

Digestive Aids in Horses:

Many owners are looking for safe and effective alternatives to pharmacological methods for promoting the health and well-being of their horses. Often this comes in the form of a digestive aid, in an attempt to alter the microflora found in the horse. Most horsemen understand the need for a healthy population of bacteria in the digestive tract in order to undergo fermentation of fibrous feedstuffs. However, bacteria and other microflora are capable of doing much more. Through the use of sophisticated research techniques, we now have a deeper understanding and appreciation of the equine microbiota beyond just fiber fermentation. Simply put, an animal's, or human's, microbiota is the complex ecological community of all microscopic flora and fauna existing throughout the body. These microbes exist in a sophisticated and complex interaction with the host. The bacteria, protozoa and fungi making up this microbiota exert powerful effects which can promote health or cause disease, affect metabolism and may even control behavior! Thus manipulation of the microbiota through the use of probiotics has exploded in recent years.

Historically, probiotics have been used for health promoting effects for hundreds of years. However, in the last 30 years, they have increasingly been used in humans, production animals, and of course in horses. This is in part due to concerns of over administration of antibiotics, antibiotic resistance, and a move towards more "natural" therapies. In general, probiotics are live organisms which exert beneficial effects beyond their nutritional value when fed in adequate amounts. The original concept behind the use of probiotics was to provide a beneficial type of microorganism which enhances the fermentation process in the hindgut. Typically these organisms promote digestion, improve fiber fermentation and alter the types of volatile fatty acids that are produced during fermentation. This has been repeatedly shown to be true in ruminant species, as well as some evidence in horses.

Additionally, probiotics are used to protect against the more negative or pathogenic types of organisms. Originally it was thought they did so by competing with them for resources. Essentially the first bacteria to the "food" got to eat it. This was typically referred to as a competitive exclusion effect. However, it is becoming more widely understood that probiotics may have farther reaching effects than just simply outnumbering undesirable bacteria and may actually be capable of inhibiting other bacteria. The so called "good" bacteria adhere to intestinal epithelial cells and block binding sites for other pathogens. In other cases they stimulate the intestinal cells to increase mucin production which also blocks pathogenic bacteria from reaching the intestinal cells and binding to them. Pathogenic bacteria such as *E. coli* or *Salmonella* are then unable to establish their own colonies. Some bacteria can release *bacteriocins* (a protein produced by one strain of bacteria which are active against other strains of bacteria) as well as produce enzymes which hydrolyze other species toxins. Overall, certain strains and species of bacteria may be powerful allies for the body in fighting off disease causing bacteria.

Bacteria can also modify the immune system of the host animal to help prevent disease. Live, or even dead, bacteria can influence the immune system directly or by the release of metabolic byproducts. Yeasts and lactate using bacteria may stimulate the *gut associated lymphoid tissue* (see below) or GALT to ramp up its activity. This enhances the immune system of the horse and may make them more capable of handling exposure to pathogens. In addition, bacteria can serve an anti-inflammatory role as well. Probiotics can alter cytokine production of both the intestinal epithelial cells as well as cells of the immune system such as macrophages. Probiotics may down regulate the production of inflammatory cytokines.

Perhaps the most intriguing finding concerning microbes is their ability to affect mood and behavior. Bacteria have been linked to depression, anxiety and more recently to autism. Bacteria produce mood altering chemicals such as dopamine and serotonin. Probiotics have been shown to reduce anxiety and stress related behaviors in humans and mice. Now, with that said, there is no suggested probiotic to alter a horse's behavior and no substitute for training and exercise. Effects have been bacterial strain specific and have not yet been studied in horses. However it is a very promising line of research.

Taken together, it is clear that the microbiota of the horse can have powerful effects on its health. Next we will discuss the types of organisms typically found in probiotics, what one needs to consider when selecting a probiotic and when then use might be warranted.

Horse owners have many options when selecting probiotics, including powders, pills, pastes, feeds, live culture yogurt or even inoculations of fecal microflora from healthy horses. Remember that probiotics refer to live micro-organisms that are fed to the horse. One key feature for probiotics to be effective is that they are able to survive exposure to acid, bile and enzymes in the foregut of the horse and reach the hindgut alive. Perhaps more of a challenge, an effective probiotic must remain viable during processing and storage until it is fed to the horse. Further, microorganisms must be present in sufficient quantities in the product to have an effect. Using information from human studies, it is suggested that foals be provided with a minimum of 10 to 20 billion colony forming units or CFUs, with some studies suggesting an increase of 10 fold in adult horses. Therefore concentrated forms of probiotics are often the most effective, rather than just a feed with added probiotics which may contain insufficient numbers of organisms. It is highly recommended that horse owners read product labels carefully in choosing a digestive aid for their horse to ensure the product contains living organisms at sufficient numbers. Unfortunately, many commercial products may not actually even contain the amount of microorganisms listed on the label. In a study from 2002, products contained as little as 2% of the CFUs claimed on the label. In addition, some claims may be misleading and actually only contain fermentation products, which are not live cultures and therefore not probiotics. While they may have nutritive value, they will not be able to act as a true probiotic.

Beyond viability and amount of probiotics, the type of organism contained in the probiotic is key. The most common classes of probiotics are the *lactate* utilizing bacteria including lactobacilli, bifidobacteria and enterococci. These bacteria are those that convert lactate to *propionate* in the gut which may help stabilize colonic pH. Live yeast cultures have also been used, in particular *Saccharomyces cerevisiae*. This differs from the use of yeast products which may be fed in order to supply vitamins or protein from the process of digestion of the yeast itself. When looking for a yeast supplement intended to be a probiotic, be sure that it actually contains live yeast. Most species of organisms in probiotics are not typically found inhabiting the gut of the horse. Thus they fail to form permanent stable colonies in the gut, and will no longer be present after administration has been ceased. Therefore continual supplementation may be necessary depending on the desired outcome.

But how do you know if you should be providing your horse with a probiotic? Probiotics are frequently administered when there is believed to be a disruption in normal gut microflora, such as during bouts of diarrhea, following anti-biotic administration or other gastric upsets. This can also include any stressful period for the horse such as travel, new environments, or alteration in diets. Horses supplemented with yeast and subjected to transport had greater biological diversity of bacterial species in the hindgut, and an increase concentration of lactate using bacteria and cellulolytic bacteria. Thus these horses maintained

a healthier hindgut population compared to non-supplemented controls. Supplementation of live *boulardii* yeast, a sub species of *Saccharomyces cerevisiae* resulted in a shortened period of diarrhea and a quicker return to normal feces in horses suffering from *enterocolitis* compared to a placebo group. Horses in this study had a broad range of causative factors for the diarrhea. Thus probiotic administration may be an additional therapeutic tool in managing colitis or diarrhea in horses. Probiotics may also reduce the detrimental effects of a high starch diet on the microbial population. Typically high starch diets promote the growth of amylolytic bacteria and decrease the population of cellulolytic bacteria, thus suppressing fiber fermentation. In addition, the by-products of amylolytic bacteria are responsible for lowering the pH of the hind gut. If probiotics are used in conjunction with higher concentrate diets, the overall health of the gut may be improved.

So when is a probiotic right for you? Certainly during periods of digestive upsets, probiotics can help return the microbiology of the gut of the horse to a healthier state. They may also assist a horse during times of stress, not only preserving the health of the GI tract, but also the health of the horse itself. Probiotics promote a stable pH in the gut and can assist in fermentation in the gut. There are very few negative indicators for probiotic usage, rather just be sure that you choose an effective product. Select a product that has some evidence of usefulness and a manufacturer that you trust.

Definitions and terms

Lactate – a product of fermentation or glucose metabolism

Propionate – one of the volatile fatty acids produced during fermentation and can serve as a source of glucose

Enterocolitis – inflammation of the colon or intestinal tract

Gut associated lymphoid tissue – the gastrointestinal tract's immune system is typically referred to as the GALT. It serves as a storage site for immune cells, and can release antibodies to defend against pathogens. In humans, GALT represents the largest mass of lymphoid tissue

Cytokine – proteins which are used to affect the immune system through cell interaction, communication or how cells act. Common cytokines include interleukins, lymphokines and other cell signaling molecules