

BENEFICIAL BACTERIA IN PET RABBITS

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LIVIA BENATO considers how these live microorganisms, known for carrying health benefits, could help the well-being of a rabbit's gastrointestinal tract

PROBIOTICS are live microorganisms that confer health benefits to the host in several ways, such as modulating and maintaining intestinal flora balance, competing with pathogens for intestinal mucosal space and boosting the host's immune system ([Table 1](#)).

They are already empirically used in pet rabbit gastrointestinal disease management and, along with traditional medical treatments, it seems reasonable to consider the possibility probiotics could contribute to re-establishing a healthy microbial colony in the rabbit gastrointestinal tract.

Digestion

Rabbits are hindgut-fermenting herbivores, with fermentation occurring in the caecum. The caecum contains a well-established population of different types of bacteria – such as *Bacteroides*, *Bacillus* and *Enterococcus* species – and plays an important role in food digestion.

Factors that adversely influence caecal microflora composition – such as poor diet, pain, stress, infection and inflammatory diseases – lead to dysbiosis and microbial imbalance, resulting in gastrointestinal disease, which is common in pet rabbits (Rees Davies, 2006).

For example, dietary fibre deficiency due to a diet predominant in cereal mix, affects caecal metabolism and reduces intestinal motility, predisposing to increasing food retention in the caecum. This alters the caecal microflora and predisposes the rabbit to diarrhoea and enterotoxaemia.

Similarly, high starch levels in the diet lead to a drop in caecal pH that inhibits the normal microflora and allows pathogens such as *Clostridium spiroforme* and *Escherichia coli* to proliferate, causing severe enterotoxaemia (O'Malley, 2005).

Probiotic uses

Probiotics are used in both the medical and veterinary field. In human medicine, it has been shown that probiotics might treat and reduce the symptoms of many gastrointestinal diseases, improve human immune function and modulate inflammatory response (Roberfroid, 2000; Isolauri et al, 2001; Moller et al, 2004).

The most studied condition treated by probiotics is diarrhoea. However, it is often not clear which type, dose or duration of probiotic treatment to select to achieve a clinical benefit (Harish et al, 2006).

In the veterinary field, probiotics are used to restore and maintain normal intestinal flora in many animals such as cats, dogs, horses and farm animals. Probiotics are generally used for weight gain and feed conversion in farm animals and as a dietary supplement for various conditions such as diarrhoea, stress and recovery from surgery in companion animals (Weese, 2001).

In pet rabbits few studies have been conducted, while many have been carried out on lab and commercial rabbits to better understand the use and role of probiotics on general rabbit growth and health.

Preliminary evidence from commercial rabbits bred for meat suggests probiotics may have beneficial effects on the immune system, improve feed conversion, increase body weight and reduce post-weaning mortality (Hollister et al, 1990). They are also effective for preventing diarrhoea in young rabbits, which do not have as well an established caecal population as adult rabbits.

In laboratory rabbits, it has been shown probiotics can regulate the serum level of cholesterol and may help to reduce the incidence of atherosclerosis and cardiac diseases in rabbits (Shrivastava et al, 2010). Also, they can reduce the proliferation and translocation of *E coli* (Lee et al, 2000), thus reducing the chance of enterotoxaemia.

Extrapolating some of these findings for pet rabbits when considering probiotic use, probiotics could, therefore, be used to increase bodyweight, boost the immune system of recovering animals and have beneficial effects in rabbits with diarrhoea and gastrointestinal problems. However, more research is needed in this field to confirm the usefulness of probiotics in pet rabbits.

Probiotic varieties

The most common types of bacteria and yeast present in commercially available probiotic products include *Lactobacillus acidophilus* and other lactobacilli, *Saccharomyces cerevisiae*, *Enterococcus faecium* and *Enterococcus faecalis*. *S cerevisiae* is the most tested probiotic in rabbits, however, many other probiotics have been tested in rabbits and have been proved useful.

In young rabbits, *S faecalis*, *Clostridium butyricum* and *Bacillus mesentericus* were able to prevent the growth of *E coli* (Tachikawa et al, 1998), while *Lactococcus lactis* was shown to decrease colonisation of *Enterobacter cloacae* in the stomach and lungs (Copeland et al, 2009). *Bacillus licheniformis* and *Bacillus cereus* reduced both morbidity and mortality rate in fattening rabbits (Kustos et al, 2004; Matusevicius et al, 2009).

Any non-pathogenic bacterium, fungus, yeast or protozoa is a possible candidate for probiotic use (Martins et al, 2005). However, the microorganism needs to be tested to show ability to survive the conditions found in the digestive tract and not become pathogenic for the host. For a microorganism to be defined as probiotic, it should have specific characteristics.

Probiotics should, above all, be safe and not invasive, nor pathogenic. They should be able to survive the passage through the stomach and low pH, resist bile digestion and be in a sufficient amount to stabilise and have an impact on the intestinal microflora (Myers, 2007; Del Piano et al, 2011). They also need to have the ability to adhere to cells, excluding or reducing pathogenic adherence, to multiply and co-aggregate to form a normal balanced flora (Weese, 2001; Kaur et al, 2002).

Specifically for rabbits, a successful probiotic strain should be acid and bile tolerant, should be able to adhere to the intestinal epithelium and colonise it in order to compete with pathogens and to produce antimicrobial substances (Simonova et al, 2005).

Within the European Union, regulations set out by the European Food Standards Agency pertain to which probiotics can be used in certain animal species. The only probiotic species authorised for use in rabbits is *S cerevisiae* (CNCM I-4407) 4b1702. This is the only strain that has been shown to be safe in rabbits.

Lactobacilli are used as probiotics in humans, but in rabbits their use is controversial. Lactobacilli are rarely found in rabbit caecal flora and, although they are resistant to low gastric pH, they lack adhesive capability and this prevents them from colonising the caecum and giving potential health benefits. For this reason, the use of lactobacilli as probiotics should be carefully considered in rabbits.

S cerevisiae is a yeast commonly used in baking and breweries. Due to several biological characteristics, it also has many applications in both biological and medical fields, including its use as a probiotic. It has been previously reported that animals fed with *S cerevisiae* showed an improved resistance to enteric infectious diseases, due to the ability of the yeast to adhere to

pathogenic bacteria, thus becoming more resistant to the infection (Martins et al, 2005; Perez-Sotelo et al, 2005).

In rabbits, *S cerevisiae* is resistant to the low pH of the stomach and improves the digestive health of growing rabbits, removing toxins and pathogenic bacteria and reducing the mortality rate.

In meat rabbits, dietary supplementation with *S cerevisiae* has been shown to improve growth performance, increase bodyweight, enhance haematopoiesis (formation of red and white blood cells) and reduce serum cholesterol (Onifade et al, 1999; Matusevicius et al, 2004). Therefore, *S cerevisiae* remains a probiotic of potential use in the pet rabbit.

E faecium and *E faecalis* are Gram-positive bacteria used to control contamination in food, feed and the digestive tract of animals. They are the predominant enterococcal species in the rabbit gut and are able to survive the acidic gastric pH, colonise the mucosal surfaces and prevent the attachment of pathogens (Linaje et al, 2004).

Probiotics such as enterococci also have antimicrobial properties and produce bacteriocins able to inhibit a variety of bacteria (Szabóová et al, 2008). Although they are extensively used as a probiotic in dogs but not in rabbits, all these qualities suggest these organisms may prove useful probiotics for rabbits.

Probiotic strains

In the UK, different probiotic strains are available and come in powder, granule or paste form. Some products may contain one or more probiotic strains and are sometimes also associated with prebiotics (nondigestible food components that stimulate the activity of the good bacteria of the gastrointestinal tract) and vitamins.

Although probiotics are generally considered safe, the ingredients should be checked before administration, not only to evaluate the type of probiotic, strain and concentration available, but also to ensure the rest of the ingredients are specifically appropriate for pet rabbits.

The product label generally includes instructions for its correct use, including dosage and storage advice. Moreover, it is important to consider that probiotic supplementation should be given for a period generally longer than two weeks, if not more, before the rabbit can experience benefit from it.

Conclusion

In the medical and veterinary fields, probiotics are used to maintain and treat the health of the gastrointestinal tract as well as for stimulation of the immune system.

In rabbits, it appears some probiotics could be useful in providing additional support to maintain the balance of the intestinal microflora and could be used in the case of gastrointestinal diseases alongside traditional treatments. Moreover, some strains could contribute to reducing the level of cholesterol in the blood, preventing cardiac disease or increasing the bodyweight of those animals that are recovering from weight loss.

However, more research is needed to understand further which strain, dose or duration of probiotic treatment is likely to be of greatest benefit for the maintenance of rabbit health and to achieve a clinical benefit.

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In rabbits, probiotics could contribute in providing additional support to maintain a healthy intestinal microflora.

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| 1. Safe and non-pathogenic to the host |
| 2. Survive gastric low pH |
| 3. Survive contact with bile |
| 4. Adhere to intestinal epithelial cells |
| 5. Reduce pathogenic adherence |
| 6. Stabilise intestinal microflora |
| 7. Ability to multiply and colonise |
| 8. Modulate immune response |
| 9. Produce antimicrobial substances |
| 10. Survive feedstuff production and packaging |

TABLE 1. Characteristics of probiotics (Weese, 2001; Kaur et al, 2002; Myers, 2007; Del Piano et al, 2011)