Understanding pet digestion

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Providing optimal nutrition to your four-legged patients includes understanding how digestion works in dogs and cats, from one end of the body to the other.

From the outside, pet nutrition seems like an easy subject. Buy a bag of pet food. Feed the same dry food to the pet every day of her life. No fresh food, no variation. As veterinarians, this is typically what we are taught. But is that really the best recipe for pet health? Does it make sense? To find the answer, it is best to shine a light on the inside of a dog (or cat), gain a better understanding of digestion, and examine what they really need from the lens of my 20 years of veterinary practice.

Health is entirely dependent on nutrition

The best way to insure vibrant health and longevity is to provide an excellent and species-appropriate plane of nutrition. Digestion is the product of both the complexity and simplicity of nature. All animals on the planet keep themselves alive and healthy through the actions of finding food and water, ingesting, regulating, digesting, absorbing, rejecting, and defecating. Every aspect of the food our pets eat – moisture, freshness, processing, balance, structure, sourcing, amount, ingredients, frequency of meals, and even how it is served – plays a role for good or ill, in the digestive process.

Not being able to find ways to truly heal animals can be frustrating for veterinarians and pet parents who are depending on inappropriate foods for the animals in their care. Why did we ever think that a processed dry food would be better for our beloved animal family members? Why is it so difficult to consider feeding fresh food? If fully changing to a fresh raw food is daunting, it is possible to simply add some fresh food even a few times a week. The health changes can be dramatic. Often, just adding a sardine or two to the food, and using a small amount of fresh meat or pre-prepared raw foods (even lightly cooked) a few days a week can improve health. It is possible (and often a great first step) to mix and match processed and fresh foods.

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The real first step to creating a healthier animal is to understand digestion. It is clear that food supports the overall development, growth and maintenance of strong bones, muscles, nerves and organs; the regulation of gene expression, the immune system, circulation, and fluid balance; the daily balancing of hormonal/endocrine reactions and behavior; the support of the bacterial biome in the GI tract, skin and throughout the body, and creating an overall happy, healthy and long life. Understanding why and how all these are affected by diet choices is an important and typically absent part of veterinary care.

So what is happening in there that we don’t know about?

Who’s on the inside?

Digestive activity is not limited to textbook pictures of the organs and cells of the GI tract. There are many players in digestion besides the animal’s own cells – in fact, nearly 70% of what happens in the GI tract results from other organisms’ actions, production and reactions.

The most important component of the digestive process may well be a healthy combination of “good” and “bad” bacteria (a healthy GI biome). There are thousands of species of bacteria that play roles in animal health. In fact, we know that the number of bacteria living in an animal’s body significantly outnumber their own cells. The symbiotic relationship between the body and its GI biome is responsible for a significant portion of the regulation, fermentation, border patrol, absorption and production of nutrients. Healthy animals eating species-appropriate foods are feeding and supporting appropriate GI bacteria. This healthy population of bacteria then keep the animal healthy. Appropriate bacteria play vital roles in the breakdown of fibers and toxins, vitamin production, protection from pathogenic bacteria, integrity of the GI tract lining, and appropriate absorption.

We see dysbiosis and illness when bad bacteria overrun the good. Dysbiosis, GI disorders, absorption problems and other GI related health issues are becoming more prevalent in our pet populations. It is likely that the increase in these disorders is related to bacterial imbalances resulting from increased use of antibiotics, herbicides and pesticides, as well as species-inappropriate, sterile processed foods.

Mythconceptions about bacteria

- If we get rid of all bacteria, we will be healthier. *(Just not true.)*
- If bacteria are resistant to antibiotics, we have no other solutions. *(Integrative medicine has many options — e.g. essential oils, honey, herbs, immune supplements, and excellent foods can all help cure resistant bacterial infections.)*
- If we sterilize surfaces and bathe more, we will be healthier. *(The more we rid our environment of good bacteria, which fight bad bacteria, the more likely we will have troublesome problems with bad bacteria, which will multiply unabated and become resistant. Also, sterile environments are implicated in allergy and immune system issues in youngsters.)*
- Plastics are safer than wood surfaces. *(Wood has natural antibiotic properties, and what protects trees from bacterial invaders protects wood products from bad bacteria.)*
- All raw meat foods contain harmful bacteria for animals. (*While testing is done, healthy dogs and cats are designed to fight many pathogens in their meats, including E.coli and Salmonella. After all, they eat poop, pick up and swallow who-knows-what old meat/animal parts outside, and are fine.)*
- Eating pasteurized, cooked, processed foods is safer for our pets, and for owners and vets. *(There are risks and recalls for all meat pet foods. Companies making raw foods are just as concerned about pathogens as processed food makers. Pathogenic bacteria — more of an issue for humans, and not always a problem for pets — have been found in all types of pet foods, whether kibble, canned, raw, freeze dried, treats, etc., and no one food is inherently safer than another. The best advice is to be careful with all foods.)*

The GI tract functions as an absorptive, protective, motile, interactive immune surface full of live organisms. It protects the body from bad bacteria, disease and toxins, absorbs and creates nutrients, and provides triggers for hormonal, immune and neurologic interactions.

Macronutrients and micronutrients

Nutrients and water are obtained, absorbed and moved through the gastrointestinal (GI) tract to support the many systems of the body. The three generally recognized macronutrients (needed in large amounts) are protein, fat and carbohydrates.

Micronutrients are vitamins and minerals that are needed in small amounts.

Water is not considered a macronutrient, although it is needed in large amounts for most of the processes, reactions and transportation functions of digestion. It also provides a structural vehicle in which nutrients are presented for use. When we remove water from fresh foods, we create a jumble of dry ingredients that the body needs to untangle. In their original form, fresh foods maintain their cellular integrity and form. The water's structure creates an appropriate vehicle and an orderly balance for recognition and absorption. Adding or taking away water should not be done lightly.

Cats in troubled waters

Moisture-appropriate foods are even more important for cats. It is possible that cats may be prone to developing

kidney problems because we feed them dry foods. They are desert animals and inclined to get their moisture from their prey, as fresh water in the desert is scarce. They will drink to get their moisture, but it will not be a natural activity for them, so they may wait until they are significantly dehydrated before taking a drink. If, for their whole life, for every meal, cats are given dry food that provides little moisture and requires significant moisture from the body just to digest it, we are setting up a situation that causes dehydration and stresses the kidneys. Over time, this can translate into urinary tract disease, stones, infections or kidney disease.

Smell, taste and temperature

Detecting an appetizing smell is essential to start the body's juices flowing. There are many medications that affect smell and taste, so it is useful to be aware of the side effects of medications. If an animal develops a decrease in olfaction from non-steroidal anti-inflammatory drugs (NSAIDS), it can affect his appetite. This is something known to the owners of dogs who do nose work, so they avoid NSAIDS, especially when the dog is working. Animals will generally also avoid foods that do not smell appetizing, or that smell rotten or toxic (except for some Labradors named Orion, Quincy or Darwin!). This is also true for taste. The ability to detect unhealthy odors or tastes is an important first defense.

Temperature and moisture can also play a role in enhancing odors and tastes and stimulating the appetite. Meats would typically be at least at room temperature or even "body temperature" when animals hunt and eat. There is something to be said for trying to mimic what would make a carnivore excited about his food in the wild.

Teeth – not for chewing

The dentition of a carnivore is specifically geared towards tearing off chunks of food and getting them ready to swallow, not for chewing. Dogs and cats have these little pyramids of teeth. Their teeth are sharp, and they interlock to hold and rip flesh. The teeth have done their job if what they have torn off can fit down the esophagus. There are no flat "chewing" teeth. Carnivores can chew, but it is not the "point" of their teeth.

We learn in grade school what different teeth do from their shape. There is a difference between large, wide, flat chewing cow teeth and sharp pointy carnivore teeth. Moist meaty foods are easily cleaned off the surfaces of the teeth with a swipe of the tongue. Inappropriate, dry, sticky carbohydrates will stick to the teeth and create tartar. Changing to a fresh, moisture-appropriate food can be one way to improve dentition and mouth biome health.

Saliva, drool, slobber — lubricant

The carnivore mouth is just a momentary stop for food on the way down. Saliva reflects that purpose. Saliva's main activity in dogs and cats is to act as a lubricant, although it will mix with bacteria — both good and bad. It even has a bit of antibacterial capacity to fight pathogens, but its main purpose is to allow easy and quick swallowing.

Wolfing it down — dogs have the stomach for it

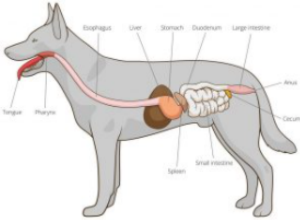
The term "wolf it down" is correct for Canids. This is what they do — they swallow first and ask questions later. Which is why we have hundreds of radiographs of foreign objects (including a personal favorite – an entire GI Joe) in the stomachs of dogs. But in nature, wild dogs would grab large pieces of meat from their prey, or even the whole prey, and swallow. A dog can eat a huge amount of fresh meat and organs in seconds, and show no ill effects. In fact, their digestive tracts appear to be designed to do just that.

Dogs can keep about 70% of their ingesta in the stomach, and only 30% in their intestinal tracts. In humans, those percentages are reversed – 30% in the stomach and 70% in the intestines. So people eat smaller meals, more frequently. We only encounter problems with a dog or cat's instinctual speed-eating when we feed dry foods, because these foods are not what the body expects. The stomach is made for more moisture-appropriate diet. Animals eating meals of dry processed foods are five times more likely to bloat than animals eating large amounts of fresh moisture-appropriate foods.

The stomach

The stomach creates a very large muscular acid bath for the food. In fact, the stomach acid of a carnivore has a pH of 1 — extremely acidic. When food arrives in the stomach, it stimulates parietal cells to secrete hydrochloric acid (HCl), which decreases the pH. Eventually, a negative feedback mechanism recognizes there is enough HCl and shuts off production. The acid bath softens foods, kills pathogenic bacteria, breaks bonds, and starts the digestive process. The muscular motion of the stomach wall mechanically mixes the acid with the foods.

Intestines, small and large



As acidic ingesta moves from the stomach into the duodenum, the fats, proteins and lowered pH of the ingesta will stimulate pancreatic and bile secretions, cholecystokynins and digestive enzymes that further digest and neutralize the acid in the food. Proteins are somewhat digested to amino acids, di-peptides, tri-peptides (short-chain polypeptides) by pepsin. Triglyerides (fats) are emulsified, broken down and absorbed. Nutrients are transported across epithelial layers with help from bacteria and the brush border enzymes, pancreatic juices and bile salts. Sugars are fast energy and are absorbed and used quickly (and will affect inflammation and the glycemic index).

Note: Production of digestive enzymes depends on appropriate levels of micronutrients and minerals like iron, manganese and selenium .Animals may become deficient in many micronutrients because of an increase in herbicide chemicals like glyphosate in pet foods. Glyphosate insolubly binds many micronutrients and minerals in foods (specifically metals essential in the production of enzymes), making them unavailable for these metabolic processes.

The large intestine is involved in the absorption of water, electrolytes, vitamin production and absorption. Both the small and large intestines contain a great deal of bacteria that serve a number of functions. They are essential for the absorption of vitamins (especially B and K), they produce small fatty acids used as energy by GI epithelial cells, and they are needed to break down indigestible fibers and molecules.

What the poop?

Defecation in the carnivore should not involve huge, voluminous soft feces. Normal canines use most of their food, and the resulting poop should be very firm, relatively dry, not horrible-smelling and in a small amount. When carnivores eat healthy, appropriate fresh food, "even the poop is cute". Poop odor and flatulence in dogs and cats is related to their biome. Bacteria produce many unpleasant gasses and smells, and an unhealthy biome will smell unhealthy.

Pets defecating more than twice a day, and creating soft, odiferous and large feces, reflect the amount of filler and inappropriate ingredients we put in pet food, and is not a normal condition for dogs and cats.

A good way to monitor proper feeding amount is by looking at weight and monitoring the frequency of defecation. Dogs and cats normally defecate one to two times a day at a maximum.The stool is small, firm, and doesn't always look exactly the same. If dogs and cats are pooping more than that, they are either eating too much or ingesting too much filler.

Diarrhea and vomiting

Vomiting or diarrhea can be a reaction to something in the food, or symptoms of a systemic illness. If it is a reaction to food, expelling the food with urgency might be a sensible mechanism. The body is saying "wrong food!" and removes it as quickly as possible. Medical interpretation often describes vomiting and/or diarrhea as a disease process in itself, so medications to stop the expulsion of food are prescribed. These medications can be useful to stop the cycle of GI distress, but they do not solve the problem if the diet is deficient.

The answer for many cases of chronic or even sudden GI upsets could be simply to slowly change to a more biologically appropriate, fresh organic food. The natural bacterial biome will be nourished, it will more easily assist in digestion, and the body will be healthier. During diet changes, it can be useful to take a couple weeks to change foods, and consider the need to add an appropriate prebiotic fiber, probiotic bacterial supplement and perhaps even some enzymes for support.

Teamwork in the end

Helpful bacteria, fungi and parasites live in harmony within the body and play an important role in digestion. With the overuse of antibiotics in pets and food animals, and an increase in pesticides/herbicides in many pet foods (like glyphosate, which has known antibiotic properties), we are seeing more problems than solutions to bacterial problems. As new resistant bacteria become more common, and helpful bacteria diminish, we are upsetting the delicate balance needed for proper digestion. In addition, over-cleaning, over-bathing, sterile foods and lifestyles do not help pets replenish a healthy biome.

There are cases in which the only way to fully replenish a damaged bacterial population is to perform a fecal transplant. This procedure involves taking feces from a healthy, fresh food-eating dog or cat, using a special recipe to create a liquid that can be introduced to the unhealthy animal through an enema or capsules. This procedure, while it seems crude, can be tremendously effective in a depleted animal with poor absorption.

Don't give up, try food!

As we think about all these interactions, and the complicated anatomy and biology of the digestive tract, we may feel overwhelmed by how intricate the system is. There is much to consider: available pet foods, food animal conditions, organic sourcing, pesticides, GMO, costs of various foods, GI bacterial relationships and bacterial species, pH motility, secretions, digestive triggers, external stressors, automatic activity, autonomic nerve reactions, parasympathetic reactions (rest and digest), sympathetic reactions (fight and flight), enteric nervous system intrinsic to the GI tract, histamine releases, HCl secretions, bile flow, absorption, nutrient loss, toxin rejection, defecation issues and more….

The sensible way to maintain health is to be aware of this complexity, and use that understanding to recognize that before we interfere with this naturally balanced system, we should make sure there is really be a good reason. When we tip the balance with a less than optimal food, a gut-changing medication or other intervention, we may see unexpected and unwanted side effects as a result.

Eat less, get healthy, clean up!

Eating once, or at most twice, a day is normal fare for a carnivore. A hunt would provide a meal, they would eat, rest and digest, and maybe not hunt again that day. It may appear that certain dogs or cats are "nibblers" and need/like to eat a little bit all day. This is likely a misunderstanding of what is happening. It is not the ancestral behavior of a carnivore (a dog or cat) to nibble on their prey. It is possible that a bowl of dry kibble left out for free-feeding may be so uninteresting that a pet will only eat a little at a time, hoping for something better. Most animals, when they are changed to a fresh food diet, eat quickly and consume all the food. They don't need a dry kibble left out all day to snack on if they are eating the wet food well. Cats and small dogs do well on twice-daily feeding, while medium to large dogs may do well on once-a-day feeding.

Learning about digestion involves not only learning about how animals process food, but also how they manage when they are hungry. A strong body of evidence suggests that many animals tap into the body's natural ability to re-invigorate itself when they are hungry. Certain processes that make an animal healthy only turn on when he feels hunger, or when he goes into a fasting, ketogenic state. The animal will switch from the processing food mode to a clean-up mode. This is very different from the type of ketogenic condition we see in a diabetic, where there is a high blood sugar, no insulin, resultant ketones and illness. In a healthy ketogenic condition, the blood sugar is low but not a health threat, and the body is producing ketones to effectively use as energy while it turns on body systems to seek out unhealthy cells, assess mitochondria, DNA and organelles for damage, and repair them. When hungry, the body recognizes the need to hunt more efficiently with a healthy body, so it gets to work on its own cells.

Because there is little education about the existence of this health mechanism, we rarely let our pets get hungry. A way to think about this is that the body will be conservative and only do what is necessary. If there's plenty of food, why clean up? Things must be fine. Or imagine the difference between having a party with plenty of food for everyone, and having the food run out and the kitchen in a huge mess. It's time to clean the kitchen. If we never let an animal feel hungry, he will never "clean the kitchen".

GI inflammation

Inflammation in the GI tract, including inflammatory bowel disease (IBD), is often just the body reacting sensibly to "wrong food!" by becoming inflamed for protection and to keep absorption of the wrong food to a minimum. Resolution of signs can often be as easy as supporting the bacterial biome with supplements and changing the food to something appropriate (fresh, organic). Sometimes an animal needs some extra help to re-florinate the population of bacteria.

For every case, complicated or obvious, healthcare should always begin by focusing on returning to a natural, biologically sensible dietary balance. It is possible that given the right tools, the body can take care of the rest for us.

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