Probiotics And Antibiotics: A Brief Overview

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Abstract

INTRODUCTION

Probiotics is defined as live microbial feed supplements, which beneficially affect the host animal by improving its intestinal microbial balance. Antibiotics and other related compounds are not included in this definition. In humans, lactobacilli are commonly used as probiotics, either as single species or in mixed culture with other bacteria. Other genera that have been used are bifidobacteria and streptococci [1] Probiotics are small organisms that help maintain the natural balance of other organism in the intestines. Probiotics may be a safe and "natural" approach that helps curb the population of unwanted bacteria that cause microbial infections. The largest group of probiotic bacteria in the intestine is lactic acid bacteria.

A human's digestive tract ranges from 25-35 feet and houses over 400 species of bacteria. In total there are over a 100 billion organisms in our digestive tract. A person taking antibiotics is equivalent to pouring bleach into a fish tank to kill an overgrowth of algae. The bleach not only kills the algae but everything else that is present in that environment. It is necessary for people taking antibiotics to alternate with probiotics because antibiotics kill beneficial bacteria along with the bacteria causing the illness

A BALANCE OF MICROFLORA

Cultures of direct-fed microorganisms or probiotics are able to multiply in the intestinal tract to create a balance of microflora. Some lactobacillus species used in probiotic applications include L. acidophilus, L. casei, L. reuteri, L. rhamnosus and Bifidobacterium bifidum. These and other organisms form a symbiotic or mutual relationship with their host. Each species has developed a resistance to the disease-causing potential of such organisms and in fact have formed mutual beneficial relationships with these organisms (Doane). In the gut of a healthy bird, the beneficial bacterial population---gut flora---thrives in great numbers. The established flora prevents other, sometimes dangerous, organisms from invading and flourishing within the digestive system (Vriends). That is, these beneficial microorganisms fill all the available ecological niches in the body. This prevents harmful bacteria,such as E. coli from gaining a foothold and flourishing. The familiar L. acidophilus produces lactic acid, reduces gut pH and acts as a colonizer (Schoen). Thus, establishing healthy gut flora and preventing disease.

The normal avian microflora/gram positive bacteria found in the avian gut are: Corynebacterium, enterococus, Bacillus, Streptococcus, Staphylococcus, Micrococcus and or course Lactobacillus. Lactobacillus acidophilus, the best known of a type of acidophilus bacteria (bacteria attracted to acid), is a genus of bacteria belonging to the family Lactobacillaceae. It has been suggested that L. acidophilus is a beneficial or so-called "friendly" bacterium, which provides an important function in the body of animals and birds. Lactobacillus organisms are gram-positive, nonmotile, rod shaped organisms that do not produce spores, are acid resistant and thrive in acidic conditions (pH 4-5; neutral pH is 7.0; blood is at a pH of 7.2).

BENEFICIAL BACTERIA

This "beneficial bacteria" create an acidic environment that inhibits the intestinal growth of pathogenic bacteria, yeast, and fungi. "Test tube studies have shown that L. acidophilus can and will inhibit the growth [that is discourage the growth, not treat of candida albicans. It has also been suggested, based on test tube studies, that L. acidophilus may have potential antibiotic effects of its own" (Scott-Hartland). Probiotics do produce a natural antibiotic-like substance called bactericine, which helps to eliminate unwanted coliforms. Thus, a bird's normal bacterial flora

develops an effective defense mechanism against infection and illness. The end result is a healthy, viable intestinal lining that can maintain optimal nutrient absorption capabilities and ultimately fight disease. However, if the bacterial balance is destroyed or if natural flora has not been established dangerous disease causing organisms will thrive, eventually requiring medical intervention.

MICROBIALS AND STRESS

It is during times of illness, antibiotic therapy, injury and excessive stress that the normal microflora, pH and digestive process can be effected. Examples of stress that can alter a birds normal microflora populations in the gut are: feed or formula changes, poor nutrition, hatching, weaning, inadequate or close housing, shipping, excessive temperatures, exposure to pathogenic microorganisms or viruses, weakened immune system, and over exertion. Stress can lead to a decrease in food intake, and without adequate energy sources, beneficial microflora populations' decline. Subsequently, the pH of the GI tract rises and pathogenic bacterial populations increase. Direct-fed microbials can reestablish the natural gut flora that in turn lower the intestinal pH, making the GI environment less favorable for disease causing organisms. Probiotic therapy will introduce “good” bacteria into the gut, encourage colonization and a healthy growth of microflora. The probiotics will prevent undesirable organisms (pathogens) from gaining a foothold and colonizing in the intestine ultimately causing illness.

With the dawn of antibiotics, “sterile” became the word of the day. Antibiotics are produced by the normal metabolism of certain molds and bacteria. Penicillin was the first to be discovered in 1929, and since then whole families have been discovered and produced. They were used for just about every disorder and disease, and for a while, these “wonder drugs” lived up to their reputation.

Antibiotics were routinely prescribed for colds (even though colds are caused by viruses and immune to antibiotics) supposedly to prevent secondary infections. They were also used to control many communicable diseases and virtually eradicated some. Later they were added to animal feeds as a precautionary measure, too. Here, sub-theraputic doses were used to constantly kill everything in the gut. Feed conversion efficiency was increased, making it cheaper to produce quality meats for market.

All went well for a while, but then certain problems began to be noticed. Indiscriminate use of antibiotics let to situations - mostly unanticipated - that are just now rearing their ugly heads. The center of focus is drug resistance

Triple-antibiotic therapy is used to aggressively eradicate Helicobacter pylori, the bacterium that causes gastric ulcers. Using probiotics between antibiotic courses repopulates the digestive tract with friendly bacteria and effectively inhibiting colonization of H. pylori.[2]

Frequent antibiotic users are familiar with subsequent overgrowth of yeast (Candida albicans), which thrives in a gut low in friendly bacteria. Probiotics are recommended in cases of yeast infection.[3] Researchers are now beginning to advocate antibiotic/probiotic combinations for such conditions as diarrhea, female urinary/genital tract infection and infective endocarditis.[4]

Probiotics are also a promising alternative among individuals who have adverse reactions to antibiotics because they help the gastrointestinal flora resist gastrointestinal aggression brought on by antibiotics.[5,6].

Clinical studies have shown that certain probiotics may be useful in treating a variety of diarrheal disorders, including rotavirus diarrhea, antibiotic-associated diarrhea, Clostridium difficile diarrhea, and traveler's diarrhea. New data suggest that probiotics might be useful in controlling inflammatory diseases, treating and preventing allergic diseases, preventing cancer, and stimulating the immune system, which may reduce the incidence of respiratory disease. Different modes of administering probiotics are currently being investigated, which may ultimately lead to the widespread use of probiotics in functional foods.

THERAPEUTIC ACTION OF PROBIOTICS

Extensive biomedical research has documented considerable evidence for the wide-ranging therapeutic properties of probiotic organisms and has established their role in maintaining optimal health. The major areas of their therapeutic clinical action includes:

- Competition against harmful micro-organisms including Candida, preventing colonisation of pathogens through the production of inhibitory substances including acids and hydrogen peroxide and natural antibiotics;
- Enhancement of digestion of lactose (milk sugar);
- Reduction in blood cholesterol levels;
- Immune enhancement, including enhanced

macrophage activity;

- Reduction in the levels of and deactivation of potential cancer causing chemicals, particularly in the colon and direct anti-tumour activity of certain strains;
- Reduction in liver toxicity;
- Enhancement of peristalsis, digestion, regularity and re-absorption of nutrients, In infants, promotion of healthy digestive tract colonisation;
- Enhancement and balance of oestrogen levels, prevention of osteoporosis through increased calcium uptake;
- Protection against food poisoning, travellers' diarrhoea, allergies, skin problems;
- Enhancement of vitamin status (B, K), digestion of proteins, fats, carbohydrates.

DYSBIOSIS – OUT OF ECOLOGICAL BALANCE

The ecological balance within our internal organs may be disrupted by numerous external influences:

- Diet, particularly if high in fat, sugar and meat. People who eat a varied diet with high proportions of vegetables and fruits have higher numbers of beneficial organisms in their colons than do heavy meat and sweet eaters;
- Drugs such as antibiotics, steroids, hormones including the Pill;
- Environmental pollution;
- Spermicides including Nonoxynol, household cleaning chemicals;
- Stress, which may cause profound changes to the mucosal lining of the colon;
- Depressed immunity including illnesses such as AIDS and treatments such as chemotherapy and radiation;
- Natural ageing which results in a decline of acidic gastric juices and a consequent drop in the numbers of probiotic inhabitants.

All of the above may change the conditions within the inner environment of parts of our body and encourage the entry and colonisation by pathogenic bacteria. When our previously healthy ecological balance is shifted, harmful micro-organisms – E. coli, Klebsiella, Bacteroides, Streptococci and Staphylococci species and yeasts such as Candida species – invade, colonise and take over. Following the disruption of our internal intestinal ecology, our health may suffer fairly dramatic and far-reaching negative consequences, including bacterial overgrowth, lowered immunity, increased risk of cancer, allergies, impaired digestion and toxic overload.

CHARACTERISTICS OF THE PREDOMINANT PROBIOTIC ORGANISMS

The two main groups of micro-organism which have been shown to be therapeutically beneficial as probiotics are the lactobacilli and the bifidobacteria.The microbiological properties of two of the most important probiotic lactobacillus strains, L. acidophilus and L. bulgaricus are summarised briefly, followed by the two major bifidobacteria strains B. bifidum and B. infantis:

L. acidophilus Inhabits the human small and large intestine, also found in the mouth and vagina; Able to grow either in the presence or absence of oxygen (facultative anaerobe); Produces lactic acid as the main by-product of carbohydrates, thereby maintaining the vaginal pH at 4 – 4.5; Optimum growth temperature 35° – 38°C; Suppress hostile invaders, including Candida albicans through production of natural antibiotics and other inhibitory substances such as lactic acid, and H_2O_2.

L. bulgaricus Found in yoghurt and cheese; Facultative anaerobe; optimum temperature 40° – 43°C A transient bacterial inhabitant in human ecology which can encourage a more acidic environment by producing H_2O_2 and antibiotic substances to inhibit harmful bacteria;

B. bifidum The major bacterial component in the human large intestine, but also found in small intestine and vagina; Grows without oxygen (anaerobic); Optimum temperature; 37° – 41°C; usual pH range – 5.5 – 7; Produces acetic and lactic acid, increasing the intestinal acidity, making it less desirable for harmful bacteria; Competes with and control populations of pathogenic intestinal bacteria and yeasts; Produces B vitamins;

B. infantis Predominant bacterial inhabitant of human

infants' large intestine; Produces lactic, acetic,and formic acids from carbohydrates; Optimum temperature 37° – 41°C; Protects against dysentery caused by Shigella species.

Antibiotics were the “cure all/end all” drug of the century. Without them our current medical system would be radically different, helping to eradicate many harmful strains of bacteria. They provide a quick way to kill off most wild bacterial infections. Most antibiotics interfere with the bacteria's ability to synthesize a cell wall, a necessary component for bacterial life. Others interfere with the bacteria's ability to synthesize proteins by attaching themselves to the ribosome (the in-house protein manufacturing plant). Eucaryotic (human) cells do not have cell walls or ribosomes that are similar to bacteria. This being the case, antibiotics inhibit the growth of any cell with a wall or ribosome resembling that of most bacteria. This sounds great, but remember the story above? When called in, the police not only eliminated your uninvited guests, but your invited guests as well.

Billions upon billions of bacterial cells make a home in a healthy human body. These bacteria are not infectious, but actually beneficial (these guys are our friends). More than 500 different species can be found in the intestinal track alone. Bacterial cells outnumber human cells ten to one. From their perspective, we are their hotel manager and they are our guests. This analogy is a good one because your body has gone through a lot of trouble to present these “guests” with a suitable living environment (the intestinal lining serves as an excellent ecosystem for bacteria). These invited guests serve us well by synthesizing vitamins, fighting off infection, aiding in digestion, and supporting a healthy immune system. However, sometimes we are exposed to malicious strains of bacteria which become unwanted tenants by creating infections. Most of the time the immune system, in combination with the beneficial bacteria, can elminate infections when given enough time and supported through nutrition. But in some instances, an infection can become too much and other actions need to be taken. Human technology, past and present, has produced a number of ways to fight infections, one of them being antibiotics. Others include probiotics, colloidal silver, and speciality herbs and herb combinations. Even still, sometimes antibiotics become necessary.

When you take an antibiotic, not only do you kill the deleterious strains that are causing the infection, but you are also killing the friendly bacteria. What's worse is that the friendly bacteria were actually helping you eliminate the bad ones. As a result, a number of problems can arise when taking antibiotics. For one, antibiotics can create an imbalance in the ecosystem of your intestinal flora, resulting in diarrhea. In these instances, probiotics can help to quickly reestablish a healthy intestinal flora. Antibiotics can actually create an infection of another sort, candida albicans. Candida Albicans, and other infectious yeast are not bacterial cells but eucaryotics cells. As described earlier, eucaryotic cells are impervious to antibiotics. Normally, a healthy gut flora will keep these infectious yeast at bay. Once antibiotics kill and weaken their neighbors, they can rapidly grow and become too much to constrain. Candida albicans have been associated with all sorts of chronic illnesses, one of the most common being chronic fatigue syndrome. Once established, it is very difficult to rid the body of a candida albican infection. (Note: The use of broad spectrum antimicrobials

Antibiotics are a double edged sword. Their power of fighting infection is indiscriminate towards all bacteria. All bacteria succumb to their powers, no mercy is shown towards beneficial strains. One should avoid the use of antibiotics unless it becomes life threatening. The human immune system has developed many ways to survive an infection and should be trusted, nourished, and given time. Our species would not have survived if our immune system was not the best defense we have against deleterious infections. If the use of antibiotics becomes absolutely necessary, proceed with caution. The longer the duration of antibiotic treatment, the more likely a candida albican infection can occur. Also, the use of probiotics during and immediately after antibiotic treatment will help minimize the destructive effects of antibiotics to the beneficial flora.

CONSUMPTION

During antibiotic therapy, taking probiotics as well keeps the intestinal flora in proper balance. They can be taken together, but not at the same time of day. In order for the probiotics to be the most effective, they should be taken at least two hours after each dose of antibiotic. When the treatment has been completed, double or triple the probiotic supplements for about ten days or two weeks. Probiotics should be taken with food or shortly after eating as food dilutes the stomach acids enough for them to survive their trip through to the intestines where they belong.

When taking beneficial bacteria or an antimicrobial agent, pathogens begin to die off. This sometimes causes unpleasant side effects known as The Jarisch-Herxheimer Reaction, so named for the German dermatologist who first

identified it. As pathogens begin to die, others try to escape by quickly exiting the body. When these microbes appear in large numbers, the exit routes from the body begin to clog -- much like rush hour traffic! It is at this point that the host may begin to experience headaches, bloating, gas, or allergy-type symptoms. Depending on the individual's level of tolerance for these unpleasantries, the dosage of probiotics may have to be reduced until the symptoms subside, and then increased slowly to the maximum recommended. Regardless of first appearances, it is important to realize that this reaction is a positive indication that all is going well.

CONCLUSION

The beneficial effects of probiotics seem to be strain-specific. For example, a few strains of certain species of lactobacillus may be capable of shortening the duration of rotavirus diarrhea, whereas most others are not.[10]The genetic variability among various strains of lactobacilli is considerable.[11] Probiotic benefits are most often dependent on the ability of the organism to colonize the bowel. This usually requires the presence of receptors on the bacterial cell wall that permit attachment to the gastrointestinal epithelium.[12] Most strains do not have such receptors. Certain strains are more bile- and acid-resistant than others and some strains produce bacteriocins, which kill adjacent organisms.[13] Additional factors or characteristics are probably also important. Consequently, controlled studies are needed to determine the efficacy of each specific strain of probiotic to determine its usefulness in clinical situations. Ultimately, we may view probiotics as we now view antibiotics, with many choices of strains useful in different situations and many double-blind, placebo-controlled studies to direct our choice for prevention or therapy

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