

Managing Microbes

by Kate Kruschwitz
EQUUS

Just when you thought that you finally had a handle on how best to meet your horse's feed needs, the news from the scientific community is that his current ration may not be allowing him to derive the maximum benefits from what he consumes. The reason? Most equine feeds do not seem to meet the nutritional ideals of your horse's microbes - the bacteria, protozoa, fungi and yeasts that live side by side in his gut and help him to process fiber. As a result, a number of nutritional supplements have been introduced. Called "probiotics", "direct-fed microbials" and "lactobacillus cultures", they are designed to bolster the ranks and efforts of the tiny inhabitants of the equine digestive system.

Even before he is born, a horse begins to acquire microbes. During delivery, a foal collects them as he passes through the birth canal. Nursing supplies more, as does virtually every other contact with the environment. As a youngster grows, a succession of different organisms colonizes the gut, competing for food and space. The by-products of some species serve as the energy source or poison of others. Colonies multiply and strive with neighbors so that by adulthood the equine gut plays host to a stable, self-regulating population of hundreds of different microbes. Between 30 and 40 species dominate.

You might assume that the gastrointestinal tract encourages the proliferation of these helpers. Actually, keeping microbes around is not as simple as making their acquaintance; and for a good reason. If it were too easy for microbes to stay and multiply, the horse would eventually have a problem supporting all of his boarders. Accordingly, the equine gut seems designed to be a difficult, but not impossible place to stay. Few organisms can endure the acid bath they find there. In addition, the intestinal contents keep flowing along and then out of the system. The lining of the digestive organs produces a constant stream of mucus, while its cells are constantly sloughing off. Special adaptations enable the resident microbes to stick around long enough to multiply and maintain their colonies. Some secrete "glues" or filaments to hold themselves in place. Other, spiral-shaped bacteria apparently spend their lives slowly, constantly swimming upstream against the mucous tide.

The cecum, large colon and associated microorganisms together function like a fermentation vat, although most of the microbial species are fussy eaters and thus, their labor is carefully divided. Some bacteria break apart cellulose - a chain of tightly linked sugar molecules - into single units of glucose that can be absorbed by the horse as well as by fel-

low microbes. Others use the byproducts of cellulose breakdown to construct nutrients such as vitamins. There are even fungi that remove oxygen from the gut, making life possible for their hardworking anaerobic brethren who cannot function in the presence of air.

The beneficial microbes that occupy the gut are also an important barrier to colonization by their disease-causing relatives (pathogens). Not only do they monopolize the available nutrients and residential sites, they also produce a chemical stew in which only the highly adapted can survive. Some species even flavor it with antibiotics against other species. Various *Lactobacillus* strains, for example, produce lactic acid, acetic acid and hydrogen peroxide, which inhibit the growth of *Escheria coli* and other gas-producing coliforms which cause disease when they are in excessive numbers.

Unless invaders appear in overwhelming numbers, the population of gut microbes in a healthy adult horse makes it extremely difficult for pathogens to gain a foothold and cause mischief. It is all dynamic, interconnected and efficient as you would expect of a system that has had over 150 million years to work out the kinks.

Today, most horses do not live the kind of life their microbe-driven innards were designed for grazing and digesting small quantities of forage throughout the day. Instead, they are likely to be stabled indoors, get fed twice daily and eat high-concentrated diets, which likely skews the carefully balanced population of the helper in their digestive tract.

Behavioral stresses can be similarly disruptive. Scientists have, for example, reported profound, rapid changes in the bacteria of the rodent digestive system as a result of crowding in cages and handling. Levels of certain gut bacteria in people have been shown to change following an argument.

Broad spectrum antibiotics and some antiparasitic chemicals periodically introduced into the system devastate the beneficial microbial populations as well as the target pathogens. Then there is the frequent stress of travel, competition and breeding.

Even in the course of normal digestion, these organisms expire in vast numbers; in dying, they supply the horse with proteins and energy as they are digested and absorbed. Dead microbes are a major component of feces.

However, given the losses in normal digestion, plus the stresses of the domestic equine lifestyle, it is no wonder that digestive problems appear to be so common among horses. Probably some young and stressed adult animals have an imbalance of gut microbes that need to be remedied to ensure the animal's nutritional status. Enter the latest in equine supplements.



Most of these microbe-managing feed supplements contain "probiotics", which are cultures of viable microbes. The term "probiotic" (for life) was coined to mean the opposite of "antibiotic" (against life). Some call these cultures direct-fed microbials (DFMs).

The idea behind probiotics and DFMs is that feeding a horse beneficial microbes will help combat stress, aid digestion and fight pathogens. Improved digestive efficiency (indicated by less undigested matter in droppings, weight gains and improvement in appearance and temperament) have been reported as a result of their use.

Some products target foals, other adults. Some are administered orally with syringes, others sprinkled on feed. Some are intended to replace microbes lost to antibiotics and deworming, while others are fed daily. Typically, these products contain only one or a few different microbial species.

Several products contain *Lactobacillus* strains, which are antagonistic to certain pathogens and are also capable of breaking down a wide range of carbohydrates. *Lactobacillus* additives have been reported to relieve diarrhea and promote weight gain in cattle, pigs and chickens. Some of the most striking effects have been on young animals, which may not be surprising, considering how long adult level populations take to establish themselves. Erroneously once thought to be the dominant intestinal organism - which probably account for its popularity with researchers - lactobacilli are now reported to not be among the top 25.

Other supplements contain live yeast cultures, which supply B vitamins and take up oxygen from the gut environment, benefiting the anaerobes. *Aspergillus oryzae* is another popular ingredient which helps to digest cellulose. *Streptococcus*, *Streptococcus faecium*, *Saccharomyces cerevisiae* as well as *Bacillus subtilis* are also used. Some products include vitamins, minerals and enzymes.

One liquid supplement is even marketed as a nutritional supplement for your horse's microbes. It contains key nutritional growth factors needed for peak microbial activity. The recommended dosage is a few drops a day sprinkled on the feed.

There is a lot of evidence supporting DFMS, but as an article in *Feedstuffs* reports, a good bit of it is inconclusive since the study of equine digestion is in its infancy. Most of the research has been done in laboratory test tubes. The living, seething cauldron of the equine gut, where hundreds of species of microbes reside and spew chemicals at each other and the feedstuffs passing by, is vastly more complex. Even so, the weight of opinion seems to be that DFMs can be beneficial, and there is a growing trend toward adding microbial to the diet. The livestock industry, especially, is looking to such products as substitutes for the increasingly frowned-on hormones and antibiotics used to promote growth in food animals.

As a result, horsemen can expect to see more of these feed products in the equine market. Yet, it will probably be years before even the experts know for sure what really works, when and why. Perhaps the most encouraging thing about supplements claiming to help manage microbes is that none of them are reported to do any harm, so it is possible to try them out with little or no risk. If your horse is a hard keeper, has a poor appetite, or shows other signs of digestive distress that other treatments have not remedied, probiotics may be exactly what you have been looking for to restore his well-being, inside and out.

