

Prebiotics in horses.

Last month we discussed the use of probiotics in horses, including the definition and types of probiotics, their effectiveness, and when their use might be warranted. This month we will address a closely related and often misunderstood topic: prebiotics. The use of both of these feed additives may work together, more so than either alone, to promote digestion in your horse, keep his immune system in top shape and allow him to face the various stressors which may be present in his life.

As opposed to probiotics, prebiotics are not live organisms. Rather, they are chains of specific types of carbohydrates which promote the growth of organisms which are beneficial to the well-being of the host. Compared to probiotics, they are easier to feed as prebiotics are not as sensitive to temperature, storage and processing. Almost think of them as supplying a source of food to the beneficial bacteria in your horse's gut. Additionally, prebiotics may also interfere with the binding of pathogenic bacteria to the gut wall, similar to some of the effects of probiotics.

Prebiotics are derived from a variety of products, including milk, fruit, vegetables and fermentation byproducts, typically from yeasts. They are typically oligosaccharides, or short chains of differing types of sugars. When referring to sugars, this simply means the single unit of a carbohydrate, such as glucose, galactose, ribose etc. Simply stated, oligosaccharides are shorter chains of carbohydrates or saccharides (sugars) as compared to polysaccharides such as starch, glycogen or cellulose. Most prebiotics are typically chains of fructo-oligosaccharides (FOS), which are a mix of fructose and glucose; mannose oligo-saccharides (MOS) often derived from yeast cell walls, or galacto-oligosaccharides (GOS) comprised of more galactose.

Because of the type of bonds joining these carbohydrates together, prebiotics are not able to be enzymatically digested in the stomach and small intestine. Instead they provide substrates for fermentation of a specific group of bacteria and thus allow them to flourish. When providing pre-biotics to horses, it may be helpful to think about prebiotics as providing food for the good types of bacteria, rather than feeding your horse. In ruminant animals such as cattle, sheep and goats, they have a direct effect on the rumen microflora, while in monogastrics (think pigs, chickens, and dogs) and hind gut fermenters such as the horse, prebiotics pass to the hindgut where they exert part of their beneficial effect. Horses also have a substantial microbial population in the foregut as well.

So why would you have to feed the bacteria? Certainly a horse on a high forage diet would have adequate nutrient delivery to those microbes, correct? Well, different types of organisms utilize different substrates for food. If there is more food available for one type, they will be more successful and reproduce at a higher rate. Cellulytic bacteria, those that digest cellulose, are responsible for fermentation of the fibrous portion of a horse's feed and are typically associated with a higher pH in the gut. However, amyloytic bacteria, or starch digesters, prefer substrates such as sugars and starches. When we over feed concentrate to our horse or forages containing more rapidly fermentable sugars, these amyloytic bacteria flourish and can produce negative by-products for the horse. Prebiotics typically provide substrate for more beneficial strains of bacteria including bifidobacteria (found more in humans), lactobacillus and lactate utilizing bacteria.

The use of prebiotics has shown to be effective in preventing the rapid and detrimental shift in bacterial population which occurs when horses are overfed concentrates. Now certainly it would never be advisable to subject our horses to a rapid increase in carbohydrates. However, we could think of

supplementation of prebiotics during periods of dietary adaptation, shifting to a new feed source or when starting to graze in the spring as a potential way to modulate gut microflora. However, supplementation of prebiotics would not be an alternative to slow controlled adaptation to new diets.

Prebiotics may have more benefits than just helping to increase fermentation or stabilize the population of the hindgut. Prebiotics help prevent the colonization of pathogenic bacteria such as Salmonella and E coli and so improve the overall health status of the animal. Bad bacteria are able to survive in the GI tract by actually binding to the cells which line the intestine. This prevents them from being swept out as feed passes through the intestine. But prebiotics “trick” bacteria into binding to themselves, therefore blocking them from binding to the intestinal wall and reproducing. Even promoting the growth of the beneficial bacteria may limit the growth of pathogenic bacteria. In the war of bacteria against bacteria, prebiotics can strengthen the ranks of the good bacteria. Bifidobacteria and lactobacillus possess their own bactericidal/anti-microbial effects against harmful bacteria. The “good” type of bacteria can even release enzymes which destroy the toxins produced by pathogenic bacteria, or even release their own bactericidal assault. Clearly it is easy to see why the feeding of prebiotics has gained much attention in feeding production species as an alternative to antibiotics, an often controversial topic.

In addition to these direct effects on bacteria, prebiotics may be able to directly stimulate the immune system within the gut. There is a substantial amount of gut associated lymphoid tissue located within the intestine. Immune enhancement with prebiotics appear to be not only in response to viral or bacterial challenge, but even with allergen stimulated immune responses. In pig and mouse models, supplementation with prebiotics have an anti-inflammatory effect on both normal as well as inflammation inducing conditions. The use of prebiotics may be a tool in helping to develop the immune system of neonatal foals, as has been proposed in other species. Human infants supplemented with prebiotics which mimic those found in breast milk developed fewer infections compared to those not receiving prebiotics. Of course, this may still be a result of improving the intestinal microflora.

However, there is also limited evidence that prebiotics may have an effect on the systemic immune system. Intestinal epithelial cells may be able to transport prebiotic oligosaccharides into the body, putting them in direct contact with cells of both the local and systemic immune system. In a study of immune cells harvested from equine blood, these cells showed an increased immune response in the presence of galacto-oligosaccharides (GOS) and fructo-oligosaccharides (FOS), two types of commonly used prebiotics. In this model, no bacteria would have been present to produce effects thus prebiotics themselves may stimulate the immune system. Finally, prebiotics may serve as natural anti-oxidants themselves. In part this could help explain their effects on the immune system as well. Taken all together, consider using prebiotics when the animal might be undergoing periods of stress, as stress typically weakens the immune system.

Even beyond their ability to affect the population of micro-organisms in the hindgut or stimulate the immune system, prebiotics may also help with insulin sensitivity. This has been shown in dogs, veal calves, rodents and humans. The effect is believed to be due to the alteration of fermentation in the hindgut, resulting in a shift in the ratio of volatile fatty acids which are produced. In obese horses supplemented with short chain fructoligosaccharides, a modest improvement in insulin sensitivity was observed after 6 weeks. Prebiotics may serve as an aid to restoring insulin sensitivity, but certainly should not replace diet modifications or a sound weight loss program.

Certainly the addition of prebiotics to the human food supply is increasing, and a number of products designed for use in pet foods and production animals point to the value of this natural foodstuff in promoting the health for all. There do not appear to be any risks associated with feeding prebiotics, and the number of proven health benefits is quite expansive. The evidence for their effectiveness in improving the health and well-being in many species of animals is substantial. So if your horse needs help with digestion, stress, his immune system or even insulin resistance, consider a prebiotic. However, remember if your horse is already consuming a high quality diet, and has a healthy population of gut bacteria, prebiotics may not show any effect at all, and are simply unwarranted.

Oligosaccharides – short chains of sugar units; prebiotics are typically a variety of oligosaccharides