# MICROBIAL TOOLS FOR EQUINE HEALTH

*An overview of probiotics, prebiotics, and other potions for horse owners.*



In recent years the awareness of the importance of what is now commonly called the "gut biome", i.e., all of the microbial life that exists in an animal's digestive tract, has grown tremendously. We are informed, virtually on a daily basis, of the way in which this biome affects and interacts with issues of health, well-being and even mood and mental health. A dizzying array of products, some with attractive or even startling claims flood the market. This article is an attempt to give horse owners some clarity and understanding regarding the various categories of products and some of the pitfalls to be avoided.

The basic premise of probiotics and other types of microbial tools (MTs) is that there are "good" microbes and "bad" microbes. This is perhaps an oversimplification but it is true that all of the products on offer are in one way or the other purporting to affect the gut biome in a way that advantages the "good" bugs that support well-being at the expense of "bad" bugs that do not do such a good job of helping your horse to thrive.

Let us first touch on a few of the basic mechanisms whereby MTs affecting the gut biome can help or hinder your horse and then take a look at the common categories of products available to you today.

## Nutrition

Probiotics and other microbial tools (MTs) are often associated with good nutrition or digestion. It must be noted here that many of the nutrients absorbed in the equine gut are not digested directly by the horse and are instead the 'leftovers' made available through microbial digestion within the horse's hindgut. In essence, the microbes eat first and your horse gets what is left behind. A greedy gut biome will not allow your horse to thrive, virtually no matter how much feed you provide and a generous biome will allow you to maintain condition and well-being on a much more modest (more affordable!) ration. MTs thus attempt, with varying success, to promote a generous biome and discourage a greedy alternative.

In addition, a healthy gut biome will synthesise vitamins that are absent from the horse diet, such as vitamin K (Schoster et. al., 2014), and some MT's attempt to support this function.

## Immune System

The majority of a horse's immune system focuses on the digestive tract because most of the pathogenic microbes likely to challenge the horse are consumed via feed or water. "Good" microbes, in addition to not being pathogenic themselves, are often quite good at killing or limiting the ability of "bad" microbes to thrive. Phrases like "competitive exclusion" or "pathogen shedding" are used to describe some of the various ways that the good guys combat the bad to your horse's benefit.

There is an abundance of research (e.g. Schoster et al, 2014) showing the potential that the "good" microbes have in stimulating the immune system not only within the gut but also throughout the horse's body. In this context, "good" microbes (or bits of microbes) are sometimes said to stimulate the immune system but caution must be taken with these types of claims given the complexity of the immune system itself and the variability of just what is good or bad in a microbe for an individual horse. This general stimulation of the immune system may be responsible for benefits outside of the digestive tract, such as improvements in skin conditions or allergies, which are occasionally associated with MTs

## Gut well-being

Ulcers, suspected or diagnosed, are a common concern

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for horse owners. While acute, serious ulceration is a matter for your veterinarian, an understanding of how the gut biome can protect the digestive tract will help to select the MTs you give to your horse to manage the risk of gut irritation and ulceration.

The equine gut is normally protected by a slimy layer, a biofilm, which is a complex community made up of many different microbes. When this layer is damaged or broken down, through stress, antibiotics/ antithelmics, illness, etc., and if there is not a natural source of "good" microbes to re-inoculate the gut and rebuild the protective biofilm, the tissues of the gut are left exposed to stomach acid as well as the mechanical irritation of feed moving along the tract. This leads to irritation, inflammation, and ultimately ulceration, all of which cause discomfort and pain to the horse. MTs can contribute to the presence and rebuilding of this biofilm (Schoster et. al., 2014).

It must be noted that cells on the surface of the gastro-intestinal wall shed regularly every few days, taking the protective biofilm with them. This shedding is one of the ways that a horse can eliminate pathogens without having to fight them at all, i.e., the pathogen shedding mechanism mentioned above. Natural re-inoculation of the biofilm on the surface of the gastro-intestinal wall is interrupted through confinement, processed feeds, hard work, drugs, transport, etc. If the biofilm is to be rebuilt, "good" microbes must be introduced by other means and some MTs are useful in this regard.

Windsucking and crib-biting are complex stereotypical behaviours with causes that are imperfectly understood. A range of issues affecting the digestive tract have been suggested as contributing to these behaviours and some of these issues may be mitigated through the use of MTs.

## Mental well-being

A horse is an honest stimulus/response system. If pain or discomfort are present, the fight or flight impulse can result in a range of undesirable behaviours such as girthy-ness, separation anxiety, spooky-ness, grumpiness, etc. While emerging research in humans suggests complex interactions that affect depression, anxiety, eating disorders and other mental health issues (Shoster et. al, 2014), the limitations of this article lead us to conclude simply that gut well-being can easily affect your horse's mood and behaviour in a positive manner.

## CATEGORIES OF MICROBIAL TOOLS (MTS)

Let us now take a look at the categories of MTs and the types of commercial offerings within these categories.

## Probiotics

"Probiotics are live microorganisms, which when administered in adequate amounts confer a health benefit on the host." (FAO, 2001)

First and foremost, probiotics are alive. They consist of microbes that are understood by science to be both safe and beneficial for health gut function. A probiotic product, to be effective, must deliver a sufficient number of the appropriate type of live microbes to that part of the gut where they are capable of delivering a benefit to your horse.

Unfortunately in many places, including New Zealand, the term "probiotic" is not regulated in any way and a manufacturer can (and some do!) call anything, alive or dead, a probiotic. For those searching for a product that can actually help their horse it is very much a buyer-beware market.

The majority of products sold today as probiotics are freeze-dried microbial cultures. These include single strain products and products where several or even many different freeze-dried cultures are mixed together. It is generally accepted that multi-strain products, freeze-dried or otherwise, are more effective than single strain products. These products are sometimes contained in pellets or other coatings. These coatings are sometimes claimed to help protect the microbes in the gut but they are generally there to extend the shelf life of the product (a properly selected probiotic microbe can easily handle the challenge of

stomach acid, bile salts, etc., and do not need encapsulation to help them do so).

Evidence exists supporting the proposition that freeze-dried cultures can provide a beneficial effect, as demonstrated by the abundance of studies undertaken by the companies selling these products (Schoster et. al. 2014). Freeze-drying has important benefits, especially the creation of a long period of shelf-stability, especially when stored under controlled (refrigerated and free of oxygen or moisture) conditions. Freeze-drying does have its costs too. Many of the cells are damaged and less than 10%, (and often less than 1%) of the microbes survive the drying/rehydration process, especially given the harsh conditions found in the equine gut. Further, "waking up" takes time and the freeze-dried microbes will pass through at least a part of the gut before they can begin to take a probiotic effect.

Far more effective are live microbial cultures that are administered in an active state (Salexlin, 1996). Products containing live, active microbial cultures are uncommon in the market and come with certain limitations, especially a much shorter shelf life.

## Prebiotics

Prebiotics are non-digestible food ingredients that promote the growth of beneficial microorganisms in the gut. These often take the form of fiber or carbohydrates that are not readily broken down through normal digestive action but which provide a substrate, or living space, for the types of "good" microbes that promote healthy gut function.

The overwhelming majority of products that claim to be prebiotic consist largely or entirely of inulin, a polysaccharide carbohydrate generally refined from chicory. Inulin is an effective prebiotic but it is often touted as some sort of high-tech additive to a product, usually powdered, rather than the very inexpensive and widely available bulk product that it truly is.

## Organic Acids

There are a number of organic acids that are understood to benefit gut function. The most commonly available is cider vinegar, an excellent source of acetic acid. Other beneficial organic acids include lactic acid and butyric acid. Products containing a variety of these acids are available in some markets (especially in Europe where they are part of a range of "natural" options gaining popularity after the ban on production-enhancing antibiotics was enacted there in 2006). Organic acids are routinely fed to production animals in Europe and China as an alternative to antibiotic growth promoters (Riley, 2014). Apart from cider vinegar, the NZ horse owner has few options in this regard.

## "Enzyme" Products

There are a number of products that claim to be enzyme-based products. These are often made through microbial fermentation that is halted (killed) in the manufacturing process. What is left over is a broth of both intact cells and cell fragments, the metabolites produced by the microbes in the manufacturing process, and, yes, some enzymes released during the process. Because enzymes continue to work even after the microbe that produced them is killed it is very hard to stabilize these products. Further the scientific work associated with these products is often not of the same quality as with other categories of MTs. Differentiating the quality or efficacy of "enzyme" products is beyond the scope of this article and it is another buyer-beware territory.

## STUFF FROM THE MARKETING DEPARTMENT

Companies selling products derived in one way or another from microbes have come up with a number of pseudo-scientific terms to describe their products and these are quite confusing to consumer and scientist alike. Some products attempt to combine probiotics and prebiotics giving rise to the term "Synbiotic." Other products invent terms that are seemingly self-contradictory, such as "probiotic extract." When confronted with novel terminology, a reference to a dictionary or Wikipedia can help to separate genuine technical terms from marketing wizardry.

## Pitfalls to Avoid

The most common source of confusion about probiotics is the number of microbes present in a product. The overwhelming majority of manufacturers, including most of those making freeze-dried products, declare only the number of live microbes present at the time of manufacture. They are silent with regards to the number of microbes that will actually be alive to take effect in the gut. One should always ask for information regarding the number of microbes that will survive any shelf-stabilization and "waking up" process to finally produce effects in the gut. If a satisfying answer is not forthcoming, an alternative should be sought.

In 2012, four products sold in NZ with a claim to being "probiotic" on the label were tested and the results were published in the NZ Vet Journal (Bennett et. al. 2013).

This assessment underscores the vast differences between products using the term "probiotic" to describe their products and the importance of looking beyond mere marketing terms for the genuine facts.

Numbers (cfu/mL) of lactic acid bacteria and yeast in four probiotic feed supplements (from Bennett et. al. 2013)

| | Product A | Product B | Product C | Product D |
|---|---|---|---|---|
| Lactic acid bacteria | 5,000,000 | 500 | 500 | 6 |
| Yeast | 12,000 | 0 | 0 | 0 |

In the area of prebiotics, there is much in the way of claims and jargon but little in the way of disclosure. With bulk inulin being the most common ingredient in products claiming to be prebiotics, if you cannot get an answer to the question of just what the prebiotic is and what its source (chicory, etc.) was, then it is probably time to look for a cheaper source of prebiotics, likely the most affordable source of inulin that you can find.

We have touched on the confusion often created by the dark arts of marketing. Quite simply, if you cannot get an answer to a straightforward question about a product, or if the answer is couched in pseudo-technical jargon, it is probably time to move on to a product presented in a simpler and technically credible manner.