Chapter 65

Flatulence

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"He couldn't ad-lib a fart after a baked-bean dinner."
Johnny Carson

CLINICAL IMPORTANCE

Flatulence is excessive formation of gases in the stomach or intestine, but the term is often used incorrectly. Excessive flatulence is usually associated with noticeable flatus, belching, borborygmus or a combination of these signs. Flatus, rather than flatulence, is gas expelled through the anus. Belching is the noisy voiding of gas from the stomach through the mouth. Borborygmus is a rumbling noise caused by the propulsion of gas through the intestines.

Excessive flatus is a chronic objectionable problem that occurs often in dogs and less commonly in cats. Although belching and borborygmus are rarely chief complaints of pet owners, routine questioning may elicit their presence. Flatus, belching and borborygmus occur in normal pets but often develop as a consequence of small intestinal or colonic disorders. At times, flatus is the primary reason pet owners seek veterinary advice.

PATIENT ASSESSMENT

History and Physical Examination

Pet owners often describe an increase in frequency of belching, audible flatus or an objectionable odor associated with flatus (Jones et al, 1998). At times, it may be possible to elicit a history of dietary change or dietary indiscretion in association with flatus. Occasionally, belching and flatus develop in conjunction with other gastrointestinal (GI) signs including weight loss, diarrhea and steatorrhea. This type of history is very suggestive of an underlying small intestinal disorder.

In most cases, physical examination findings are unremarkable in dogs and cats with flatulence, although abdominal distention is sometimes noted in cats. Intestinal gas can often be detected during abdominal palpation; however, it is difficult to assess the quantity of gas by palpation alone. Animals having poor body condition and objectionable flatus may have an underlying GI condition.

Laboratory testing is usually not indicated. However, further evaluation is in order if concomitant GI signs are present. Readers are referred to earlier chapters involving small and large bowel disorders for further information.

Risk Factors

Excessive aerophagia is a risk factor for flatulence and is seen with brachycephalic, working and sporting canine breeds and pets with aggressive and competitive eating behaviors. Dietary indiscretion and ingestion of certain pet food ingredients may be risk factors for certain individuals.

Etiopathogenesis

Gas in the GI tract is normal and may be derived from three sources: air swallowing, intraluminal gas production and diffu-

sion of gas from the blood to the GI tract.

Regarding flatus, the rate of excretion of gas per rectum varies greatly in people and animals. Excretion rates in people range from 400 to 1,500 ml/day (mean 705 ml/day). People, eating their usual foods, passed gas per rectum an average of eight to 10 times per day with an upper normal limit of 20 times per day (Strocchi and Levitt, 1997). Swallowed air is thought to contribute the most to gas in the digestive tract. This may be the cause of flatus commonly seen in many brachycephalic breeds. Vigorous exercise and rapid and competitive eating situations may exacerbate aerophagia. Studies using ultrafast computed tomography in people show that a mean of 17 ml of air accompanies the swallowing of 10 ml of water. In people, air introduced into the stomach can result in flatus within 15 to 35 minutes and it has been estimated that gases can move 10 cm/second through the GI tract (Levitt, 1980). In a study using an in vivo methodology of flatulence assessment in dogs, flatus developed as soon as two hours post-feeding (Yamka et al, 2006).

A large amount of gas is formed from colonic bacterial fermentation of poorly digestible carbohydrates and certain fibers. Fiber-containing foods contribute to flatus indirectly through reduced dry matter (DM) digestibility. Certain fibers (soluble or fermentable) used in pet foods are fermented by colonic microflora and may contribute to flatus directly. Foods that contain large amounts of nonabsorbable oligosaccharides (e.g., raffinose, stachyose and verbascose) are likely to produce large amounts of intestinal gas (Levitt, 1980). Dogs and cats lack the digestive enzymes needed to split these sugars into absorbable monosaccharides. Therefore, bacteria in the colon ferment these sugars producing hydrogen and carbon dioxide. Soybeans, beans and peas contain large quantities of nonabsorbable oligosaccharides (Yamka et al, 2003, 2006). Soybean meal is commonly used in pet foods as a protein source. The stachyose and raffinose content of soybean meal is variable ranging from 32 to 112 g/kg and 6 to 14 g/kg DM, respectively, which could contribute to flatulence if they compose more than 22 g/kg of food DM (Yamka et al, 2006).

Diseases that cause maldigestion or malabsorption are often associated with excessive flatus because excessive amounts of malassimilated substrates are delivered to the colon where bacterial fermentation occurs. Flatus may be present in animals with lactose intolerance.

The interaction between hydrochloric acid and alkaline food and saliva produces carbon dioxide in the stomach. The reaction between gastric acid and pancreatic bicarbonate in the duodenum also generates carbon dioxide. In addition, carbon dioxide enters the GI tract via diffusion from the blood. Belched gas is largely swallowed air (nitrogen and oxygen) plus variable quantities of carbon dioxide.

Odorless gases (i.e., nitrogen, oxygen, carbon dioxide, hydrogen and methane) compose as much as 99% of flatus (Strocchi and Levitt, 1997). The residual 1% is composed of odoriferous gases that contain sulfur, such as hydrogen sulfide, methanethiol and dimethylsulfide (Roudebush, 2001; Collins et al, 2001). These gases contribute the objectionable odors associated with flatus. Excessive quantities of odorless gases provide a vehicle for the odoriferous gases and volatiles and probably worsen objectionable flatus. Onions, nuts, spices, cruciferous vegetables (e.g., broccoli, cabbage, cauliflower, Brussels sprouts) and high protein ingredients often increase production of odiferous gases.

Key Nutritional Factors

Table 65-1 summarizes the key nutritional factors, discussed below, for foods for dogs and cats with objectionable excessive flatulence.

Digestibility

Digestibility, especially of the carbohydrate fraction of food, is an important nutritional factor in patients with excessive flatulence. Feeding a highly digestible food reduces the residues available for bacterial fermentation in the large intestine. Thus, foods with high digestibility (fat and digestible [soluble] carbohydrate ≥90% and protein ≥87%) are recommended for patients with objectionable flatus).

Carbohydrate

Certain carbohydrate sources may affect flatus production in individual patients. Changing the source of carbohydrate in the food may benefit some animals (Suarez et al, 1999). Anecdotal reports in people suggest that a food in which all carbohydrate is supplied by white rice reduces flatus output. Studies in dogs have also shown that foods containing rice as a carbohydrate source result in less intestinal gas formation than foods containing wheat or corn (Washabau et al, 1986). This suggests that animals with flatus may benefit from foods with rice as the sole or predominant carbohydrate source.

Protein

Dietary protein sources and amount may affect flatus odor. Changing the sources of protein in the food may benefit some patients (Suarez et al, 1999). Ammonia and volatile amines are odorous and could result from microbial fermentation of food protein residues reaching the large intestine. Therefore, protein digestibility (discussed above) and amount should be considered if flatus is a problem. Dietary protein should probably not exceed 30% for dogs and 40% for cats DM. Leguminous protein sources such as soybean meal should be avoided in pets with excessive flatulence.

Fiber

Soluble or fermentable fiber-enhanced foods may contribute to excessive flatus in some patients. Soluble fibers including fruit pectins and gums (e.g., guar gum, carrageenan) are readily fermentable by gut microbes resulting in gas production (Chapter 5). Even some mixed fibers in adequate amounts (brans, soy fiber, soy hulls, pea fiber and beet pulp) can be a source of flatulence. Some of these sources of fiber also contain non-fiber ingredients that can contribute to objectionable flatus (e.g., soy hulls and pea fiber). For patients with excessive flatus, the amount of fiber should probably be limited to no more than 5% DM.

Table 65-1. Key nutritional factors for foods, treats and snacks for dogs and cats with excessive flatulence.*

Factors	Recommendations
Digestibility	Increased digestibility
	Fat and carbohydrate digestibility ≥90%
	Protein digestibility ≥87%
Carbohydrate	Change source: rice is preferred
Protein	Avoid high-protein foods
	Adult dogs: limit to ≤30% or less
	Adult cats: limit to ≤40% or less
	Avoid legumes (see below)
Fiber	Dogs and cats: limit to ≤5% fiber (most important aspect regarding fiber)
	Avoid high-fiber foods, especially soluble/fermentable and mixed fibers (soy fiber, soybean hulls, pea fiber, psyllium, pectin, carrageenan, guar gum, bran and beet pulp)
Legumes	Avoid all beans (including soybeans), peas, lentils, peanuts
Lactose sources	Avoid milk, ice cream, cheese, yogurt
Sulfur-containing vegetables	Avoid broccoli, cauliflower, Brussels sprouts, cabbage
Onions	Avoid
Nuts	Avoid
Spices	Avoid
Fructose	Avoid fruits and high-fructose corn syrup
Vitamin-mineral supplements	Avoid; unnecessary with most commercial foods

*Nutrient values are on a dry matter basis.

Food Ingredients

As discussed above, certain protein, carbohydrate and fiber ingredients or levels may affect flatus production in individual animals. Of the numerous foods alleged to enhance flatus in people, baked beans is the only natural food that has been carefully studied. A diet regimen deriving half of its calories from pork and beans increased flatus elimination in people from a basal level of 15 to 176 ml/hour (Steggarda, 1968).

Changing the sources of protein or carbohydrate in the food may benefit some animals (Suarez et al, 1999). For example, changing from a commercial dry food that contains corn, chicken meal and soybean meal to a dry food that contains lamb meal, rice and barley may be helpful. Vegetarian-based foods can be problematic because they often include potentially odiferous sulfur-containing vegetables and legumes. The lactose content of foods and treats (e.g., cheese, ice cream, milk) may be a factor in adult dogs and cats, especially those with lactase deficiency or in animals with underlying GI disease. A series of dietary trials is often successful in finding a food that lessens flatulence in individual pets. **Table 65-1** lists several categories of human foods and food ingredients to avoid or limit.

FEEDING PLAN

Dietary management of flatulence is primarily concerned with decreasing intestinal gas production by bacterial fermentation of undigested food. Changes in the feeding plan can be used in conjunction with other therapy. Recently, commercial products have been introduced that claim to reduce flatulence (**Box 65-1**).

Assess and Select the Food

Obtaining a thorough dietary history is of paramount importance in evaluating patients with excessive flatulence. Specific foods, major food ingredients, treats, supplements and opportunities for dietary indiscretion should be evaluated.

In general, pets with excessive flatulence will benefit from highly digestible foods. Consumption of such foods may reduce the amount of residue reaching the large intestine, thereby decreasing substrate availability for bacterial fermentation and subsequent gas production. Commercial foods and treats fed to pets that have excessive flatulence should also be evaluated for specific ingredients that might be further contributing to the problem. To accomplish this, compare the food's ingredient list on the package or label (Chapter 9) to the ingredients recommended to avoid or limit as listed in **Table 65-1**. If a food's major ingredients are potentially offensive, change to a food that has a nutrient profile and ingredient list that more closely compares to the recommendations in **Table 65-1**. Several veterinary therapeutic foods marketed for GI diseases or adverse food reactions are often suitable for feeding to patients with excessive flatulence (**Tables 65-2** and **65-3**, for dogs and cats, respectively). Most of these foods are complete and balanced for long-term feeding. Dietary trials may be necessary to select a food that reduces flatus. **Table 65-1** also lists human foods to avoid as treats or snacks or as ingredients for homemade foods for patients that have a history of excessive flatulence.

Assess and Determine the Feeding Method

A thorough assessment should include verification of the feeding method currently being used. Considerations include feeding frequency, amount fed, how the food is offered, access to other food, relationship of feeding to exercise and who feeds the animal. All of this information should have been gathered when the history of the animal was obtained. If the animal has a normal body condition score (2.5/5 to 3.5/5), the amount of food previously fed (energy basis) was probably appropriate.

Reducing aerophagia is important in the control of flatulence in dogs, especially in brachycephalic breeds. Feed several small

Box 65-1. Carminatives.

INTRODUCTION

Carminatives are medicines or preparations that relieve flatulence. Various herbal and botanical preparations have been used for thousands of years as carminatives. More recently, commercial products have been introduced that claim to reduce or control flatulence. These products can be used in conjunction with changes in the feeding plan and usually contain activated charcoal, bismuth subsalicylate (BSS), zinc acetate, simethicone, *Yucca schidigera* preparations, α-galactosidase, pancreatic enzyme supplements and various herbal preparations. Nonabsorbable antibiotics such as neomycin reduce flatulence and the number of flatus episodes in healthy people and dogs. However, routine use of nonabsorbable antibiotics in otherwise healthy pet animals with flatulence is not indicated.

ACTIVATED CHARCOAL

Dry activated charcoal adsorbs virtually all odoriferous gases when mixed directly with human feces and flatus gas. However, ingestion of activated charcoal by human subjects has been ineffective in reducing the number of flatus events, volume of intestinal gas released, odor of feces or breath hydrogen excretion after bean ingestion. In vitro studies suggest that the failure of ingested charcoal to reduce liberation of volatile sulfur compounds is due to the saturation of charcoal binding sites during passage through the gut. Wetting activated charcoal slows uptake of sulfur-containing gases considerably. Activated charcoal is found in a number of commercial canine treats purported to control flatulence.

BISMUTH SUBSALICYLATE

BSS reduces fecal and flatus odor in people when given frequently (four times daily). Bismuth is the active ingredient and avidly adsorbs hydrogen sulfide, forming insoluble bismuth sulfide. Bismuth sulfide imparts a characteristic black color to feces. Bismuth also has antibacterial activity, which may account for some of its effects. BSS contains 50% bismuth by weight and is found in various commercial veterinary antidiarrheal-adsorbent products and in over-the-counter antidiarrheal products for human use (e.g., Pepto-Bismol). There appears to be a striking dose-dependent response with BSS in that a dose of 400 mg of BSS/100 g of dry food completely suppresses cecal hydrogen sulfide release in rats, whereas one-fifth this concentration has no demonstrable effect. BSS may be effective in controlling objectionable flatus in pet animals but probably needs to be given multiple times per day, which precludes its practical, long-term use. BSS should be used with caution in cats because of concerns with salicylate toxicosis.

ZINC ACETATE

Similar to bismuth, zinc acetate binds sulfhydryl compounds and reduces volatile sulfur compounds when exposed directly to gas from human flatus. Addition of zinc acetate to food (1%) decreased fecal hydrogen sulfide concentrations and improved flatus odor in rats. One report showed that an oral treat containing zinc acetate, activated charcoal and *Yucca schidigera* extract reduced highly odoriferous episodes of flatus in dogs.

SIMETHICONE

Simethicone (dimethylpolysiloxane) is an antifoaming agent that reduces surface tension of gas bubbles and is found in commercial veterinary products and over-the-counter products for human use. Why simethicone would be beneficial in patients with flatulence is not obvious; however, one could speculate that altered gas bubbles might be more effectively eliminated. A few controlled trials of treatment with simethicone have been conducted in people. In general, simethicone had no effect on total daily flatus volume, number of

Table 65-2. Key nutritional factors in selected commercial veterinary therapeutic foods for dogs with excessive flatulence compared to recommended levels.*

Dry foods	Protein digestibility (%)	Fat digestibility (%)	Carbohydrate digestibility (%)	Protein (%)	Crude fiber (%)
Recommended levels	**≥87**	**≥90**	**≥90**	**≤30**	**≤5**
Hill's Prescription Diet i/d Canine	92	93	94	26.2	2.7
Iams Veterinary Formula Intestinal Low-Residue	na	na	na	24.6	2.1
Medi-Cal Gastro Formula	na	na	na	22.9	1.9
Purina Veterinary Diets EN GastroENteric Formula	84.5	91.4	94.4	27.0	1.5
Royal Canin Veterinary Diet Digestive Low Fat LF 20	na	na	na	24.2	2.3
Royal Canin Veterinary Diet Intestinal HE 28	na	na	na	33.0	1.6

Moist foods	Protein digestibility (%)	Fat digestibility (%)	Carbohydrate digestibility (%)	Protein (%)	Crude fiber (%)
Recommended levels	**≥87**	**≥90**	**≥90**	**≤30**	**≤5**
Hill's Prescription Diet i/d Canine	88	94	93	25.0	1.0
Iams Veterinary Formula Intestinal Low-Residue	na	na	na	35.9	3.9
Medi-Cal Gastro Formula	na	na	na	22.1	1.0
Purina Veterinary Diets EN GastroENteric Formula	85.1	95.6	92.2	30.5	0.9
Royal Canin Veterinary Diet Digestive Low Fat LF	na	na	na	31.9	3.0
Royal Canin Veterinary Diet Intestinal HE	na	na	na	23.1	1.4

Key: na = information not available from manufacturer; see **Table 65-1** for specific ingredients to avoid.
*Protein and crude fiber levels are on a dry matter basis.

flatus episodes or average volume per flatus event in people. Simethicone may help reduce gastric accumulation of gas and alleviate upper gastrointestinal (GI) signs. The effectiveness of simethicone in controlling flatulence in pet animals is unknown. It would not be expected to control objectionable flatus odors.

Yucca schidigera

Extracts of the *Yucca schidigera* plant have been used to control fecal malodor in animal waste lagoon systems and may help decrease fecal aroma. The mechanisms of action are poorly understood and may include "binding" ammonia or altering microbial activity. In the United States, *Yucca* preparations are only approved as flavoring agents in pet foods and it is unknown whether they effectively control flatulence or objectionable flatus odors when ingested by pet animals. An oral treat containing *Yucca schidigera* extract, activated charcoal and zinc acetate reduced highly odoriferous episodes of flatus in dogs.

α-GALACTOSIDASE and β-MANNANASE

Products containing α-galactosidase are available as human (Beano) and veterinary (CurTail) products. They reduce flatus volume by improving digestion of nonabsorbable oligosaccharides found in soybeans, beans, peas and other legumes. These products would not be expected to improve excessive flatus due to other causes (e.g., aerophagia) or improve the odor of flatus. Anecdotal reports suggest that these products may be beneficial in some animals. β-mannanase is another enzyme that may improve digestion of nonabsorbable oligosaccharides in legumes. β-mannanase has been used to increase feed conversion and dry matter digestibility of soy-based diets in poultry and swine. In dogs, however, supplemental β-mannanase was not shown to increase digestibility of food or reduce flatulence.

PANCREATIC ENZYMES

Pancreatic enzyme supplementation decreases abnormal intestinal gas production in dogs with exocrine pancreatic insufficiency. Pancreatic enzyme preparations have also been widely used for bloating and abdominal distention in people. Because ingestion of these preparations should add little to the enzyme output of the pancreas in otherwise normal individuals, no solid rationale exists for their use in flatulent patients without pancreatic disease. Nevertheless, a recent study in people showed that a microencapsulated pancreatic enzyme preparation significantly reduced postprandial symptoms of bloating and abdominal distention experienced by healthy people ingesting a high-calorie, high-fat meal. This finding suggests that pancreatic enzyme supplements might benefit some patients with flatulence.

HERBS AND BOTANICALS

More than 30 herbal and botanical preparations have been listed as carminatives. Grape seed extract containing proanthocyanidins is one botanical preparation that alters GI microflora and decreases fecal release of volatile sulfur compounds in human patients. The dosage, safety and efficacy of grape seed extract and other botanical preparations in pets with flatulence have not been established.

SUMMARY

To date, the best evidence exists for short-term use of bismuth subsalicylate, zinc acetate and nonabsorbable antibiotics as carminatives. Less evidence exists for use of activated charcoal, simethicone, digestive enzyme preparations, *Yucca* extract and grape seed extract. Changing the feeding plan (food and feeding method), rather than using carminatives, offers the best opportunity for successful long-term management of flatulence in pet animals.

Table 65-3. Key nutritional factors in selected veterinary therapeutic foods for cats with excessive flatulence compared to recommended levels*

Dry foods	Protein digestibility (%)	Fat digestibility (%)	Carbohydrate digestibility (%)	Protein (%)	Crude fiber (%)
Recommended levels	**≥87**	**≥90**	**≥90**	**≤40**	**≤5**
Hill's Prescription Diet i/d Feline	88	92	90	40.3	2.8
Iams Veterinary Formula Intestinal Low-Residue	na	na	na	35.8	1.8
Medi-Cal Hypoallergenic/Gastro	na	na	na	29.8	3.1
Purina Veterinary Diets EN GastroENteric Formula	94.0	93.1	79.7	56.2	1.3
Royal Canin Veterinary Diet Intestinal HE 30	na	na	na	34.4	5.8

Moist foods	Protein digestibility (%)	Fat digestibility (%)	Carbohydrate digestibility (%)	Protein (%)	Crude fiber (%)
Recommended levels	**≥87**	**≥90**	**≥90**	**≤40**	**≤5**
Hill's Prescription Diet i/d Feline	91	89	91	37.6	2.4
Iams Veterinary Formula Intestinal Low-Residue	na	na	na	38.4	3.7
Medi-Cal Hypoallergenic/Gastro	na	na	na	35.5	1.2
Medi-Cal Sensitivity CR	na	na	na	34.5	2.5

Key: na = information not available from manufacturer; see **Table 65-1** for specific ingredients to avoid.
*Protein and crude fiber levels are on a dry matter basis.

Table 65-4. Feeding plan summary for patients with excessive flatulence.

Control aerophagia
Discourage rapid or competitive eating
Feed a mixture of moist and dry foods
Feed several small meals daily
Surgically correct stenotic nares and elongated soft palate in brachycephalic dogs

Decrease production of obnoxious intestinal gas
Select a food with the appropriate key nutritional factors (**Table 65-1**)
Walk the dog outdoors within 30 minutes of meals to encourage defecation and the elimination of intestinal gas. In general, more activity and exercise result in fewer problems with flatus.

Carminatives
If changes in the feeding plan do not result in significant improvement, consider the use of carminatives. To date, the best evidence exists for short-term use of bismuth subsalicylate, zinc acetate and nonabsorbable antibiotics. Less evidence exists for use of activated charcoal, simethicone, digestive enzyme preparations, *Yucca* extract and grape seed extract (**Box 65-1**).

meals daily in an effort to discourage rapid eating and gulping of air. Feeding small frequent meals also improves digestibility and reduces food residues available for bacterial fermentation in the large intestine. A recent study in dogs demonstrated that feeding twice daily resulted in fewer episodes of flatus (9.9/day) than feeding once daily (13.5/day) (Yamka et al, 2006). Feeding in a quiet, isolated location will eliminate competitive eating and reduce aerophagia. Walking dogs outdoors within 30 minutes of eating encourages defecation and elimination of intestinal gas (**Table 65-4**).

REASSESSMENT

Patients should be evaluated for evidence of malassimilation if the methods outlined above are not successful in reducing or controlling flatulence, including objectionable flatus. Relapses in animals that have been controlled often indicate dietary indiscretion. The prognosis for control of flatulence is good in most cases. However, owners should be educated about normal intestinal gas production and should not expect complete cessation of flatulence (Cho, 1994).

If changes in the feeding plan do not result in significant improvement, consider use of carminatives (**Box 65-1**).

REFERENCES

The references for **Chapter 65** can be found at www.markmorris.org.

CASE 65-1

Flatulence in a Young Puppy

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Patient Assessment

A 16-week-old intact male beagle puppy was examined for routine health maintenance procedures. The owners obtained the puppy from a local animal shelter six weeks ago. The puppy had been active and healthy with no apparent problems. However, the owners complain the puppy passes excessive amounts of intestinal gas with an offensive odor, especially after meals. There has been no evidence of vomiting, diarrhea or other gastrointestinal (GI) problems. Physical examination revealed an active puppy with no abnormalities. A fecal sample was negative for intestinal parasites.

Assess the Food and Feeding Method

The patient was fed a commercial dry puppy food containing the following ingredients: corn, chicken meal, soybean meal, animal fat, beet pulp, rice, fish oil, flaxseed, vitamins and minerals. The daily feeding amount was divided into two equal meals, offered in the morning and evening. The puppy's appetite was very good and the food was usually consumed at each meal within a few minutes. The puppy also enjoyed small amounts of fresh fruit and vegetables as snacks.

Questions

1. What are the common clinical manifestations of flatulence?
2. What are the most common causes of excessive intestinal gas formation?
3. Are there ingredients in the current diet that could be contributing to excessive intestinal gas formation?
4. Outline a feeding plan for this puppy that will help control the problem with flatulence.

Answers and Discussion

1. Flatulence is excessive formation of gases in the stomach or intestine. Excessive flatulence is usually associated with noticeable flatus, belching, borborygmus, abdominal distention or a combination of these signs. Flatus, rather than flatulence, is the term that should be used for gas expelled through the anus. Dog owners often complain of excessive amounts of flatus, with or without an objectionable odor.
2. The quantitatively important gases in the intestinal tract are nitrogen, oxygen, hydrogen, carbon dioxide and methane. These gases comprise more than 99% of the intestinal gas volume and are odorless. The characteristic unpleasant odor of intestinal gas appears to result primarily from the presence of trace gases that contain sulfur. Gas in the GI tract is derived from four sources: 1) air swallowing (oxygen and nitrogen), 2) interaction of bicarbonate and acid (carbon dioxide), 3) diffusion from the blood (carbon dioxide, nitrogen and oxygen) and 4) bacterial metabolism (carbon dioxide, hydrogen, methane and a variety of trace gases). Swallowed air and bacterial fermentation in the colon contribute most of the intestinal gas volume.
3. Foods that contain ingredients with nonabsorbable oligosaccharides (e.g., raffinose, stachyose, verbacose) are likely to produce large amounts of intestinal gas. Dogs and cats lack the digestive enzymes needed to split these sugars into absorbable monosaccharides. Therefore, bacteria in the colon ferment these sugars producing hydrogen and carbon dioxide. Soybeans, beans, peas and other legumes contain large quantities of nonabsorbable oligosaccharides. Fiber-containing foods may contribute to flatus indirectly through reduced dry matter digestibility. Many fibers used in pet foods are fermented by the colonic microflora and may contribute to flatus directly. Rapidly fermentable fibers in pet foods include pectins and most gums. Intestinal gas production is also increased by fresh or dried foods containing fructose and fermentable fiber (e.g., apples, prunes, bananas). The food fed to this puppy contains soybean meal, a source of nonabsorbable oligosaccharides, which is likely contributing to excessive gas formation. The fresh fruits and vegetables used as snacks may also be contributing to the problem. Rice is the most highly digestible carbohydrate source used routinely in pet foods. Pets with flatulence will often improve when fed foods with rice as the sole or predominant carbohydrate source.
4. Feeding plans for animals with flatulence should focus on the food, feeding method, efforts to control aerophagia and management after meals. For this puppy, another commercial dry food that is complete and balanced for growth should be found that does not contain legumes (especially soybean meal), vegetables or fruits. A snack or treat should also be recommended that is not a vegetable or fruit. Aerophagia is most likely associated with rapid eating. Food can be offered more frequently to decrease the amount of air ingested at each meal or other methods can be tried to slow food ingestion and prevent gulping. Finally, the puppy should be walked or allowed to exercise within 30 minutes of each meal to encourage defecation or passage of intestinal gas outdoors.

Progress Notes

A different commercial dry puppy food was recommended (Science Diet Puppy Lamb Meal & Rice Formula[a]). This food contains the following major ingredients: lamb meal, rice, corn gluten meal, wheat, animal fat, egg, beet pulp, fish oil, vitamins and minerals. It does not contain soybean meal and uses rice as the major carbohydrate source; this change in ingredients should help minimize intestinal gas formation from bacterial fermentation. The food was still offered twice daily, but large rubber balls were put in the food bowl in an attempt to slow the rate of food ingestion. Fruits and vegetables were replaced as snacks with an appropriate commercial puppy treat (Science Diet Puppy Treats with Real Chicken[a]). The puppy was allowed to exercise in the fenced yard for 30 to 60 minutes after each meal. During the next health maintenance examination four weeks later, the owners reported a noticeable reduction in objectionable flatus.

Endnote

a. Hill's Pet Nutrition, Inc., Topeka, KS, USA.