Probiotics in cats and dogs

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One of the fastest growing areas in research is into the microbiome.

With the development of next-generation sequencing it has become possible to identify the DNA of microorganisms that cannot be cultured in the laboratory. This has revealed each individual is an ecosystem with a unique population of microorganisms that outnumbers the host's cells by a factor of 10 and, collectively, contains a hundred times as much DNA as the host cells[1,2].

Microbiota has been shown to be individual specific in humans, dogs and cats. It is affected by the individual's genome, diet, life style, disease and antibiotic administration, is considered to be fairly stable through adulthood and then changes in old age[3,4,5]. The evolution of the microbiota is driven by the need of the host for the metabolites and protection from pathogenic organisms provided by the microbiota, which benefit, in turn, from the habitat provided by the host[3,6].

The ecological conditions provided by the host are different for the various parts of the body and the microbiota reflects these differences[1].

It was thought the fetus is sterile, but recent research shows the placenta has its own microbiota[7] and that the meconium passed shortly after birth also has a microbiota[8]. The infant is inoculated with the vaginal and fecal bacteria of the mother during a normal delivery, and these, along with the bacteria in breast milk and the bacteria that colonised the fetus during gestation, make up the initial microbiota, which then develops along with the host as it grows up[3,9].

Microbiota is crucial for health and has many functions. Among these is it serves the host by educating the immune system to tolerate commensal organisms and potentially allergenic food components. It provides colonisation resistance, which limits the opportunity for pathogens to invade. The metabolism of the microbiota provides micronutrients and, by metabolising otherwise indigestible elements, it makes these available to the host[3,6]. It is, therefore, apparent the health of the microbiota is inextricably linked with the health of the host.

Probiotics

The administration of probiotics, which are “live microorganisms that confer a health benefit to the host when administered in appropriate amounts”, and prebiotics, which are “food substances that can be consumed to selectively promote the growth and activity of beneficial bacteria that colonise the intestinal tract”, are the means of therapeutically supporting the microbiota. The use of probiotics in dogs and cats was reviewed in this journal by Cosgrove and MacLauchlan[10], in which they outlined evidence for their use in gastrointestinal disease, dermatological disease, urogenital disease and respiratory disease in dogs and cats.

So far, studies on the efficacy of probiotics in dogs and cats have enrolled small numbers of animals and, at best, suggested there may be some evidence of efficacy – particularly in acute diarrhoea. The probiotic bacteria in these studies were *Bifidobacterium animalis* strain AHC7 used in a study by Kelly et al[11], and a combination of *Lactobacillus acidophilus*, *Pediococcus acidilactici*, *Bacillus subtilis*, *Bacillus licheniformis* and *Lactobacillus farciminis* used in a study by Herstad et al[12]. However, preparations containing these bacteria are not licensed for use in dogs and cats in the EU.

The only probiotic licensed for use in dogs and cats in the EU is *Enterococcus faecium* NCIMB 10415/SF 68. Two studies have shown an effect of treatment with *E faecium* NCIMB 10415 on the development of stress-induced diarrhoea. Barlow showed a 50 per cent reduction in cases of acute diarrhoea in dogs that were given *E faecium* NCIMB 10415 versus those that received a placebo at a rehoming centre in the UK[13], and Gore and Reynolds showed Alaskan sled dogs that were given *E faecium* SF 68 had less severe diarrhoea and recovered more quickly than dogs that were not[14]. Thus, evidence exists for a beneficial effect of the use of *E faecium* NCIMB 10415/SF 68 in supporting the intestinal microbiota during times of stress.

Targeting

As with all therapeutic intervention, it is important it has a specific target. Nutraceuticals, and these include probiotics, are inclined to be seen as a therapy to try – “it might do some good, but it won’t do any harm”. This gives nutraceuticals such as probiotics a bad name, because indiscriminate use results in poor evidence for efficacy. In the case of probiotics, it is important to realise not all probiotic bacteria are made the same, nor do they have the same functions in all species.

The functions of some bacteria are known – *Bifidobacterium infantis*, which is a commensal bacteria and a probiotic, has been shown to enhance the expression of tight junction proteins and, therefore, to decrease intestinal permeability[15]. *Lactobacillus rhamnosus* is a commensal bacterium and a probiotic strain. *L rhamnosus* GG has been shown to upregulate the expression of the MUC2 gene leading to increased mucus secretion, thus strengthening the epithelial barrier and reducing the risk of bacterial translocation[16]. *Faecalibacterium prausnitzii* and *Clostridium XIVa*, also commensals, produce butyrates in the colon, and these short-chain fatty acids have anti-inflammatory effects on the colonocytes[17].

Bednorz et al fed *E faecium* NCIMB 10415/SF 68 to piglets from birth and showed a reduced number of extra-intestinal pathogenic *E coli* harbouring virulence-associated factors adhering to the mucosa of the ascending colon in the probiotic group versus the placebo group. They speculated this probiotic bacteria may provide colonisation resistance – having a function in preventing adherence of potentially pathogenic bacteria to the intestinal mucosa[18]. *E faecium* NCIMB 10415/SF 68 was originally a commensal bac terium, having been isolated from an infant in Sweden in 1968[19] and, as with all commensal bacteria, has a role in intestinal homeostasis.

The key to successful use of this probiotic bacteria in dogs and cats will be to use it in situations where its efficacy has been shown by well thought-out clinical studies.

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