Prebiotics & Probiotics for Cats – Why and Which Ones

Updated 2019

Since 2015 when this article was originally written, there has been advancement of the knowledge base as it relates to the microbiome, diet and disease in our pets. We've learned a lot from the work of AnimalBiome, our own cats and the combined experiences of members and their cats in the Raw Feeding for IBD Cats Facebook group (with almost 7,000 members now). Thus, this update is more of a re-write, with a fundamental shift in focus. Our best tool to aid our cats with IBD – apart from diet – in 2015 was S boulardii and human grade bacterial probiotics, typically comprised of proven species of lactic acid bacteria and bifidobacterium. While the off-the-shelf bacterial probiotics do have an important role in supporting IBD cats in health and nutrition metabolism by making up for loss of native intestinal functionality due to the gut dysbiosis (a defining characteristic of IBD), in 2019 we have superior tools to help restore and support the health of our cats' own microbiome.

The Microbiome

According to a report published in September of 2015, the microbiome of mammals is so important, it can be thought of as another vital organ: "It is comparable to the immune system in as much as it is made up of a collection of cells, it contains a 100 times more genes than the host, is host-specific, contains heritable components, can be modified by diet, surgery or antibiotics, and in its absence nearly all aspects of host physiology are affected."

Just what is the microbiome? As explained by Harvard's T.H. Chan School of Public Health, "Picture a bustling city on a weekday morning, the sidewalks flooded with people rushing to get to work or to appointments. Now imagine this at a microscopic level and you have an idea of what the microbiome looks like inside our bodies, consisting of trillions of microorganisms (also called microbiota or microbes) of thousands of different species. [1] These include not only bacteria but fungi, parasites, and viruses. In a healthy person [all mammals], these "bugs" coexist peacefully, with the largest numbers found in the small and large intestines but also throughout the body. The microbiome is even labeled a supporting organ because it plays so many key roles in promoting the smooth daily operations of the human body." [1] Ursell, L.K., et al. *Defining the Human Microbiome*. Nutr Rev. 2012 Aug; 70(Suppl 1): S38–S44.

In fact it has been suggested by microbiologists that mammals can be – should be – thought of as environments rather than as individuals: in humans, the microbes we host are thought to outnumber our cells ten to one. With a rapidly growing body of research, we are learning that the symbiosis between host and bacteria is so deep

and interdependent that bacteria affect ***every*** aspect of being: how well the immune system functions, the nutrition metabolized, – even moods and mental health – all impacted by the make-up of the microbiome. The largest area of research focus to date has been the bacterial portion of the microbiome in the gut. This research has made it clear: mammals depend on host microbes for health and wellbeing. Importantly, the make-up of the microbiome has a direct impact on the health of immune system – not at all surprising as the gut accounts for 70% - 80% of immune system function.

Gut Dysbiosis, Inflammation & Immune System Health

An imbalance of "healthy" vs "unhealthy" bacteria is called "gut dysbiosis," or "gastrointestinal (GIT) dysbiosis." And gut dysbiosis has been linked to at least inflammatory bowel disease, liver disease, chronic kidney disease, chronic pancreatitis, development of asthma & allergies, oral health (& halitosis), obesity, hypertension, heart failure, type 2 diabetes mellitus, and cancer. Every organ in our body, our joints, our cardiovascular system – all can be affected by chronic inflammation. The more research is done, the clearer it becomes the host microbiome is key in managing inflammation, and controlling inflammation is key in prevention or management of many chronic diseases (especially inflammatory bowel disease, becoming ever more prevalent in our cats and dogs).

As it relates to IBD, according to *Dysbiosis in the Pathogenesis of Pediatric Inflammatory Bowel Diseases*, (Comito and Romano, 2012),

> A condition of "dysbiosis", with alterations of the gut microbial composition, is regarded as the basis of IBD pathogenesis. The human gastrointestinal (GI) microbial population is a complex, dynamic ecosystem and consists of up to one thousand different bacterial species. In healthy individuals, intestinal microbiota have a symbiotic relationship with the host organism and carry out important metabolic, "barrier," and immune functions. Microbial dysbiosis in IBD with lack of beneficial bacteria, together with genetic predisposition, is the most relevant condition in the pathogenesis of the pediatric IBD."

Since that article was published in 2012, enteric pathogens and gut dysbiosis are now considered a definitive precipitating factor in the development of IBD. There are few studies (though thankfully this body of literature is growing) of the microbiome in cats and dogs. The published studies examining the microflora of healthy vs IBD cats found significant differences in gut microflora. A study recently published in dogs indicated the ability to diagnose IBD from typing the bacteria of the stool. This indicates a likelihood of the same route of pathogenesis in cats and dogs as in humans.

Inflammation and impaired gut motility: hairballs and vomiting are not normal in cats! The impact of gut dysbiosis in IBD is inflammation that damages the health of the intestines. One consequence is impaired motility. Most think of diarrhea when they think of IBD, but it can also mean constipation, vomiting, and in cats, hairballs. In cats, chronic hairballs are a sign of hypomotility. ("Chronic hairballs," as defined by the study author, Dr. Gary Norsworthy, are vomiting hairballs more than twice a month in any cat, or every two months or more in short-haired cats). This can be an early warning sign of IBD and even intestinal lymphoma (more often small cell rather than large cell, and the older the kitty at the time of diagnosis – as per Dr. Norsworthy's data - the more likely it is lymphoma rather than IBD). [*Please see our article on How Best to Manage Hairballs*].

Treating the Symptoms versus Managing the Condition(s)

Many people and vets, when dealing with pets with chronic vomiting or diarrhea, take a few well-known steps to address the problem: limited ingredient diets, prescription hydrolyzed (easily digestible) diets, antibiotics, and steroids. But these "treatment" approaches address the symptoms, not the cause. These may enable a cat or dog with impaired intestinal function to no longer display symptoms and feel better. But this traditional approach does not address the underlying cause of the inflammation or motility problem: the balance of healthy vs unhealthy bacteria and working to address that.

So how do we take steps to ensure a healthy gut flora in our pets? How do we manage when problems already present – and how do we try to avoid the development of those health problems in the first place? How do we (try to) keep their immune systems functioning at their peak? Make sure they have a healthy, diverse microbiome?

1) Feed a fresh, human grade, biologically appropriate diet to our carnivores.

> *Why human grade?* The lack of oversight and regulation in the animal feed industry. This overview written by a Harvard Law student explains in detail the lack of regulations or enforcement that allow such vast differences between human grade foods and pet feed in quality and contamination. Make no mistake, despite marketing that would have us believe otherwise, pet food is feed grade.
>
> *Why fresh (raw) and biologically appropriate?*
>
> - A 2017 study of dogs conducted by a Finnish research project to learn more about how nutritional, environmental and genetic factors influence disease in dogs (created by a team at the school of Veterinary Medicine, Department of Equine and Small Animal Medicine, University of Helsinki) found a profound impact of diet on circulating levels of homocysteine, a marker of inflammation and a risk factor of "life-threatening inflammatory disease." As reported by Dr. Becker in "*Dogs Fed Kibble Have Elevated Levels of Metabolic Stress and Systemic Inflammation*," the research involved four groups of dogs for six months. The first group consisted of previously raw fed dogs who were switched to dry food for the second half of the study (the last three months). The second group consisted of dry-fed dogs that were switched to raw food for three months. The third and fourth groups continued eating their regular food (either dry or raw for the full six-month study). Results? "The dogs fed raw food who continued to eat raw food had the lowest homocysteine levels, at 0.17mM… The dogs who ate dry food and continued eating dry food had the highest levels of homocysteine, 10 times more than the raw fed group (1.57mM)." And "the dogs raised on raw food and switched to kibble had a fivefold increase in levels of the disease marker in the body at the completion of the study (0.77mM)." And, importantly, "the dogs raised on dry food and changed to raw food for three months had a dramatic decrease in the disease marker (0.3mM)."
>
> - A 2017 study on the impact of diet changes on the gut microbiome in dogs found a raw diet with vegetables "promoted a more balanced growth of bacterial communities and a positive change in the readouts of healthy gut functions in comparison to [an extruded] diet."

- A 2017 study demonstrated raw food is the most highly digestible form of food for dogs as did a 2015 study in cats, discussed in What is Digestibility and Why Does it Matter?

It really shouldn't come as a surprise that a species-appropriate diet fed in the format our pets evolved to eat is highly digestible, promotes a healthy microbiome, and thus is also anti-inflammatory. The growing body of independent studies is confirming: diet composition, food processing, cooking – all of these things impact gut microflora. And yes, raw is preferable to cooked, as discussed in the article, "Raw or Cooked? Which Should I Feed and Why?" Our pets do not require their meat be cooked, they are well designed to manage bacterial loads we can't.

2) Minimize the use of antibiotics (e.g., do not use them prophylactically). Notably, Dr. Martin Blaser of New York University's Langone Medical Center has warned that antibiotics' impact on gut bacteria may be permanent — and so serious in its long-term consequences that medicine should consider whether to restrict antibiotic prescribing to pregnant women and young children. "Early evidence from my lab and others hints that, sometimes, our friendly flora never fully recover [from antibiotic use]. These long-term changes to the beneficial bacteria within people's bodies may even increase our susceptibility to infections and disease. Overuse of antibiotics could be fueling the dramatic increase in conditions such as obesity, type 1 diabetes, inflammatory bowel disease, allergies and asthma, which have more than doubled in many populations."

3) Use alternatives to antibiotics where and when applicable:

Saccharomyces boulardii: As noted by L. V. McFarland in Chapter 18 of *The Microbiota in Gastrointestinal Pathophysiology* (2017) Used for over 50 years, "Saccharomyces boulardii is one of the most studied types of probiotics and has been found to be effective for a wide diversity of infections. From 1976 to 2015, 90 randomized controlled trials covering 15 different types of disease conditions have been conducted with S. boulardii. The most robust evidence-based efficacy is for the treatment of acute pediatric diarrhea, for the prevention of antibiotic-associated diarrhea, for the treatment of Helicobacter pylori infections and the prevention of side effects associated with H. pylori eradication treatments. Strong evidence is also found for S. boulardii efficacy for the treatment of acute adult diarrhea and the treatment of inflammatory bowel disease" and efficacy in other disease indications include clostridium difficile, giardiasis, "traveler's diarrhea," and enteral nutrition-related diarrhea. We note, the experience of the Raw Feeding for IBD Cats group is that S boulardii is very effective at clearing Clostridium perfrigens infections, and it has been used by UC Davis to treat Clostridium difficile in cats. Importantly, McFarland notes: "S. boulardii was well tolerated by study participants, regardless of age, or disease condition."

Notably and importantly, S boulardii has both direct anti-inflammatory properties that "promote epithelial restitution relevant in IBD," AND immune-modulating properties. Please refer to our **article reviewing the science of S boulardii** in gut health.

Mannan oligosaccharides (MOS): Mannan oligosaccharides (MOS) have had an important role in reducing or eliminating the use of antibiotics in food animal production. Used for over 20 years and supported by over 700 published studies, MOS is a prebiotic that stimulates growth of beneficial bacteria; however, in contrast to other popular prebiotics like inulin / fructo-oligosaccharides (FOS), MOS has a ***direct*** impact on pathogenic gut bacteria colonization (as does

S boulardii. There is cross-over, but they both also specialize in different pathogens, which is an important reason they are so effective when used together). Importantly, MOS attracts and removes salmonella and Campylobacter jejuni. It also blocks attachment and colonization of the intestines by E. coli and other gram negative bacteria: notably, MOS has been shown to be effective in treating gastroenteritis in dogs, clearing E coli in 85.7% of dogs vs just 25% cleared in the group treated conventionally without the addition of MOS.

MOS also has numerous important roles in improving the health of the intestines and their structural functionality. A large surface area is key for optimal digestive function and nutrient absorption: healthy intestines have long villi. MOS has been shown to increase both villi length and density. It also aids in restoring intestinal health by improving the integrity of intestinal mucosa (needed to protect the villi and intestinal surface); and like S boulardii, MOS stimulates the enzymes the intestines naturally produce, helping restore normal function.

Finally, as described in our **article containing a review of the science of MOS**, it also acts as an immune modulator. Produced in large quantities by the mucosal immune system, IgA is the only antibody secreted into the intestinal lumen. MOS promotes secretion of IgA into the gut mucosal layer, making pathogenic agents more susceptible to the body's natural immune defenses.

Thus, it is no wonder our Raw Feeding for IBD Cats group on Facebook has found the combination of S boulardii and mannan oligosaccharides to be a powerhouse in stopping diarrhea and improving gut health. Jarrow brand Saccharomyces boulardii with MOS is the only product we are currently aware of in the U.S. that contains effective doses of both to be the most effective option in stopping diarrhea, often working when S boulardii without MOS didn't. In fact, the combined experience of group members over the past five years indicates the Jarrow brand formulation can be used instead of flagyl (metronadizole) in most instances when a vet does or would provide it. (Again, we encourage you to review the science on Saccharomyces boulardii and Mannan oligosaccharides). And if your kitty does need antibiotics, as a yeast-based probiotic, it can be given alongside the antibiotic to control antibiotic-associated diarrhea without concern to timing.

For those outside of the U.S., as discussed in the products section (below), iHerb.com ships to most countries, and Jarrow brand S boulardii with MOS is available on amazon UK. If an alternative is needed, a plain S boulardii can be combined with a product available in Europe and Canada (but sadly, not the U.S.) called Entero Chronic.

PLEASE NOTE when S boulardii will NOT work:

- If your cat's **B12 levels are low** (common when there is inflammatory bowel disease, intestinal lymphoma, or other chronic GI disease). This can be tested via the GI panel that also tests for folate levels and pancreatitis.

- If your cat has **exocrine pancreatic insufficiency** ("EPI"). You need to have the fTLI tested and the diarrhea will not resolve until your cat is on pancreatic enzymes and properly digesting food.

- If your cat has **hyperthyroidism.** Have blood work done that includes T4 and free T4. The diarrhea will not resolve until kitty's disease is controlled with methimazole or cured with I-131 radioiodine treatment.

Is feeding a human grade, biologically appropriate diet and minimizing use of antibiotics enough?

Certainly not for some. We have seen cats weaned to raw develop inflammatory bowel disease, pancreatitis, chronic kidney disease, and exocrine pancreatic insufficiency – all diseases we know are related to inflammation and gut dysbiosis. How does that happen? Are we missing something? Of course, as in humans, each pet's microbiome is inherited, being populated during birth; thus much can depend on the health of mom's microbiome. And antibiotics, dewormers, vaccinations, the quality of the meats, toxins to which our pets are exposed, in our homes & out – even in their drinking water – will all have an impact. But in the end, there are several glaring components missing from the modern diet, even raw diets: appropriate sources of fiber and healthy microorganisms ("probiotics"). This we can address, we do have tools.

How *do* cats, obligate carnivores, sustain a healthy microbiome?

1) *A carnivorous source of short chain fatty acids.* A study in cheetahs indicates the presence of undigested tissue, such as skin, bone and cartilage, may actually act as a kind of "fiber" in the diet of cats. The study found that whole prey consumption was associated with many changes in the gut associated with fiber fermentation in human guts. A follow-up study found it is primarily the collagen in the cartilage that increases production of the short chain fatty acids.

> ***What we can provide:*** Cartilage / Collagen. If we are not feeding a raw diet with bone and connected cartilage, we can offer our cats bone broth. We don't know collagen in this form contributes to the creation of short chain fatty acids, but it is a healthy addition to the diet of our cats, and it is very healing for cats with IBD: **Bone Broth for IBD**.

2) *Predigested / enzymatically fermented fibers.* Thanks to a meta-analysis of feral cat diets conducted by Dr. Esther Plantinga and colleagues, we know the amount of carbohydrates in the natural diet of the domestic cat is very small: just 2% on an energy basis, or 2.8% on a dry matter basis (just 0.8% as fed), and not all of this is starch as noted by the study authors. Based on the analysis of the diets, "carbohydrates from plant matter are not a meaningful or intentional part of the diet." Those carbs come from what their prey has eaten, and it is just 0.5% - 2% of the body weight of their small prey. Cats (with one of the shortest gastrointestinal tracts-to-body lengths in the mammal world), do not have a physiology meant to ferment fiber: the digesta of their prey provides *predigested / enzymatically fermented* fibers.

> ***What we can provide***: fermented grasses and seeds. As the primary prey of hunting domestic cats is small seed-and-grass eating mammals, this is the closest proximation to the digesta of prey. While there are many "super green foods" available on the market, most are not fermented, and many contain unwanted ingredients inappropriate (or toxic / dangerous) for our cats.
>
> **We remind readers it is extremely important to introduce these by starting VERY SMALL and increasing slowly, especially for cats with IBD, pancreatitis and food sensitivities / allergies.**
>
> Fermented grasses: To date, we have found three fermented grass options, available in the U.S. and Canada. In the U.S., Perfect 3 Grass Blend (organic oat, barley and wheat fermented grasses,

dried and powdered). From Canada, also available on Amazon (US), Prairie Naturals Organic Fermented Grass Blend (organic oat, barley, wheat and alfalfa fermented grasses, dried and powdered). In Canada only, Organic Matters' organic fermented grass blend (organic oat, barley, wheat and alfalfa fermented grasses, dried and powdered). **Dose if using only the fermented grasses:** Dependent on the amount of food you feed. But a general guideline: if feeding 6 ounces a day or less, 1/4 teaspoon once a day (this can be divided in half and fed at two meals). If feeding more than 6 ounces a day, 1/2 teaspoon once a day (this can be divided in half and fed in two meals). **If using fermented seeds, too:** If making fermented seeds and using both (fermented) seeds and grasses, use half of these dose amounts (thus 1/8th teaspoon fermented grasses total daily for cats eating 6 ounces or less and 1/4 teaspoon fermented grasses total daily for cats eating 6 ounces or more) and provide the other half of the daily fermented fiber via the fermented seeds.

Fermented seeds: We have not found a fermented seed product commercially available. They are, however, very easy to make at home. We are using a mix of raw chia, sunflower, flax, and hemp seeds – but any safe seeds for cats can be used. Instructions for fermenting seeds. Please note Carolina's adaptation (which isn't necessary, you can just follow the instructions): double-ferment the kefir for the whey; ferment the seeds for 24 hours as per instructions, then process the (now) fermented (whole) seeds into a paste, and let ferment for one more day. Refrigerate. Please also note: in the U.S., you can use Answer's Kefir for pets. Just filter some of the kefir through a coffee filter to separate the five tablespoons of whey used in the recipe. **Dose if using only fermented seeds:** as this is a wet product, the amount of fermented seeds to use is based on the "as fed" amount. We're rounding to 1% (from 0.8%). Just take the weight of the food you feed your cat daily and multiply by 1% to determine the amount of seeds to weigh out to add to food. As an example, if your cat eats 6 ounces of food, the amount of fermented seeds is 6 oz x 1% = 0.06 oz. Best to convert to grams. There are 28.35 grams per ounce: 0.06 oz x 28.35 grams = 1.7 grams. This can by rounded to 2 grams, you don't need to be accurate to the tenth of a gram. And if you get confused with the math, there are online converters where you just enter the amount in ounces, and it'll convert to grams for you. Because this is such a small amount, you may want to use 2 grams as a guideline for cats eating up to 9 ounces of food per day. Above 9 ounces, you can increase to 3 grams of fermented seeds. **If using fermented grasses, too:** we're using the same amount of fermented seeds, but you can divide into half (just 1 gram per day) and provide the other half of the daily fiber via the fermented grasses in the amount provided above.

Any questions, please ask in the Facebook group, Raw Feeding for IBD Cats, a link to the group is at the bottom of each web page.

A note on prebiotics in cats. In humans, while we typically think of prebiotics as "fiber," not all fibers have prebiotic properties. Effective prebiotics are actually complex carbohydrates – sugars – that are not metabolized, but (usually) partially digested in the small intestine and then fermented by anaerobic bacteria in the colon. Well-known prebiotics include inulin, chicory root (inulin is derived from chicory root), beet root or FOS (fructooligosaccharides). In humans, these complex sugars have been shown to increase lactic acid bacteria and bifidobacterium (the typical standard against which prebiotic functionality is measured) without increasing deleterious / unwanted microorganisms. There has been little published work on prebiotics in our pets and

existing studies report conflicting data. Clearly this is an area that merits further work. We do not know if fermented grasses and seeds act as prebiotics. They certainly provide nutrients, some probiotics and enzymes – and fiber. In the meantime, as traditional prebiotics for humans are not proven in pets and can cause gas and cramping, especially at typical doses recommended on commercial products, we prefer pursing a species-appropriate approach, despite the lack of research. ***No matter what you choose to use, please introduce slowly, starting with a very small amount. Nothing will agree with all cats, and there is no way to predict what will or won't agree with any cat, especially one with IBD.***

3) ***Probiotics with every meal.*** In the wild, cats get what amounts to a dose of "probiotics" with every meal by eating the stomach contents and digestive tract of their small prey. Our hunting feral cats would normally, naturally and constantly resupply microorganisms to populate their microbiome: they do not rely on feeding existing colonies with fiber. The diet we feed our cats and dogs (even those feeding fresh food) is typically devoid of healthy microorganisms. As obligate carnivores, we should not expect the microbiome of healthy cats to resemble that of a healthy human. And while studied probiotics for humans, typically lactic acid bacteria and bifidobacterium, can and do confer benefit – until the creation of the company AnimalBiome – access to truly species-specific bacteria that can colonize was limited to fecal microbiota transplants administered in a limited number of veterinary hospitals.

What we can provide: Studies of the microbiome and its role in health are exploding, and the good news is that our pets are not being left behind. In fact, we have a tool for our pets not yet available for humans: a fecal microbiota transplant (FMT) in a pill. Affectionately known in our Raw Feeding groups as the "poop pill" or "poobiotics," AnimalBiome has been analyzing pet poop for years. The products for both cats and dogs are one of the most exciting developments in pet health we have seen in a LONG time. Called the Gut Restoration pill, it is a fecal microbiota transplant in a pill. This capsule brings the only opportunity for **truly species-specific bacteria that can colonize to be easily administered orally**. Freeze dried stool (screened for pathogens) from young, healthy cats with a microbiome of healthy diversity is encapsulated. We may cringe, but this is simply a form of probiotic. It can also be thought of as a fermented food. (Dogs certainly snack on poop without our purchasing it. The difference, of course, is we know the diversity of bacteria in the FMT pill is healthy for our pets). The results seen by a number of early adopters in our Raw Feeding for IBD Cats Facebook group have been, for the most part, quite remarkable. But we are seeing that with time, some cats need repeat rounds of administration. This is consistent with our observations that 1) hunting cats constantly refresh the microorganisms available to the gut by eating the entire GI tract of prey, and 2) our modern diet options are lacking in components that properly feed the microorganisms we want in the guts of our cats. Importantly / notably, many of us have stopped providing daily probiotics to our pets, and instead provide intermittent administration of the FMT pills ((e.g. one bottle of (50) pills is ordered per year, and one pill is given daily, or every second or third day, etc. Some give one pill per week, thus the one bottle lasts just about a year).

For our IBD cats, given the gut dysbiosis, probiotic formulations have a healthful role, performing jobs the damaged microbiome cannot address or cannot efficiently accomplish. Gut microbiota are essential in metabolism of B12, and can synthesize a number of vitamins, notably vitamin K, and other B group vitamins.

The bacterial microbiota perform many other important functions, and thus lactic acid bacteria and bifidobacteria should be given alongside S boulardii + MOS to our IBD cats as their guts heal.

Human Grade Probiotics versus Pet Probiotic Products

Interestingly, most articles on probiotics for pets recommend using pet probiotics - as if the species of bacteria sold in products labeled for pets are different than those in probiotics sold to humans. Yes, there may be an emphasis on different species/strains, but make no mistake, they are not cultured from dogs or cats. (The only one already widely commercially available in the market is FortiFlora. This strain of E faecium, developed and marketed by Purina, is cultured from dogs. But it is one strain, not very much of it, and it is not the primary ingredient in the probiotic). But of course every species has a microbiota that is unique. Ideally, we provide bacteria derived from cats to cats and bacteria derived from dogs to dogs for best results. As mentioned, this is an emerging field of science, and currently there is only one commercially available way to do this (outside of a hospital-based fecal microbiota transplant) as discussed above.

For those that are not interested in or able to use the AnimalBiome FMT pill but want to provide the benefits of probiotics to their cat with a GI system impaired in some way (and recommended when there is IBD), one of the lead researchers in the field of pet microbiomes, Jan Suchodolski D.V.M. of Texas A&M, feels that probiotic selection for use in pets should be based on researched strains [in humans], not whether or not the probiotics are pet-specific, and writes "studies have shown that human or dairy developed probiotic strains are capable of conferring health benefit across species. At this point there is no proven benefit of using a canine or feline specific strain." If you have tried a pet probiotic and it "didn't work," it was likely the wrong strain(s) or not enough colony forming units. Pet probiotics tend to have very little active colony forming units compared to human probiotics, and the (lack of) quality in many pet probiotics (apart from the low, typically ineffective quantities) is one of the main reasons to consider using human grade probiotics. As to doses? This is a very imprecise science at the early stages of research. Too few colony forming units will simply do nothing: too many may cause diarrhea or GI upset.

How much is too much? There is no right answer to that. This is very cat-dependent. As discussed in the presentation by Dr. Suchodolski (hyperlink above), "A substantial percentage of orally administered probiotic bacteria will be lost through competitive exclusion by the highly complex resident microbiota. Therefore, probiotics need to be administered at high doses. Even then, probiotics will represent only a minor fraction of the total microbiota. For dogs and cats, it is difficult to provide a proper dosage for probiotics as no dose-response studies have been performed in clinical patients. Currently, we are extrapolating information from human studies to dogs and cats. Doses between 1×10^8 [100 million] and 4.5×10^{11} [450 billion] colony forming units (CFU) of bacteria have demonstrated clinical benefits."

The effective dose in cats ranges from 100 million CFU (very low) to 450 BILLION (extremely high). The typical recommendation you'll see here for adult cats is between 5 billion and 40 billion (half these for kittens). But this is why using probiotics can take quite a bit of trial-and-error. The probiotics listed here are those that have worked well for many cats, at the doses recommended by my holistic vet, Dr. Aleda Chang, (except for S. boulardii, which dose recommendation is derived from a U.C. Davis study). It is important to note, many have used much more than the listed dose to achieve results. For maintenance doses when we are not treating diarrhea, we will likely not "see results," but hopefully the intended benefit of improved digestion, nutrient absorption, and prevention of inflammation is achieved.

We note, a potent source of probiotics for ourselves and our pets is homemade kefir. Kefir is one of the most powerful, natural sources of beneficial bacteria available. It is inexpensive and easy to make. Please see the article, **Kefir for Pets.** As previously mentioned, Answers brand also has kefir for pets, available for sale in the U.S.

How to Use Probiotics

Probiotics & Antibiotics: Most probiotics should be given separately from antibiotics, at least 2 hours before or after antibiotic administration. The exception is the yeast-based probiotic, Saccharomyces boulardii (and MOS), which can be used as adjunct therapy with antibiotics (though the use of S. boulardii can, in some instances, replace the need for antibiotics as noted above).

Introducing Probiotics: Remember when working with cats with impaired GI systems (IBD, pancreatitis, chronic kidney disease, etc.), ANYTHING new should be discussed with your vet, and if you decided to use a probiotic, it should be introduced small and increased slowly. Start with an amount lower than the recommended dose and work up to it. The slow-introduction exception is if your kitty is in crisis, and you're adding S. boulardii with MOS stop diarrhea. For emergency use, see instructions below. That said, if the addition of S boulardii makes diarrhea worse, obviously stop, start over after a break for at least 24 hours, and re-introduce it slowly. As with anything, S boulardii will not always agree with all cats, though most do seem to tolerate it well, even if the very slow introduction is needed.

Regarding Recommended Doses: As mentioned above, these are guidelines as provided by a holistic D.V.M. additionally trained in Chinese Medicine and other modalities. If the suggested dose does not provide benefit and does not create a gassy tummy or has no impact on incidence of vomiting, diarrhea, or constipation, you can safely double (or more) the suggested therapeutic dose before considering trying a new probiotic. This is a combination of art and science at this point, and you need to see how your cat reacts to determine how much is truly needed. If you see improvement, but not resolution of symptoms, try a higher dose. Of course, we again note, please consult with your vet prior to probiotic administration.

Regarding Brands: There is no need to use these particular brands and this is list is by no means exhaustive. As mentioned, ***any*** quality L. acidophilus supplement can provide benefit, as can *any* S. boulardii supplement, though we do recommend Jarrow Brand S boulardii as it has proven to be the most effective. As mentioned, we recommend human probiotics specifically because they tend to be of higher quality than pet probiotics (due to tighter regulation) – with claims of active colony forming units matching label claims more frequently, for instance.

Important things to consider when purchasing a probiotic are

- **The number of colony forming units** (CFU). An adult cat dose can range from several billion CFU to 20-40bn CFU daily. You can often save money by purchasing a higher CFU capsule and using a smaller portion of it.

- **The types of probiotics in the formula**. If the specific strains of each species are identified, even better, though many simply list the species. The most proven bacterial probiotic species in humans are L. acidophilus, L. rhamnosus, and L plantarum and several strains of bifidobacterium (which act in the colon). L. acidophilus is one

of the few species also studied in cats, and it did show significant benefit. So consider the mix of species, bearing in mind that more isn't always better, and be mindful of the "other" ingredients.

For S. boulardii, the therapeutic (treating diarrhea) adult cat dose is typically 5 billion CFU (250mg) split into two daily doses of 2.5 billion CFU each, though plenty have used as many as 15BN or more daily at first and then scaled back down after a few days or a few weeks. It has been proven safe and is also often dose-dependent, so use as needed. If you see improvement (typically the first signs of resolution are lower frequency of bowel movements) but not resolution, you can increase the dose, or you can be patient, it is working. Again, this is not an exact science, it is guidelines that work for many cats. You may need to experiment to find what works best for yours. Please join the Raw Feeding for IBD Cats Facebook group for help and questions.

EMERGENCY "STOP DIARRHEA" DOSING INSTRUCTIONS FOR S BOULARDII

Jarrow Brand S. Boulardii is the most commonly locally available S. Boulardii supplement (in the U.S.). As discussed, this is the preferred product. If you absolutely cannot get Jarrow S boulardii with MOS into your cat (you can transfer it to smaller empty gel caps to pill it, a #3 cap works well; you can try putting it into a teaspoon or two of meat baby food – although Beech Nut is pure meat and Gerber contains corn starch, many cats prefer Gerber. You can also syringe it in the baby food base). If you simply cannot get the Jarrow product into your cat, try one without the MOS though it may not work as well, and it does not confer the same health benefits as one with MOS).

For emergency "stop diarrhea" use, it is recommended to give small amounts frequently to "flush" the gut – get it in there and get it working. Either use small amounts of baby food with ¼ capsule of boulardii given every few hours or after every bowel movement, or fill 10 or so empty #3 size gel caps and administer them to your cat every 2 hours or so. This often stops diarrhea within 24 – 48 hours, and you'll typically see a reduction in stool frequency first. Again – these will not work when diarrhea is caused by another disease that requires treatment (low B12, exocrine pancreatic insufficiency, hyperthyroidism, as examples). This "loading dose" can be continued for three to four days if necessary. **It is NOT necessary to use this approach**, it can be given at "therapeutic" doses twice a day though this approach will take longer. In humans, it takes up to 3 days to get it to therapeutic levels in the gut with twice-a-day dosing in the presence of diarrhea.

NOTE: IF USE OF S BOULARDII MAKES DIARRHEA WORSE, STOP. Give kitty a break for 1 to 3 days (depending on severity of the reaction), and start over at a MUCH smaller amount, and very slowly work up to the therapeutic dose. If even the small amount makes diarrhea worse, your cat is likely sensitive to yeasts and the probiotic should not be given.

When the diarrhea has resolved with use of the emergency stop treatment protocol, begin use of S. boulardii at the therapeutic dose level (half of the 5bn CFU / 250mg capsule twice daily) and continue for at least one week and up to one month; then adjust dose to the maintenance level (half the therapeutic dose. If stools soften, resume use of S. boulardii at the therapeutic dose as needed. Given its role in improving performance of bacterial probiotics and its anti-inflammatory properties, the use of S boulardii at maintenance levels can be continued indefinitely along with a bacterial probiotic if warranted.

Brands of Bacterial Probiotics

Typical adult doses are included. For kittens up to nine months, the typical dose is half the adult dose though we remind readers that probiotics are typically safe and dose-depending, not size-dependent. Please introduce small and increase gradually.

Remember: especially for IBD cats, start very small and increase slowly.

For those outside the U.S., most of these can be ordered from iHERB. They will ship probiotics requiring refrigeration if delivery is anticipated in less than one week.

In the U.K. a recommended brand that is typically easily available locally (or on amazon UK) is OptiBac. This link is to one with a good selection of species, but do be aware it contains FOS that may not necessarily agree with kitty.

Current Top Pick: In the U.S. or if ordering from iHerb.com: with a focus on supporting our pets' native bacteria, we REALLY like the NOW Probiotic Defense (either along with or instead of using fermented grasses or seeds). This supplement contains fermented grasses, some S boulardii, and a small amount of a range of bacterial probiotics, "just" 1 billion CFU. This probiotic has more of a focus on restoring native bacteria than loss of functionality due to severe gut dysbiosis. If your cat is only recently diagnosed with IBD, especially if not yet raw fed, you may want to use this along with another of the bacterial probiotics (or kefir). Typical use of NOW Probiotic Defense in our adult cats is ½ capsule twice a day. Please also note: although we no longer recommend off-the-shelf probiotics of lactic acid bacteria and bifidobacterium at high doses for non-IBD cats, this is the one daily probiotic we're giving our own cats (when not using kefir). And for all cats - IBD or no - consider still using 1/4 capsule of Jarrow S boulardii + MOS twice a day.

For our IBD cats, some need a simple probiotic: **NOW Acidophilus + Bifidus** (8bn CFU). Typical dose is ½ capsule to one capsule twice a day. Another straightforward option is the **Natural Factors "Acidophilus plus Bifidus, Double-strength**" (10bn CFU) that contains L acidophilus, L rhamnosus, and bifidobacterium bifidum. It contains a bit of goat milk in the "other ingredients" that may or may not be in sufficient quantity to provide some benefit. Typical dose in adult cats is ½ capsule 2x a day.

Innate Probiotics. Each has the same 14 strains. This probiotic is formulated with strains developed to withstand stomach acid. It comes in three strengths, 5bn CFU, 20bn CFU and 50bn CFU. The product is shipped on ice. This probiotic contains Streptococcus thermophilus and performed very well for my CKD cat. The dose to use depends on the product you buy. Because it seems more of the bacteria survive the transit through the stomach, ½ of the 5bn CFU may be sufficient, though most would use 5bn CFU twice a day for IBD or CKD. Of course, using a portion of a larger CFU capsule is an option.

Jarrow Dophilus – Allergan Free (10bn CFU). "Other ingredients" include maltodextrin, for those that want to avoid this product in their cats. Typical dose is ½ capsule 2x a day.

Nexabiotic Advanced Multi-Probiotic (17.25bn CFU per capsule). This formula contains 23 species, including S boulardii, L rhamnosus, L plantarum, L acidophilus, and importantly for our CKD cats, Streptococcus thermophilus. Typical dose is ½ capsule twice daily.

NOW Probiotic 10-25 (10 strains, 25bn CFU per capsule). Includes the important strains (including Streptococcus thermophilus). Typical dose: ¼ to ½ capsule twice a day.

BRANDS of S boulardii

Adult maintenance dose of any boulardii product (if the capsules (which is usually the case) are 5bn CFU / 250mg) is 1/4 capsule 2x a day. Please scroll up for the Emergency Stop Diarrhea instructions and the follow-on treatment dose.

INTERNATIONAL: We recommend you consider purchasing Jarrow Brand S boulardii + MOS from amazon UK or iHERB.com (depending on your location) for ongoing use.

In the UK specifically, **OptiBac** has an S boulardii-only product you can likely find locally. This can be combined with Entero Chronic that contains MOS.

In Australia: Ethical Nutrients, the product name is Travel Bug. You can find it at Chemist Warehouse (in store and online), and possibly in store at other chemists.

Florastor is the original brand name boulardii on the market. It contains no MOS and does contain lactose, so if your kitty is lactose-intolerant, it likely won't work well. That said, it is available in many countries around the world, but uses country-specific brand names. Biocodex (the makers of Florastor) has over 40 brand names worldwide for this same product. These include Florastor in the USA and UK, Perenterol in Germany, Reflor in Turkey, and Ultra-Levure in Asia.

In the U.S. or if ordering from iHerb.com we recommend Jarrow S boulardii with MOS.

Plain S boulardii products (not recommended other than as an absolute last resort or to start because you can find them locally while you wait for Jarrow to be delivered if ordered online) of good quality include Nutricology, Renew Life, A.O.R. and NOW. Walgreens and Walmart both have store brand plain S boulardii products available to get you started, too.

Adult maintenance dose of any 5bn CFU / 250mg product is 1/4 capsule 2x a day.

Studies of the feline microbiome:

LE Ritchie 2008. *Molecular characterization of intestinal bacteria in healthy cats and a comparison of the fecal bacterial flora between healthy cats and cats with inflammatory bowel disease (IBD)*, MS Thesis, Texas A&M, Veterinary Medical Sciences.

Janeczko et al. 2008. *The relationship of mucosal bacteria to duodenal histopathology, cytokine mRNA, and clinical disease activity in cats with inflammatory bowel disease*, Vet Microbiol 128 (2008) 178-193.

Desai et al 2009. *Characterization and quantification of feline fecal microbiota using cpn60 sequence-based methods and investigation of animal-to-animal variation in microbial population structure*, Vet Microbiol 2009 May 28;137(1-2):120-8.

JF Garcia-Mazcorro and Y Minamoto 2013. *Gastrointestinal microorganisms in cats and dogs: a brief review*, Arch Med Vet 45, 111-124 (2013).

Honnafer, Minamoto, Suchodolski 2014. *Microbiota alterations in acute and chronic gastrointestinal inflammation of cats and dogs*, World J Gastroenterol. 2014 Nov 28; 20(44): 16489–16497.

Suchodolski et al. 2015. *The Fecal Microbiome in Cats with Diarrhea*, PLoS ONE 10(5): e0127378. doi:10.1371/journal.pone.0127378.