

Introduction to Gastrointestinal and Exocrine Pancreatic Diseases

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*“ . . . food should be . . . frequently administered,
for food soothes the soul.”
Aretaeus, the Cappadocian*

CLINICAL IMPORTANCE

“What should I feed?” is one of the most common questions addressed by veterinarians managing gastrointestinal (GI) and exocrine pancreatic disorders in dogs and cats. Owners of affected pets often intuitively understand that the feeding plan plays an important role in the treatment of their animals and expect guidance regarding specific foods and nutrients to avoid or change in their pet’s diet.

Many GI and exocrine pancreatic diseases are amenable to dietary management (Table 48-1). Altering food ingredients, nutrient profiles, food form and feeding method can be powerful tools in managing GI and exocrine pancreatic diseases. Drug therapy instituted without concomitant dietary therapy often yields less than desirable results. Occasionally, foods or ingredients may function as diagnostic tools in evaluating patients with GI and pancreatic disorders. Herbs (Box 48-1), oligosaccharides and medium-chain triglycerides have also been used to treat certain of these diseases.

A multitude of factors, including trophic hormones, adequate blood flow, neurologic input and nutrient composition of digesta, are involved in maintaining intestinal integrity (mass and function). The presence or absence of certain nutrients and ingredients can positively or negatively affect the bowel (Table 48-2). For example, effects of starvation include decreased pan-

creatic enzyme production and secretion, intestinal mucosal atrophy and reduced gastric emptying rates. The resultant diarrhea and malassimilation further exacerbate the malnutritive state (Guilford, 1996). In addition, starvation can markedly affect bowel immune response and mucosal integrity.

Discussion of the dietary management of patients with GI and exocrine pancreatic disease can be organized in many ways. This chapter and the ones that follow assume the reader has already identified the major clinical problems of the patient as dysphagia (i.e., oropharyngeal disease), regurgitation (i.e., esophageal disease), vomiting (i.e., many causes including primary gastric, intestinal and exocrine pancreatic diseases), small bowel diarrhea, large bowel diarrhea, constipation or flatulence. Thus, rather than being organized around clinical problems, the following GI and exocrine pancreatic chapters focus on specific diseases allowing formulation of better feeding plans for individual patients.

The individual chapters for GI and exocrine pancreatic diseases include:

- Oral Diseases (Chapter 49)
- Pharyngeal and Esophageal Disorders (Chapter 50)
- Introduction to Gastric Diseases (Chapter 51)
- Gastritis and Gastroduodenal Ulceration (Chapter 52)
- Gastric Dilatation and Gastric Dilatation-Volvulus in Dogs (Chapter 53)
- Gastric Motility and Emptying Disorders (Chapter 54)

Table 48-1. Gastrointestinal and exocrine pancreatic diseases amenable to dietary management.

Oral

Inflammatory disorders (stomatitis, radiation-induced mucositis)
Physical abnormalities (trauma, neoplasia, congenital malformations)

Pharynx and esophagus

Inflammatory disorders (esophagitis)
Motility disorders (cricopharyngeal achalasia, megaesophagus)
Obstructive disorders (vascular ring anomalies, strictures, neoplasia)

Stomach

Gastric dilatation/gastric dilatation-volvulus
Gastric motility/emptying disorders
Gastritis
Gastroduodenal ulceration
Hairballs

Small intestine

Acute enteritis
Inflammatory bowel disease
Intestinal neoplasia
Lymphangiectasia
Protein-losing enteropathy
Short bowel syndrome
Small intestinal bacterial overgrowth
Wheat-sensitive enteropathy

Large intestine

Colitis
Constipation
Flatulence
Irritable bowel syndrome

Pancreas

Exocrine pancreatic insufficiency
Pancreatitis

- Introduction to Small Intestinal Diseases (Chapter 55)
- Acute Gastroenteritis and Enteritis (Chapter 56)
- Inflammatory Bowel Disease (Chapter 57)
- Protein-Losing Enteropathies (Chapter 58)
- Short Bowel Syndrome (Chapter 59)
- Small Intestinal Bacterial Overgrowth (Chapter 60)
- Introduction to Large Intestinal Diseases (Chapter 61)
- Large Bowel Diarrhea: Colitis (Chapter 62)
- Large Bowel Diarrhea: Idiopathic Bowel Syndrome in Dogs (Chapter 63)
- Constipation/Obstipation/Megacolon (Chapter 64)
- Flatulence (Chapter 65)
- Exocrine Pancreatic Insufficiency (Chapter 66)
- Acute and Chronic Pancreatitis (Chapter 67)

Vomiting and diarrhea have a myriad of causes and feeding plans vary according to the underlying condition. The feeding plans for acute gastroenteritis are most appropriate when a specific cause of acute vomiting or diarrhea is unknown. When a specific cause of chronic small bowel diarrhea is not identified, then feeding plans as outlined for exocrine pancreatic insufficiency are most appropriate. Finally, when a specific cause of chronic large bowel diarrhea is not identified, then feeding plans for colitis are most appropriate.

Each patient should be seen as an individual variant of the norm; therefore, multiple dietary manipulations should be considered, as needed, for each patient (**Box 48-2**). Because of the

Box 48-1. Herbal Remedies for Gastrointestinal Disorders.

Herbal remedies have become a major factor in human health care. Various botanicals have become household words, and sales of herbal remedies are increasing dramatically. As herbs move out of health food stores and into mainstream supermarkets, drug stores and even pet stores, use of these products in pets will also increase.

A wide variety of herbal or botanical products are advocated for patients with gastrointestinal (GI) disorders, including individuals with diarrhea, vomiting, constipation, stomatitis, colitis and flatulence. There are also long lists of herbs and botanicals that are described as “gastrointestinal agents.” Although today’s herbal remedies exhibit varying degrees of therapeutic value, most have not been investigated thoroughly for safety and efficacy. It is beyond the scope of this textbook to list all the herbal and botanical remedies that may have use in pets. Interested readers are referred to books listed in the Bibliography for further information about human herbal remedies that might be used in pets with GI disorders.

The Bibliography for **Box 48-1** can be found at www.markmorris.org.

Box 48-2. Performing Dietary Trials in Patients with Gastrointestinal Disease.

Nutritional therapies are extremely useful for treating gastrointestinal (GI) disease in dogs and cats. Several commercial and homemade foods are available to practitioners and pet owners for this purpose. Unfortunately, there is no historical or clinical finding that will predict the success of a specific food type. Therefore, selection of the most appropriate food for an individual patient is often based on results of a dietary trial.

Dietary trials are easily performed in most clinical and home settings. Oral food consumption is preferred for managing GI diseases, except in those rare situations in which the patient is intolerant of enteral feeding.

After the veterinarian identifies those foods to be included in the trial, selection of the initial test food is often based on clinical experience and the patient’s nutritional history. In general, foods that have been used unsuccessfully in the past to manage the patient should be avoided. Typically, highly digestible GI or elimination foods are good first choices for patients with gastric or small intestinal disorders. Fiber-enhanced foods are often the initial selection when large bowel signs predominate.

No other foods, supplements, table foods or treats should be offered during the dietary trial. Dietary trials are most useful if continued for at least seven to 10 days. In certain settings (e.g., adverse reactions to food), trials lasting two to four weeks (12 weeks in cases with dermatologic signs) may be necessary to determine efficacy (Chapter 31). Successful dietary trials are marked by partial or complete resolution of clinical signs.

The Bibliography for **Box 48-2** can be found at www.markmorris.org.

Box 48-3. Food Types Useful in the Management of Gastrointestinal and Exocrine Pancreatic Diseases.

GASTROINTESTINAL FOODS

Several commercial veterinary therapeutic foods have been specially formulated for managing gastrointestinal (GI) disease in dogs and cats. Typically, these products are highly digestible and have consistent ingredient and nutrient profiles.

The term highly digestible is not defined in a regulatory sense. However, highly digestible has generally been reserved for products with protein digestibility $\geq 87\%$ and fat and carbohydrate digestibilities $\geq 90\%$. The average digestibility coefficients for popular commercial foods are 78 to 81%, 77 to 85% and 69 to 79% for crude protein, crude fat and carbohydrate, respectively. Commercial veterinary therapeutic foods formulated for GI disease usually contain highly refined meat and carbohydrate sources to increase digestibility.

Carbohydrates make up the largest nonwater fraction of foods formulated for managing GI diseases. Carbohydrate digestibility of pet foods is influenced by source and processing. Dogs digest most properly cooked starches very well, including starch components in corn, rice, barley and wheat. Other starches, including potato and tapioca, are less digestible, particularly when inadequately cooked. Although cats also efficiently digest carbohydrates, some clinicians feel that cats with small bowel disorders are less tolerant of dietary carbohydrate than dogs with similar causes of malassimilation.

There is a link between particle size and carbohydrate digestibility of moist foods. As a result, carbohydrate ingredients (e.g., rice, corn, etc.) should be chopped or ground before they are incorporated into moist foods. This relationship apparently is not an issue for extruded dry products. There is almost complete ileal carbohydrate digestibility in dogs consuming extruded grains (dry products).

The requirements for many macro- and microminerals in the face of GI disease are not well understood. However, sodium, potassium and B-vitamin losses are expected with vomiting and diarrhea. Therefore, foods formulated for managing GI diseases should contain sodium, potassium and B vitamins in excess of maintenance allowances. Patients with fat malabsorption are at risk for developing fat-soluble vitamin deficiencies. Highly digestible foods formulated for feeding steatorrheic patients should, therefore, be fortified with fat-soluble vitamins.

It is unusual for GI foods to contain crude fiber levels greater than 5% dry matter (DM) because fiber reduces dry matter digestibility and decreases pancreatic enzymatic activity *in vitro*. More recently, manufacturers of some highly digestible commercial veterinary therapeutic foods have added small amounts ($<5\%$ DM) of soluble or mixed fibers because short-chain fatty acids produced by intestinal microbial fermentation of fiber may positively affect the large intestinal mucosa.

Veterinarians recommend GI foods most often for managing acute gastroenteritis or malassimilation associated with small bowel disease or exocrine pancreatic insufficiency. The utility of highly digestible foods has been demonstrated through anecdotal reports and by the use of such foods in clinical trials involving animals with spontaneous and experimental exocrine pancreatic insufficiency. Some gastroenterologists also recommend these foods for patients with certain colonic disorders to reduce exposure of the colonic mucosa to ingesta. This therapeutic strategy has been suggested for management of inflammatory colitides and constipation.

FIBER-ENHANCED FOODS

Commercial veterinary therapeutic foods contain varying levels and sources of fiber. Based on the combined knowledge obtained from research in people, ongoing research in dogs and cats and clinical experience, fiber is beneficial in managing many large and some small bowel diseases.

Soluble fibers (e.g., pectins and gums) increase the viscosity of intestinal contents, which delay gastric emptying and slow small bowel transit time. Viscosity markedly affects the extent of intraluminal mixing of digesta and digestive enzymes, which can shift sites of absorption and subsequently the rate of nutrients entering the bloodstream. Bacteria in the colon ferment soluble fiber to short-chain fatty acids, including acetic, propionic and butyric acids. Colonocytes apparently use butyrate, whereas propionic and acetic acids are absorbed. Short-chain fatty acids are nutritive to the colonic mucosa and foster normal colonic flora while discouraging pathogenic flora. These properties result in an acidic colonic pH and increased colonic bacterial numbers, colonic mucosal mass and fecal dry matter and water content. Soluble fiber may bind and decrease macronutrient absorption and decrease protein digestibility. Certain fiber types, especially gels and gums, may be of benefit in GI disease because they bind toxins and irritating bile acids. This binding effect prevents these substances from further damaging the intestinal mucosal surface.

Insoluble fiber is primarily composed of cellulose and structural polysaccharides that are relatively resistant to digestion and that ferment slowly, increase intestinal residue and normalize intestinal transit time. These fibers have little or no effect on gastric emptying, mineral absorption or colonic microflora unless fed in high concentrations ($>20\%$ DM). One of the most profound effects of fiber on the GI tract is the normalization of gut motility, particularly in the stomach, proximal small bowel and colon. This effect appears to be greatest for insoluble fibers such as cellulose. In general, increasing the insoluble fiber content of the food resolves or modulates most cases of colitis. There are several plausible mechanisms by which insoluble fiber controls large bowel diarrhea. Undigested residues absorb water and increase bacterial mass, which increases fecal bulk. Fecal bulk provides physical intraluminal stimulation to reestablish neuromuscular-endocrine coordinations and normalize intestinal transit times. Fecal bulk increases intestinal residue, which absorbs toxins and offending agents. For more basic information about fiber see Chapter 5.

RESTRICTED- AND MODERATE-FAT FOODS

In general, dietary fat is more digestible than digestible carbohydrate and protein and provides 2.25 times more calories by weight. Average fat digestibility in commercial dog food is approximately 90%. Average fat digestibility of commercial cat foods ranges from 74

Box 48-3 continued

to 91%. Patients with GI or pancreatic disease may not tolerate high-fat foods (>25% DM), which may contribute to diarrhea and steatorrhea. Foods containing moderate amounts of fat (12 to 15% DM for dogs and 15 to 22% DM for cats) are generally tolerated and have sufficient caloric density for most patients. Commercial veterinary therapeutic foods containing less than 10% DM fat need to be fed in larger volumes to meet the patient's caloric requirement. Some patients may not tolerate this volume of food.

Restricted-fat foods are often recommended for patients with gastroenteritis in which the complex process of fat digestion and absorption may be disrupted. Unabsorbed fat in the bowel lumen may cause secretory diarrhea. Dietary fat should be reduced when fat maldigestion or malabsorption is present due to exocrine pancreatic insufficiency or reduced bowel surface area. The latter occurs in short bowel syndrome and other conditions in which inflammation, infectious agents, neoplasia or surgery markedly reduces the intestinal villus surface area. For example, intestinal malabsorption of fat is seriously impaired in primary and secondary lymphangiectasia. Fat restriction is also useful in small intestinal bacterial overgrowth in which many of the side effects of the condition can be ameliorated by removing the inciting cause of the secretory diarrhea.

ELIMINATION FOODS

Elimination foods are most often recommended for patients with GI signs due to suspected food intolerance or food hypersensitivity. Protein sources and amounts are of key importance for elimination foods. Chapter 31 discusses adverse food reactions and elimination foods in more detail.

GLUTEN- AND GLIADIN-FREE FOODS

Several potential antigens are found in flour when cereal grains are processed. One polypeptide, gliadin, is found in wheat, barley, rye, buckwheat and oat flours. Gliadin is responsible for gluten-sensitive enteropathies in people and dogs. Homologous gliadin polypeptides are not present in whole grains and flours produced from rice and corn.

In people, gluten-induced enteropathy or celiac disease is an important malabsorptive disorder. An analogous condition, termed wheat-sensitive enteropathy, has been identified in Irish setter dogs and is suspected to affect dogs of other breeds. Affected animals develop small bowel diarrhea due to malabsorption secondary to villous atrophy. Gluten- and gliadin-free foods are most commonly recommended for managing dogs suspected of having wheat-sensitive enteropathy. In most cases, withdrawal of the offending gliadin antigen from the diet results in resolution of the villous atrophy and clinical signs.

MONOMERIC FOODS

Monomeric foods are water-soluble, liquid foods containing nutrients in their simplest absorbable form. Amino acids are most commonly provided by a mixture of di- and tripeptides and/or individual amino acids. Fats are present as triglycerides or as fatty acids. Carbohydrates are generally present as mono- or disaccharides. Minerals and vitamins are present to meet requirements. These foods minimize GI and pancreatic secretions and allow nutrient usage with minimal requirements for digestion. In addition, relative to complete proteins, the small size of amino acids, dipeptides and tripeptides in monomeric products ensures delivery of a truly "hypoallergenic" food. Monomeric foods should be considered for patients with severe malabsorption or short bowel syndrome and in initial refeeding of patients with acute pancreatitis. In addition, these foods may provide "bowel rest" for patients with severe inflammatory bowel disease. Monomeric foods are often unpalatable and are not well accepted by cats. Thus, these foods are usually administered for several days via indwelling feeding tubes. Chapter 25 lists monomeric foods.

The Bibliography for **Box 48-3** can be found at www.markmorris.org.

Table 48-2. Potential dietary influences on the gastrointestinal tract.*

Food may alter:

Absorption
Cellular turnover rate
Luminal ammonia concentration
Luminal volatile fatty acid content
Microflora
Motility
Secretory rate
Villous height

Food may be a source of:

Chemical/bacterial toxins
Dietary antigens

Food may correct:

Nutritional deficiencies

*Modified from Guilford WG. Feline gastrointestinal tract disease.

In: Wills JM, Simpson KW, eds. The Waltham Book of Clinical Nutrition of the Dog & Cat. London, UK: Pergamon Press, 1994; 221-238.

diverse nature of GI and exocrine pancreatic disorders, a number of food types may be appropriate (**Box 48-3**). Nutrient profiles should be considered as *starting points* on a continuum of possible nutrient concentrations that can be adjusted for each patient as necessary. All too often, relative terms such as "low" vs. "high" are used without stating the point of reference. The reference point should be the current food that the owner feeds. Changes include increases or decreases, usually in 5 to 10% increments, of nutrient concentrations relative to the previous food.

REFERENCES

The references for **Chapter 48** can be found at www.markmorris.org.