Creature Companion 2018; January: 38, 40.

Anton C. Beynen

Diet and dog farts

Expelling gas through the anus (flatus), is normal in dogs. Excessively noisy and/or stinky farts can be a source of humor or annoyance. Twenty nine out of 314 owners of apparently healthy dogs perceived their pets' flatus at least daily (1). In another questionnaire-based study, one third of 47 owners of flatulent dogs found the smell objectionable and would change the dog's diet if it would solve the problem (2).

Flatus largely consists of odorless gases. Malodor is caused by quantitatively minor, volatile sulfur compounds. Above human's odor perception threshold, increasing concentrations of hydrogen sulfide in dog flatus are matched by worsening aroma. The hydrogen sulfide is formed in the large intestine by bacteria that process sulfate, (sulfur-containing) protein fragments and carbohydrates. Formation of hydrogen sulfide is reduced by feeding dogs on a highly digestible, protein-restricted food so that little residue reaches the hindgut, thereby starving and slowing down the stink-producing bacteria.

Compared with soybean meal in the diet, poultry meal may diminish the volume of gas production and make the smell less offensive. The latter was shown in dogs fitted with vests containing a monitoring pump that sampled air near the anus and determined hydrogen sulfide concentrations. Further reduction of hydrogen sulfide in dog flatus may be achieved by fortifying the diet with a preparation of the Yucca schidigera plant.

For an individual gassy dog, a series of dietary tests can be successful in finding a suitable food. Inspecting the ingredient and analysis panels of different foods may lead to identification of potentially beneficial products that are complete, soybean-free, low-protein (less than 20% crude protein in a dry food), low-fiber (less than 2% crude fiber) and, possibly, supplemented with a yucca substance.

Hydrogen sulfide

Part of the gas excreted per rectum is derived from bacterial fermentation in the colon. Hydrogen sulfide (H_2S), a very small constituent, appears to cause malodorous flatus. The culprit is formed by sulfate-reducing bacteria (3).

In healthy, instrumented dogs fed a commercial dry food, hydrogen sulfide was measured in air around the anus (4). The dogs moved freely in an enclosed room, together with an odor judge. The odor ratings on a 1-5 scale correlated highly with flatus H_2S concentrations. The sensory detection limit was 1 ppm. H_2S concentrations varied markedly within dogs over time and between dogs on each day (4). Aging had no effect (5).

Bacterial fermentation

Higher quantities of odorless gases could either dilute or enhance hydrogen sulfide in flatus. Perhaps, extra gas provides a vehicle that diverts the repellant from tissue metabolism. Feeding poorly digestible proteins and carbohydrates, high-fiber ingredients and indigestible, fermentable carbohydrates all promote flatus through increasing substrate availability for bacterial fermentation. Colonic hydrogen sulfide production is further stimulated by supply of sulfate (6) and/or sulfur-containing amino acids.

Clinical signs of digestive impairment may include flatus. Dogs with exocrine pancreatic insufficiency typically present with frequent flatulence, obtaining a severity score of 2 as opposed to 1 (sometimes flatulence) or 0 (no). Dietary digestive enzyme supplementation lowered the rating to 1.2, whereas healthy controls scored 0.5 (7).

Flatus volume

Flatus activity in fecal matter mirrors the state of colonic fermentation. Gas production in feces incubated at 37 ^{o}C was much greater when the donor dogs were fed a soy-grit diet rather than an all-meat diet (8). Based on conversion by dog feces (9-11), cellulose is nonflatulant, whereas soy fiber, wheat bran, beet pulp and wheat middlings are flatulent. Cellulose is indigestible in the small intestine; the other substrates are poorly digestible.

Homogenates were inserted into the ligated colon of anesthetized dogs. Inside the gut segment, gas production was negligible after introduction of cellulose, but was powerful for navy beans (12). The intestinal gas area in dogs was quantified noninvasively by radiography. Dietary probiotics had no effect (13), but mixing 30% soybean meal into an extruded corn-poultry diet (14) or replacing 16% corn by soya hulls (15) markedly increased intestinal gas volume.

Malodorous flatus

Soybean versus poultry meal in dry food led to higher, smellable levels of hydrogen sulfide in dogs' rectal gas (16). Dogs (n= 129) were switched from their habitual diet to a high-protein, low-carbohydrate dry food (36% crude protein, 24% nitrogen-free extract) with "poultry and pork dehydrated proteins" as first ingredient (17). After 14 days, the owners classified flatulence as absent in 73% of the dogs, less in 8% and more in 19%.

In a crossover study (18), dogs fed a commercial dry food received placebo and test treats (1 treat/5 kg body weight). Test treats contained three carminatives: activated charcoal (320 mg/treat), *Yucca schidigera* (2.5 mg) and zinc acetate dihydrate (57 mg). The test treat reduced the number of bad/unbearable farts from two to zero during 3 to 8 hours after feeding (Note 1). Addition of 0.5% ginger root powder to a canine dry food reduced flatus frequency and H_2S content (19).

Fecal odor

Offensiveness of flatus and feces may go hand in hand. Higher protein intake was associated with deteriorated canine fecal aroma (20). In 7 dog studies, yucca ingestion (280 mg preparation/kg diet) lowered overall offensiveness scores for feces by 31% (21, 22, Notes 2, 3). Incubation of dog feces with yucca lowered hydrogen sulfide formation (18), but the mechanism of action remains open.

Note 1.

Dogs were fed their daily ration at 8:30 am, and treats were offered 30 minutes later. Hydrogen sulfide in rectal gas was measured continuously at 20-second intervals between 10:30 am and 3:30 pm on each of the five days of the two treatment periods of the crossover study (18). The number of flatulence episodes (NOE), i.e. the number of hydrogen sulfide readings > 1 ppm during the sampling period, was 12 for the control treat and 8 for the test treat. The ppm readings were converted into odor scores using an earlier derived power function (4). The outcomes were categorized as 1 (no odor), 2 (slightly noticeable odor), 3 (mildly unpleasant odor, 4 (bad odor), and 5 (unbearable odor).

The article (18) presents the percentage distribution of the scores. Score 1, representing no odor, accounts for about 40% of the total scores. Because all sulfide readings were above the lower limit of sensory human detection (> 1 ppm), score 1 falls under smellable flatulence episodes. The distribution indicates that the control scores 4 and 5 each represented 8% of the total episodes. These values were 2 and 0% for the test treat. Thus, when consuming the control treat, the dogs had one flatulence episode each with bad (score 4) and unbearable odor (score 5). In contrast, such episodes were essentially zero when the test treat was administered.

Flatus score distributions for the two treats

	Control treat		Test treat	
Score	%	NOE	%	NOE
1	37	4.4	43	3.4
2	34	4.1	48	3.8
3	13	1.6	7	0.8
4	8	1.0	2	0.2
5	8	1.0	0	0
Sum	100	12	100	8

Note 2.

Impact of dietary yucca preparations on canine fecal odor offensiveness

Authors	Yucca dose^	Effect#	Diet type
Lowe and Kershaw, 1997*	250	54	dry
Lowe, 1991*	200	42	dry
Maia et al., 2010*	250	8	dry
Dos Reis and Saad, 2011*+	500	0	dry
McFarlane and DPI Global, 8801D*	248	56	dry
McFarlane and DPI Global, 8802D*	248	20	dry, wet
Ravikumar and Swamy, 2009 (22)	250	40	wet

*Summarized and cited by Beynen and Saris (21). ^ mg/kg diet.
Percentage decrease in degree of maldor. + Same study as reference 20.

Note 3.

In the treat study (18), the test treats contained three carminatives: activated charcoal (320 mg/treat), *Yucca schidigera* (2.5 mg) and zinc acetate dihydrate (57 mg). The administration of yucca was equivalent to 33 mg/kg dry food. This dosage is much lower than that (280 mg/kg diet) in the fecal-odor studies (21, 22). In the treat study, activated charcoal and zinc acetate probably had contributed to the observed decrease in flatus hydrogen sulfide concentration. The two carminatives are assumed to bind colonic and fecal sulfur-containing gases (18).

Literature

1. Stetina KM, Marks SL, Griffin CE. Owner assessment of pruritus and gastrointestinal signs in apparently healthy dogs with no history of cutaneous or noncutaneous disease. Vet Dermatol 2015; 26: 246-e54.

2. Jones BR, Jones KS, Turner K, Rogatski B. Flatulence in pet dogs. N Z Vet J 1998; 46: 191-193.

3. Gibson GR, Macfarlane GT, Cummings JH. Sulphate reducing bacteria and hydrogen metabolism in the human large intestine. Gut 1993; 34: 437-439.

4. Collins SB, Perez-Camargo G, Gettinby G, Butterwick RF, Batt RM, Giffard CJ. Development of a technique for the in vivo assessment of flatulence in dogs. Am J Vet Res 2001; 62: 1014-1019.

5. Apanavicius C, Czarnecki-Maulden G. Influence of age on flatulence in dogs. J Anim Sci 2004; 82 (Suppl 1): 244.

6. Suarez F, Furne J, Springfield J, Levitt M. Production and elimination of sulfur-containing gases in the rat colon. Am J Physiol 1998; 274: G727-G733.

7. Wiberg ME, Lautala H-M, Westermarck E. Response to long-term enzyme replacement treatment in dogs with exocrine pancreatic insufficiency. J Am Vet Med Assoc 1998; 213: 86-90.

8. Rackis JJ. Oligosaccharides of food legumes: Alpha-galactosidase activity and the flatus problem. In: Physiological Effects of Food Carbohydrates (Jeanes A, Hodge J, eds), American Chemical Society Symposium Series No 15, American Chemical Society, Washington, DC, 1975, pp 207-222.

9. Bosch G, Pellikaan WF, Rutten GP, Van der Poel AFB, Verstegen MWA, Hendriks WH. Comparative in vitro fermentation activity in the canine distal gastrointestinal tract and fermentation kinetics of fiber sources. J Anim Sci 2008; 86: 2979-2989.

10. Cutrignelli MI, Bovera F, Tudisco R, D'Urso S, Marono S, Piccolo G, Calabrò S. *In vitro* fermentation characteristics of different carbohydrate sources in two dog breeds (German shepherd and Neapolitan mastiff). J Anim Physiol Anim Nutr 2009; 93: 305-312.

11. Calabrò S, Carciofi AC, Musco N, Tudisco R, Gomes MOS, Cutrignelli MI. Fermentation characteristics of several carbohydrate sources for dog diets using the *in vitro* gas production technique. Italian J Anim Sci 2013; 12: e4.

12. Richards EA, Steggerda FR. Production and inhibition of gas in various regions in the intestine of the dog. Proc Soc Exp Biol Med 1966; 122: 573-576.

13. Feliciano MAR, Saad FMOB, Leite CAL, Vicente WRR, Nepomuceno AC, Silveira T. Avaliações ultrassonográfica e radiográfica dos efeitos da supplemenção com dois tipo de probióticos sobre o intestino de cães filhotes. Arq Bras Med Vet Zootec 2010; 62: 1109-1116.

14. Félix AP, Rivera NLM, Sabchuk TT, Lima DC, Oliveira SG, Maiorka A. The effect of soy oligosaccharide extraction on diet digestibility, faecal characteristics, and intestinal gas production in dogs. Anim Feed Sci Technol 2013; 184: 86-93.

15. Sabchuk TT, Lowndes FG, Scheraiber M, Silva LP, Félix AP, Maiorka A, Oliveira SG. Effect of soya hulls on diet digestibility, palatability, and intestinal gas production in dogs. Anim Feed Sci Technol 2017; http://dx.doi.org/doi:10.1016/j.anifeedsci.2017.01.011

16. Yamka RM, Harmon DL, Schoenherr WD, Khoo C, Gross KL, Davidson SJ, Joshi DK. In vivo measurement of flatulence and nutrient digestibility in dogs fed poultry by-product meal, conventional soybean meal, and low-oligosaccharide low-phytate soybean meal. Am J Vet Res 2006; 67: 88-94.

17. Chaix G, Fournel S, Zulian M, Leriche I. Assessment through a pet owner survey of the gastrointestinal tolerance of a new high protein-low carbohydrate diet range in growing dogs. Intern J Appl Res Vet Med 2016; 14: 190-202.

18. Giffard CJ, Collins SB, Stoodley NC, Butterwick RF, Batt RM. Administration of charcoal, *Yucca schidigera*, and zinc acetate to reduce malodorous flatulence in dogs. J Am Vet Med Assoc 2001; 218: 892-896.

19. Khoo C. Method to reduce odor of excreta from companion animals. United States Patent, US 7,722,905 B2, May 25, 2010.

20. Dos Reis JS, Zangerônimo MG, Ogoshi RCS, França J, Costa AC, Almeida TN, Dos Santos JPF, Pires CP, Chizzotti AF, Leite CAL, Saad FMOB. Inclusion of Yucca schidigera extract in diets with protein level for dogs. Anim Sci J 2016; doi: 10.1111/asj.12535

21. Beynen A.C. and Saris D.H.J. Beating odour with Yucca schidigera. All About Feed 2014; 21/2: 8-10.

22. Ravikumar BR, Swamy HVLN. De-Odorase® reduces canine fecal odor. Alltech's 25th Annual Symposium, Lexington, KY, 2009.