symptoms of lactose intolerance;
- (v) Decreasing the prevalence of allergy
- (vi) Reducing risk of certain cancers.

#### **MECHANISM OF ACTION OF PROBIOTICS**

Recent compelling evidence has demonstrated that manipulating the microbiota can influence the host. Several new mechanisms by which probiotics exert their beneficial effects have been identified and it is now clear that significant differences exist between different probiotic bacterial species and strains; organisms need to be selected in a more rational manner to treat disease. Mechanisms contributing to altered immune function in vivo induced by probiotic bacteria may include modulation of the microbiota itself, improved barrier function with consequent reduction in immune exposure to microbiota, and direct effects of bacteria on different epithelial and immune cell types. Probiotic bacteria have multiple and diverse influences on the host. Different organisms can influence the intestinal luminal environment, epithelial and mucosal barrier function, and the mucosal immune system. They exert their effects on numerous cell types involved in the innate and adaptive immune responses, such as epithelial cells, dendrite cells, monocytes/macrophages, B cells, T cells, including T cells with regulatory properties, and NK cells.

## **THERAPEUTIC EFFECT**

Though probiotics had been in use in food and alcohol fermentation since centuries, they were implemented for medicinal purposes only in the 20th century. Probiotics are used for effective treatment of various health problems such as lactose intolerance, candidiasis, skin allergies, food allergies, premature labor, diarrhea, intestinal infection, constipation, vaginitis, irritable bowel syndrome and leaking gut. According to research studies, administering probiotics in appropriate doses promotes a healthy digestive system and immune system and regulates cholesterol level and blood pressure. Commercially, probiotics are found in the form of tablets, powders, capsules and other dietary supplements.

### **HIV and Immune System Stimulation**

The immune system provides the primary defense against microbial pathogens that have entered our bodies. The immune system is extremely complex, involving both cell-based and antibody-based responses to potential infectious agents. Immunodeficiency can result from certain diseases (e.g., cancer, AIDS, leukemia) or, to a lesser extent, from more normal conditions such as old age, pregnancy, or stress. Autoimmune diseases (e.g., allergies, rheumatoid arthritis, inflammatory bowel diseases) also can occur due to misdirected immune system activity. Probiotic cultures have been shown in a variety of test systems to stimulate certain cellular and antibody functions of the immune system. Animal and some human studies have shown an effect of yogurt or lactic acid bacteria on enhancing levels of certain immuno-reactive cells (e.g. macrophages, lymphocytes) or factors (cytokines, immunoglobulin, interferon). In addition, some studies have shown improved survival of pathogen-infected laboratory animals consuming probiotic cultures as compared to animals consuming a control diet. Results accumulated so far suggest that probiotics may provide an additional tool to help your body protect itself. Animal models and human studies provide a baseline understanding of the degree and type of probiotic-induced immune response<sup>6</sup>. From these studies, it appears that probiotic bacteria are able to enhance both non-specific and specific immune responses by activating macrophages.

### **Lactose Intolerance**

The inability of adults to digest lactose, or milk sugar, is prevalent worldwide. People of northern European descent are unique in retaining the ability to produce the lactose-digesting enzyme, lactase, into adulthood so they can continue to drink milk. Consumption of lactose by those lacking adequate levels of lactase produced in the small intestine can result in diarrhea, bloating, abdominal

pain and flatulence. These symptoms are due to the undigested lactose reaching the large intestine and being fermented by the colonic microbes, which can produce gases and products that lead to watery stool. It has been documented scientifically that many lactose intolerant individuals are better able to consume fermented dairy products, such as yogurt, with fewer symptoms than the same amount of unfermented milk, even though yogurt contains about the same amount of lactose as milk. Yogurt was found to aid digestion of lactose because the lactic acid bacteria used to make yogurt produce lactase and digest the lactose before it reaches the colon<sup>7</sup>. In addition to yogurt starter bacteria, *L.acidophilus* and bifidobacteria have been shown by several studies to improve digestion of lactose, although generally to a lesser extent than the yogurt starter cultures, *Lactobacillus bulgaricus* and *Streptococcus thermophilus*<sup>8</sup>.

### **Hypertension**

About 50-60 million people in United States are estimated to have hypertension, or elevated blood pressure. Antihypertensive effects have been documented in animal models and in mildly hypertensive adults for three compounds derived from the growth of certain lactobacilli: i) fermented milk containing two tripeptides derived from the proteolytic action of *L. helveticus* on casein in milk; ii) bacterial cell wall components from cell extracts of lactobacilli; and iii) fermented milk containing fermentation-derived gamma amino butyric acid. Systolic blood pressure was decreased on the order of 10-20 mm Hg. These results suggest that consumption of certain lactobacilli, or products made from them, may reduce blood pressure in mildly hypertensive people. Viability of the lactobacillus is not required for the effect. Such fermentation-derived, but nonprobiotic, products have been developed<sup>9</sup>.

### **Inflammatory Bowel Disease**

Inflammatory bowel diseases, such as ulcerative colitis and Crohn's disease are serious intestinal disorders that can ultimately necessitate the surgical removal of the colon. The causes of such diseases are unknown, but it has been hypothesized that an intolerance to the normal flora (bacteria) in the gut leads to inflammation and resulting pathology. The role of gut flora in the progression of these diseases has led some researchers to study the impact certain probiotic bacteria might have on maintaining the state of reduced inflammation that occurs during the diseases' remission stages<sup>10</sup>. Several controlled clinical trials have shown that high levels of certain probiotic strains can extend the disease-free remission period. Additional research in this area is progressing in Europe and the US.



### **Diarrhea**

Many types of diarrheal illnesses, with many different causes, disrupt intestinal function. The ability of probiotics to decrease the incidence or duration of certain diarrheal illnesses is perhaps the most substantiated health effect of probiotics. Probiotics can prevent or ameliorate diarrhea through their effects on the immune system<sup>11</sup>. Moreover, probiotics might prevent infection because they compete with pathogenic viruses or bacteria for binding sites on epithelial cells. In the pediatric population, probiotics appear to benefit viral diarrhea, possibly by increasing the antibody secretory IgA and decreasing viral shedding, suggesting an immunological mechanism. Studies evaluating the effect of probiotics on travelers' diarrhea are equivocal. Traveler's diarrhea (3 times or more) occurs in residents of developed countries after traveling to subtropical and tropical zones. Drinking Lactobacillus GG strain significantly decreased the incidence of diarrhea in travelers.

### **Cancer**

In general, cancer is caused by mutation or abnormal activation of genes that control cell growth and division. Many processes or exposures can increase the occurrence of abnormal cells, among them chemical exposures. Cancer-causing chemicals (carcinogens) can be ingested in a normal diet or generated by metabolic activity of microbes that live in the gastrointestinal system. It has been hypothesized that probiotic cultures might decrease the exposure to chemical carcinogens by (a) detoxifying ingested carcinogens; (b) altering the environment of the intestine and thereby decreasing populations or metabolic activities of bacteria that may generate carcinogenic compounds; (c) producing metabolic products (e.g., butyrate) which improve a cell's ability to die when it should die (a process known as apoptosis or programmed cell death); (d) producing compounds that inhibit the growth of tumor cells; or (e) stimulating the immune system to better defend against cancer cell proliferation. Research suggests that the consumption of probiotic cultures may decrease cancer risk<sup>12</sup>.

### **Antibiotic therapy disease**

One group assessed for the impact of probiotics is people on antibiotic therapy. The purpose of antibiotics is to kill harmful bacteria. Unfortunately, they frequently kill normal bacteria as well, often resulting in disruption of the bacterial flora, leading to diarrhea and other intestinal disturbances. Replenishing the flora with normal bacteria during and after antibiotic therapy seems to minimize disruptive effects of antibiotic use. Studies show that probiotics can prevent antibiotic associated diarrhea, but that no strong effect on the ability of probiotics to treat diarrhea exists. Not all studies have shown positive

results in the prevention of antibiotic associated diarrhea or other symptoms associated with antibiotic therapy.

### **Allergies/Eczema**

Probiotic bacteria are important in down-regulating inflammation associated with hypersensitivity reactions in patients with atopic eczema and food allergy. Parental administration of Lactobacillus rhamnosus GG decreased subsequent occurrence of eczema in at-risk infants by one-half. In newborn infants, the initial bacteria to colonize the sterile GI tract may establish a permanent niche and have lasting impact on immune regulation and subsequent development of atopic disorders. In infants with already established eczema, significant improvements in dermatitis were noted after a one-month trial with Lactobacillus GG-fortified hydrolyzed whey formula. The authors suggest probiotics may enhance endogenous barrier mechanisms of the gut and alleviate intestinal inflammation, providing a useful tool for treating food allergy<sup>13</sup>.

### **Vaginosis**

The vagina and its microbiota form a finely balanced ecosystem. Disruption of this eco-system can lead to a microbiological imbalance and symptoms of vaginosis. Vaginosis used to be considered a mere annoyance, but now is being examined for a role in serious conditions including pelvic inflammatory disease, pregnancy-related complications (low birth weight babies, etc.), and increased susceptibility to AIDS infection. Vaginosis can be caused by several different organisms, and in many cases, the causative agent may not be identified. What is known is that lactobacilli predominate in the healthy vagina, and a lack of lactobacilli (especially those producing hydrogen peroxide) is a risk factor for vaginosis<sup>14</sup>. The lactobacilli are thought to maintain a favorable vaginal pH in the acidic range and to inhibit pathogens, possibly through the production of hydrogen peroxide and other antimicrobial factors. Intravaginal applications of lactobacilli have been somewhat effective in treating bacterial vaginosis. One study done with 13 women showed that consumption of yogurt containing *L. acidophilus* decreased the incidence of Candida yeast infections. Research suggests that lactobacilli may be helpful in controlling the incidence and duration of vaginal infections, but larger, controlled studies are needed.

### **Small Bowel Bacterial Overgrowth**

Under certain conditions, such as during the production of low stomach acid or kidney dialysis, microbial populations in the small intestine can increase beyond normal levels. This is termed small bowel bacterial overgrowth. Growth of the misplaced microbes can produce potentially toxic byproducts. Researchers have

found that feeding high levels of certain probiotic strains can control the toxic effects of these microbes. This is another example of the ability of probiotic strains fed in high numbers to modulate the activity of other intestinal bacteria.

### **Helicobacter pylori**

*Helicobacter pylori* is a bacterium which colonizes the stomach. Its presence is associated with gastric ulcers and gastric cancer, although its role in the etiology of these diseases is still under investigation. The effect of probiotics on *Helicobacter pylori* has been studied. Most evaluations have been done either in laboratory assays or in animal models. These studies show that antibacterial substances including (but not limited to) organic acids produced by some lactobacilli inhibit the growth and survival of this pathogen. Results in animal models demonstrate that some lactobacilli inhibit *H. pylori* attachment and prevent colonization. Results in humans show that milk fermented by a *Lactobacillus johnsonii* strain can help control *H. pylori* gastric infections, but cannot eradicate *H. pylori* from the stomach. These results are preliminary, but suggest that probiotic growth in milk may yield anti-*Helicobacter* substances that may help control this infection.

### **Kidney Stones**

A high oxalate level in the urine is a risk factor for the development of kidney stones. Use of oxalate by intestinal microbes limits its absorption. A probiotic preparation that contained bacteria able to degrade oxalate in vitro was shown to reduce oxalate fecal excretion in six patients. This study suggests that manipulation of the gut flora with the right probiotic bacteria may improve gastrointestinal tract oxalate levels and may decrease oxalate absorption. These results are intriguing, but preliminary.

### **Elevated Blood Cholesterol**

Cholesterol is essential for many functions in the human body. It acts as a precursor to certain hormones and vitamins and is a component of cell membranes and nerve cells. However, elevated levels of total blood cholesterol or other blood lipids are considered risk factors for developing coronary heart disease. Although humans synthesize cholesterol to maintain minimum levels for biological functioning, diet also is known to play a role in serum cholesterol levels. The extent of influence varies significantly from person to person. Probiotic cultures have been evaluated for their effect on serum cholesterol levels. Clinical studies on the effect of lowering cholesterol or low-density lipid levels in humans have been inconclusive. Some human studies suggest that elevated blood cholesterol levels can be reduced by consumption of probiotic-containing dairy

foods, but the evidence is not overwhelming. It is likely that some strains may demonstrate this property while others do not. The dietary cholesterol absorption is reduced in three ways: assimilating, binding, or degradation. Probiotic strains assimilate the cholesterol for their own metabolism. Probiotic strains can get to the cholesterol molecule, and can degrade cholesterol to its catabolic products. The cholesterol level can be reduced indirectly by deconjugating the cholesterol to the bile acids, thereby reducing the total body pool.

### **SIDE EFFECTS OF PROBIOTICS**

While the oral use of probiotics is considered safe and even recommended by the World Health Organization (WHO) under specific guidelines, Probiotics have been shown to be beneficial for other types of patients. In a clinical trial conducted at the University of Western Australia, aimed at showing the effectiveness of probiotics in reducing childhood allergies, Dr Susan Prescott and her colleagues gave 178 children either a probiotic or a placebo for the first six months of their life. Those given the good bacteria were "more" likely to develop sensitivity to allergens. Some hospitals have reported treating lactobacillus septicemia which is a potentially fatal disease caused by the consumption of probiotics by people with lowered immune systems or who are already very ill. In spite of various claims regarding health benefits of probiotics, they are not recommended for treatment of certain diseases. More clinical trials are to be conducted for confirmation of its safe and therapeutic use. Probiotics should not be used as a replacement option for prescribed medications. In order to prevent any health complications, always consult a qualified physician before using probiotics. As of now, there have been no reports regarding severe health complications after administration of probiotics. In normal healthy persons, probiotics when taken in recommended doses does not cause any significant side effect. As per the physician's recommendation, you can increase the doses of probiotics gradually. In rare cases, they may lead to mild digestive problems like flatulence, bloating, diarrhea and abdominal pain. If probiotics are taken in excess amount, there are chances of developing infections that require medical attentions. In case of people having an underlying disease or a compromised immune system, probiotics can cause potential health problems. In fact, these individuals are at a higher risk of developing infection after the use of probiotics. Symptoms such as bloody stools, skin rash and fever are indications of intestinal infection. In addition, probiotics may disturb the normal metabolic processes and autoimmune responses of the body. According to medical studies conducted, there is a

possibility that probiotics may interact with immunosuppressive drugs, leading to life-threatening conditions. Hence, those who are on immunosuppressive medications should strictly avoid. It is to be noted that the effects of a particular probiotic vary from those of others. Hence, while opting for probiotics, make sure to select the specific probiotic strain. As there are no standard regulations for manufacturing probiotic products, one major issue is the contamination of toxic chemicals or other substances. Probiotics side effects should be taken into account prior to using the live microorganisms as supplements. As of the present the effectiveness of probiotics still need to be scientifically proven even if it has already been used for a long time. Studies are essential even if it is considered that probiotics cannot cause any further illness to an individual. On the other hand, a lot of information is still required on the safety of probiotics to people of all ages, especially those with problems in their respective immune systems. Majority of individuals eat or ingest probiotic foods and supplements due to some insufficiency in their digestive system. Some ingest it because they want to maintain digestive health. However, prior to taking probiotics you should learn that it may also cause some possible side effects which include the following:

1. The side effects of probiotics which you will experience, if there is any, is only insipid and tolerable. Stomach swelling or excess gas may occur due to the use of probiotics supplement.
2. Probiotics can also tentatively result to contaminations that require antibiotic treatments. Individuals who have major health situations may especially be vulnerable to this kind of side effect.
3. Probiotics can also result to harmful metabolic movements, extra stimulus to the immune system, and incorporation of genetic material in the cell.
4. Majority of the side effects of probiotics are associated with digestive troubles. This is in particular if you are taking it for the first time and you are not only consuming probiotic foods but also ingesting probiotic supplements.
5. Probiotics may also lead to serious fungal infections, especially if your immune system is weakened. This is the reason why it is essential that you should consult your doctor first before taking probiotic foods or supplements if you do not want that it to cause more harm than good.

#### **CONCLUSION**

The flora in the human gut constitutes “an extremely complex living system that aggressively protects your body from outside offenders”. The average American

also eats far too many sugars, some 175 pounds per year, feeding the unhealthy bacteria, which stimulate disease. Chemicals can also disrupt the microflora. The "bad" bacteria largely reside in “the intestinal lining (mucosal barrier) that is over 300 square meters, or about the size of a tennis court”. Beneficial bacteria can boost the immune system, prevent allergies, and stop eczema and heal the intestines. A good diet, supplemented with a high-quality probiotic, will improve the balance of good and bad bacteria. In spite of the problems with dosage and viability of probiotic strains, lack of industry standardization, and potential safety issues, there is obviously considerable potential for the benefits of probiotics over a wide range of clinical conditions. Ongoing basic research will continue to identify and characterize existing strains of probiotics, identify strain-specific outcomes, determine optimal doses needed for certain results, and assess their stability through processing and digestion. Gene technology will certainly play a role in developing new strains, with gene sequencing allowing for an increased understanding of mechanisms and functionality of probiotics. In addition to such basic research, industry-centered research will focus on prolonging the shelf-life of probiotic products and likelihood of survival through the intestinal tract, optimizing adhesion capacity and developing proper production, handling and packaging procedures to ensure that the desired benefits are delivered to the consumer. Over time, new food products containing probiotics will emerge, such as energy bars, cereals, juices, infant formula and cheese, as well as disease-specific medical foods. The establishment of standards of identity for probiotic containing food products will serve to accelerate their development and availability.

Available data from traditional medicine and clinical use clearly state that probiotics have great health potential, particularly today with the increasing threat of antibiotic over-usage and prevalence of antibiotic resistant microorganisms

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