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MOS in dog food

MOS (mannan-oligosaccharides) refers to repeating units of mannose in various forms of a main chain with branches. The mannose building block is a simple sugar (monosaccharide). MOS as petfood additive concerns different preparations harvested from the outer layer of baker's yeast. Added MOS in dry dog foods provides roughly 0.2 to 10 times the amount of mannose furnished by the base ingredients.

Petfoods featuring MOS, claim that linked mannose series improve intestinal and immune health. Mannose is maintained to block bad bacteria in the gut, leading to enhanced intestinal structure, digestive and immune function (1). However, sugar's interaction with bacteria is not specific for mannose. Corn-based dry foods are in themselves high in mannose, possibly making MOS addition redundant. But most importantly, there is no research evidence that extra dietary MOS perceptibly promotes health and longevity in dogs. Even dog health indicators are not bettered by MOS.

It is asserted that MOS encourages the growth and activity of beneficial bacteria in the intestinal tract. However, controlled experiments with dogs indicate that additional dietary MOS does not enlarge the populations of good bacteria, lactobacilli and bifidobacteria, in the large intestine. At the same time, the bad clostridia bacteria are not depressed. Using the bacterial profile as indicator, MOS may not promote gut health in dogs.

As an indicator of immune activity, a substance that destroys harmful bacteria in the body was measured, namely immunoglobulin A in blood and inside the small intestine. The indicator's amounts were unchanged in dogs fed diets with added MOS. The digestion efficiency of dietary protein and fat was marginally raised by MOS. Adding MOS to the diet does not appear to enhance immunity and digestion in dogs.

Mannose and MOS

Mannose, a C-2 epimer of glucose, is scant in dog food. It probably is poorly absorbed by diffusion and then excreted in urine or used in glycolysis, gluconeogenesis or protein glycosylation. MOS variants are composed of mannose units with α(1,2) and α(1,6) bonds. MOS is resistant to the dogs' digestive enzymes, but is fermented by the colonic microflora, yielding short-chain fatty acids (2-4).

Total mannose in petfood

Brown rice, dehusked barley kernels, corn grains and dried baker's yeast may hold 7 (5), 250 (6), 450 (7) and 12.300 (8) mg mannose /100 g. In dry foods containing 1% yeast or 50% corn there would be at least 123 or 225 mg mannose/100 g. Analysis showed that mean and range of mannose concentrations for five MOS preparations were 102 and 59-144 mg/g (4). Petfood can include up to 0.5% of a MOS preparation, providing about 50 mg mannose/100 g food. Commercial MOS sources, or spray-dried yeast cell walls, contain 17-41% crude protein and 20-46% total dietary fiber (4, 9).

MOS as anti-pathogen

The recommendation of MOS as health-promoting petfood ingredient is based on the concept that its mannose component blocks colonization of the gut by pathogenic bacteria, leading to optimum intestinal digestive and immune function (1). The model says that MOS-associated mannose occupies mannose-binding sites of pathogens, rendering them unable to attach to mannose structures on the surface of the gut wall.

The MOS concept is rooted (1) in studies showing that D-mannose reduced Salmonella typhimurium colonization in broiler chickens challenged orally with the pathogen (10, 11). Supplying drinking water with 2.5% mannose or lactose, when compared with glucose, maltose and sucrose, lowered viable Salmonella numbers in cecal contents by 53 and 42% (11). In vitro adherence of Salmonella to chick epithelial cells was markedly inhibited by mannose, arabinose and galactose (12).

Gut bacteria

As possible anti-pathogen and fermentation substrate, dietary MOS could affect the gut bacterial profile by selective effects on colonization and growth, but dog studies are unsupportive. At an average level of 0.48% in dry food, MOS preparations only trivially raised both desirable (Bifidiobacterium and Lactobacillus) and undesirable fecal bacteria (Clostridia perfringens and Escherichia coli) (9, 13-16). Within dog studies (9, 16), dietary MOS levels ranging from 0.05 to 0.65% did not produce systematic dose-response relationships with the fecal bacterial counts.

Digestion

High dietary MOS levels may raise viscosity of ileal digesta (17), thereby impairing macronutrient digestion. Indeed, 5.9% MOS in dry dog food lowered apparent total-tract digestibility of protein and carbohydrates by 7.1 and 10.6% units (18). A mean of 0.48% MOS increased apparent ileal and fecal digestibilities of protein by 1.0 and 0.4% units and those of fat by 0.1 and 0.5% (9, 13-16), but dose-response relationships within trials were erratic (9, 16).

Dry dog food containing ≤ 1.5% of added MOS did not alter the consistency of feces, its pH and concentration of total short-chain fatty acids (9, 13-16, 19, 20). Meats-based food with 1.4% MOS in the dry matter elevated fecal short-chain fatty acids (21).

Immunity

Secretory immunoglobulin A (IgA) in the intestinal lumen prevents interaction of antigens with the epithelium. Serum IgA potentiates immune responses and IgG binds pathogens. MOS feeding did not affect the concentrations of IgA and IgG in dogs (9, 14-16).

Dietary MOS might fortify certain immune responses in puppies. MOS tended to raise serum IgG post-inoculation with Laptospira antigen (20) and the number of active blood neutrophils post-vaccination (1, 22). Consumption of MOS further increased skin-fold thickness after intra-dermal administration of a lymphocyte activator (20).

List of references is available on request from the author (beynen@freeler.nl)

** Dr Anton C Beynen writes this exclusive column on dog and cat nutrition every month. He is affiliated with Vobra Special Petfoods.*