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Behind the Hype: Prebiotics and Probiotics for Dogs and Cats

Everywhere we look these days we find products that include probiotics, prebiotics, or both. These can be in the form of supplements, known as nutraceuticals, or over-the-counter foods and therapeutic diets. According to the hype, these products can improve the immune system and gastrointestinal (GI) function while performing a number of other tasks just short of emptying the litter box.

A 1983 graduate of Michigan State University, Ann received her specialty certification in Emergency/Critical Care in 2000. In 2008 she was certified in Small Animal Internal Medicine and in 2013, she earned her third specialty certification in Nutrition. Ann has worked in general, emergency, and specialty practices and education. She is currently an instructor for Ashworth College's veterinary technician program. She is on the executive board for the VTS (Nutrition). Ann has written more than 50 published articles in various professional magazines, as well as coauthored the book *Nutrition and Disease Management for Veterinary Technicians and Nurses*.



The Food and Agriculture Organization of the United Nations and the World Health Organization define probiotics as “living microorganisms which when administered in adequate amounts confer a health benefit on the host”¹ and prebiotics as “nondigestible food ingredients that selectively stimulate the growth and activities of specific bacteria in the gastrointestinal tract and exert beneficial effects on the host.”² A synbiotic is a balanced combination of prebiotics and probiotics used together.^{3,4} (FIGURE 1) The US Food and Drug Administration defines nutraceuticals as “nondrug substances produced in a purified or extracted form and administered orally to provide agents required for normal body structure and function with the intent of improving health and wellbeing.”⁵

As we can see by these definitions, we are talking about bacteria or substances that benefit bacteria in the intestinal tract. Millions of bacteria normally reside in the small and large intestines of normal, healthy animals; we call this population the microflora. These bacteria help digest food, maintain intestinal mucosal integrity, participate in metabolism, and stimulate systemic immune function.⁶

Because nutraceuticals are not pharmaceuticals, regulatory scrutiny over the sale of these items is minimal. Thus, it can be challenging to find products that not only do what their manufacturers say they do but also contain viable bacteria in the types and amounts specified on the label.⁷ Not all commercially available products provide the same level of usefulness, so it is important to understand what products, especially probiotics, have actually been evaluated in dogs and cats. Not all bacteria provide the same benefits with all species, nor are all products tested and evaluated to the same extent.

GOOD BUGS, BAD BUGS

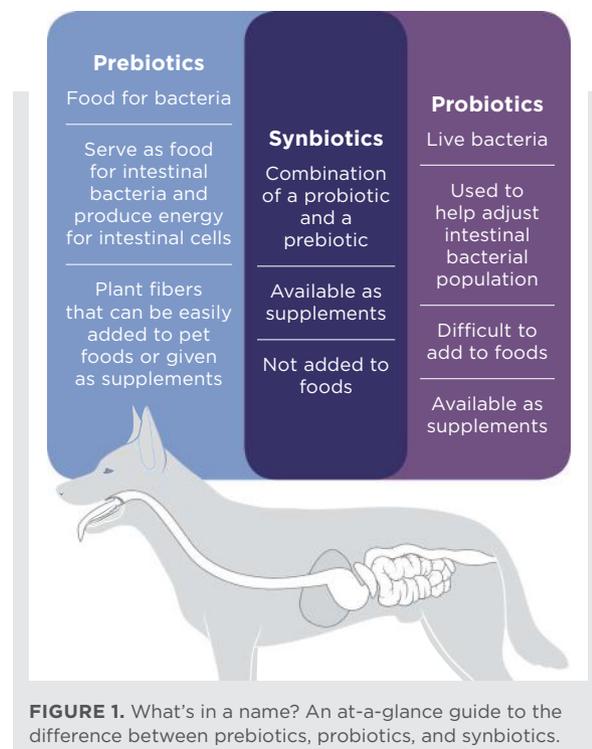
The intestines are the largest component of the immune system in the body, making up approximately 70% of the total system. The mucosal barrier in the intestines helps to block the entrance of most pathogenic bacteria into the body while allowing the entrance of permeable nutrients.⁶ Because most pathogens enter the body through the mouth and then the intestinal tract, these intestinal defenses must be working optimally to cope with the onslaught of foreign substances and pathogens to which the intestines are constantly exposed.⁶

This defense involves the coordination of 3 different systems within the intestines:

- Resident intestinal microflora, which provides an environment that favors the growth and functioning of beneficial bacteria
- Intestinal mucosa, which provides a barrier against pathogenic bacteria
- Gut-associated lymphoid tissue (GALT)⁶

It would be difficult for us to affect the intestinal mucosa or the GALT, but we can help to modulate the intestinal microflora to improve the environment the bacteria are living in, which may have a positive impact on the dog or cat. Substantial research is looking at how enteral nutrition can help improve both the GALT and the intestinal mucosa barrier. The hope is that we will see the benefits of that research in the next few years. Currently, prebiotics and probiotics are being used to help with this modulation of the GALT.⁴

Efforts to maintain a healthy microflora in the GI tract or rebalance the gut microbes after a disruption have focused on dietary manipulation; helminth therapy; fecal microbiota transplantation; prebiotic, probiotic, and synbiotic use; and antibiotics.³ Probiotics can also help to control diarrhea caused by bacterial overgrowth or parasitic infection via competitive exclusion,





competition for nutrients and binding sites, and an increase in specific and nonspecific immune response.⁶

Antibiotics are seen as a significant destroyer of the normal GI flora and can negatively affect function. Although antibiotics are usually prescribed for a specific reason, they are not necessarily bacteria- or site-specific; instead, they destroy or kill any bacteria that fall within its spectrum, regardless of whether the bacteria are beneficial or pathogenic.³

If an antibiotic is prescribed orally for pneumonia, it still must pass through the intestines and will exert its antibacterial effect on that site, as well as on the lungs, where the actual infection is occurring. Antibiotics used as growth promoters can exert an even larger effect on the microflora than do those used intermittently.³

No studies have shown that supplementing pet diets with yogurt or other fermented food products, such as kimchee, benefits the pets themselves.



PREBIOTICS AND GUT HEALTH

Prebiotics are usually considered to be a type of carbohydrate called oligosaccharides. By definition, however, noncarbohydrates can be classified as prebiotics. The ones used most frequently are classified as soluble fibers. These were first identified as a functional food in 1995 by Marcel Roberfroid. In 2007, Roberfroid clarified that only 2 classes of fructooligosaccharides (FOS) fully meet the definition of a prebiotic: oligofructose and inulin.⁸

Oligofructose is a 2-8-chain fructose-based saccharide molecule that undergoes fermentation fairly quickly in the colon, providing nourishment to the bacteria in that area. Examples of FOS sources include soybeans, oats, beets, and tomatoes.

Inulin is a longer 9-64-chain fructose-based saccharide that tends to be fermented more slowly, benefiting bacteria farther down the colon. It can also be broken

down into FOS by intestinal bacteria to provide both FOS and inulin. Inulin can be found in Jerusalem artichokes, jicama, and chicory root.

These 2 fibers are considered minimally digestible because of the β bond-based connections of the fructose molecules. Dogs and cats lack the intestinal enzyme needed to break down the β bond; instead, they usually break down α saccharide bonds. The resident bacteria in these animals can break the β bond, producing short-chain fatty acids (SCFAs). The most common SCFAs are acetate, propionate, and butyrate.⁴

Plants do not have only 1 type of carbohydrate in them; some may contain both FOS and inulin in varying amounts, whereas others may contain neither. Just adding fiber to the diet may or may not provide prebiotic effects. That benefit depends on the types of fibers found in the product.⁴

The SCFAs produced by the breaking of the β bond through bacterial fermentation are an energy source for the colonocytes, lower the colonic pH, and stimulate sodium and water absorption.² One SCFA in particular, butyrate or butyric acid, is a primary source of energy for colonocytes but may also directly enhance cell proliferation of normal cells while suppressing proliferation of transformed cells. Because both oligofructose and inulin are fibers, their addition to the diet can also have negative side effects. When used at higher levels, both FOS and inulin reduce fecal protein digestibility.²

Studies have shown addition of FOS and fructose-based inulins to the diet has generally positive effects on gut microflora and host health, as evaluated through gut integrity and bacterial colonization, and on animal performance, as evaluated through digestion, body weight gain, and feed efficiency.⁹

PROBIOTICS AND GUT HEALTH

Probiotics present an appealing approach to treatment and prevention of many conditions because of their potential to be effective and safe and to result in decreased use of antibiotics in veterinary medicine.¹⁰ Rather than encouraging the growth of beneficial bacteria and suppressing the growth of pathogenic bacteria, probiotics actually introduce these beneficial bacteria into the environment. Current knowledge suggests that the best use for these products is treatment of GI disease, such as diarrhea and other GI

abnormalities, potentially including inflammatory bowel disease.¹⁰

Studies in different animal species have often demonstrated bacterial strain-specific results. Thus, unless you use the exact product on the same species used in the study, at the exact same dose and delivery method, your results will likely not be the same as those the researchers showed.¹⁰

To function as a probiotic, the bacteria must be able to:

- Survive the acid and bile found in the GI tract
- Adhere to the intestinal cells or transiently colonize various areas within the GI tract
- Exclude or reduce pathogenic bacterial adherence
- Produce acids, hydrogen peroxide, and/or bacteriocins that antagonize the growth of pathogens
- Coaggregate to help achieve normal balanced microflora population
- Be safe, noninvasive, noncarcinogenic, and nonpathogenic⁶

The GI tract of a newborn is initially sterile but is colonized with bacteria within hours of birth. These bacteria find their individual niches within the intestinal tract and reach a state of equilibrium. Once this neonatal “grace period” ends, however, introducing bacteria is substantially more difficult because of gastric acidity and the introduction of bile acids to the chyme leaving the stomach.⁶

No studies have shown that supplementing pet diets with yogurt or other fermented food products, such as kimchee, benefits the pets themselves. The bacteria found in these products are limited in amount and type and may not be the kind that benefit the health issue being addressed.^{1,10} Research has also failed to

demonstrate that routinely adding probiotics to the diet improves overall wellness in otherwise healthy animals.¹⁰

The primary bacterial populations included in probiotics that do benefit the cat and dog are lactic acid bacteria, especially lactobacilli, bifidobacteria, and enterococci (**TABLE 1**). These bacteria use fermentation to transform some sugars into organic acids, particularly lactic and acetic acids. These acids lower the pH in the intestinal tract and inhibit the growth of pathogenic bacteria.⁶

Probiotics can benefit the intestinal microflora in many ways. They can increase the fecal count of good bacteria while decreasing the numbers of pathogenic bacteria. Some probiotics minimize adherence to the intestinal epithelial cells and establishment of pathogenic bacterial populations.⁶

Probiotics can produce various antimicrobial metabolites, known as bacteriocins, that can also enhance functionality of the epithelial barrier and help modulate the mucosal immune response.³ Compared with the large intestine, the small intestine has poor microflora colonization and limited barrier protection against pathogens. Therefore, probiotics can exert an important beneficial effect in the small intestines.^{3,5} The recommendation is to rely on a product for which research supports both the product and the manufacturer’s claims. The most extensively researched probiotic available in veterinary medicine is FortiFlora™ (purina.com).³

SYNBIOTICS AND GUT HEALTH

Synbiotics are a balanced combination of probiotics

TABLE 1 Gut Bacteria: What’s Good and What’s Bad

BENEFICIAL	PATHOGENIC
Lactobacilli	<i>Pseudomonas aeruginosa</i>
Eubacteria	<i>Proteus</i> species
Bifidobacterium	Staphylococci
Enterococci	Clostridia
Streptococcus	Saccharomyces
Pediococcus	Veillonella
Leuconostoc	
Bacillus	
<i>Escherichia coli</i>	



and prebiotics and may be advantageous for treatment of various GI diseases. The prebiotic portion may improve the conditions in the GI tract, enabling the probiotics to maximize survival, and may increase proliferation and adherence of the beneficial bacteria.⁴ Prebiotics may enhance or potentiate the benefits of the probiotics found in these products.

You need to consider if the bacterial portion of the product is still viable and as stated on the label. Benefits can also be obtained by using 2 separate products, given at the same time, as with using a probiotic in a food that has been supplemented with a prebiotic fiber.⁴

TRUTH IN LABELING: LOOK BEYOND THE CLAIMS

One of the biggest challenges for manufacturers of probiotic products is survivability of the bacteria. Most commercially available products suffer tremendous loss of activity during storage. After 5 to 6 months of storage, almost no live organisms are present. Bacteria that are present still must survive the gastric pH and duodenal bile acids before they can colonize the small intestines. To address these concerns, some manufacturers have developed microencapsulation to protect the bacteria, while others provide a variety of bacterial species to cover more bases.⁶

A study by Weese and Martin, at the University of Guelph in Ontario, Canada, compared the actual product contents vs label statements for a variety of commercially available probiotics.⁷ Of the 25 products evaluated, only 2 had acceptable correspondence between actual production of bacteria classes and what was stated on the label. All products were evaluated before their expiration dates.⁷ Prostora™ (produced at the time by the Iams Company) and FortiFlora™ were the top performers. Prostora™ was discontinued after Royal Canin acquired Iams. FortiFlora™ is still available.

CONCLUSION

Because prebiotics are used as both a source of nutrition for the colonocytes and a fiber source for the animal, inclusion in the diet is fairly easy. The ingredient panel should list the fiber source but may not state whether it is a source of FOS or inulin. Increasing your familiarity with the different fiber sources used, and their relative FOS and inulin

contents, can help in evaluating a diet. When in doubt, contact the manufacturer for further information.

Unlike use of prebiotics, use of probiotics is more of a transient process based on need rather than a long-term process. Ideally, the body will supply the bacterial population to support the best intestinal health. But when this doesn't occur, or when challenges that could affect intestinal health are expected, probiotics can be easily added to the diet to help support the bacterial populations there. No detrimental effects have been seen with long-term prebiotic or probiotic use in animals, unlike with the use of long-term antibiotics.⁴

When evaluating prebiotic or probiotic products, ensure that research supports the claims given, that the products contain the stated levels of additives, and that the products promote normal intestinal microflora. A review of probiotics in commercial dog and cat foods by Weese and Arroyo demonstrated that few products meet these guidelines.¹ Alternately, evaluation in a controlled clinical setting can provide firsthand knowledge of the effectiveness of the products used. By applying this strategy, you can ensure that you are providing the best product to support a happy, healthy intestinal tract with a hard-working population of beneficial bacteria. **TVN**

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