Back to SAIM Comprehensive Review

Raw Food Diets: A Research Review

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Andrea J. Fascetti, VMD, PhD, DACVIM (Small Animal Internal Medicine), DACVN

Davis, CA, USA

Introduction

Raw food diets are often referred to by the acronym "BARF" which can stand for "bones and raw food" or "biologically appropriate raw food" diet. It is unclear how many people are feeding their pets raw food diets. However, based on the growing number of commercially available raw diets, one can surmise it is growing, but that they are likely still fed to a small percentage of pets. Proponents of raw food diets proclaim many health benefits associated with this feeding regime, stating that dogs and cats are carnivores and as such they evolved eating raw food. However, there have been no studies to date to support that this feeding approach has any long-term health benefits compared to feeding other types of pet food. Despite the absence of long-term studies, there has been research looking at the nutritional performance as well as the possible risks and benefits of bones and raw food diets.

Nutritional Adequacy

Nutritional adequacy should be one of the first concerns of every practitioner regarding their patient's feeding program. Concerns regarding nutritional adequacy not only apply to home-prepared raw diets but to commercial raw diets as well. One study that looked at the nutritional adequacy of home-prepared raw food, also looked at the nutritional adequacy of several commercial raw food diets.[1,2] Two diets were commercial products, the remaining three home-prepared. All five diets had essential nutrients that were analyzed to be below (Association of American Feed Control Officials) AAFCO minimum recommendations.[1,2] The home-prepared diets had excessive concentrations of vitamins D and E, as well as inappropriate calcium to phosphorus ratios. A recent survey of dog owners in Germany that were feeding home-prepared bone and raw food diets found that 76% of the 77 rations analyzed had at least one nutritional imbalance.[3] Clinical case reports of problems in animals consuming commercial raw food diets are now beginning to appear in the literature as well.[4] Commercially-produced raw diets fall under the same AAFCO labeling guidelines with respect to reporting nutrient content,

ingredients and nutritional adequacy statements. AAFCO recommendations for nutrient minimums and maximums exist to guide and protect against nutritional concerns in commercially-produced foods. While some of these recommendations are based on studies using semi-purified diets, there are also many studies using extruded or moist diets. While one can argue that for traditional commercial foods there is a paucity of data concerning many nutrient requirements, bioavailability and the effect of diet on gastrointestinal microbial populations in dogs and cats, there is less for raw foods. It is well-known that nutrient requirements can vary depending on the type of diet (i.e., feline recommended allowances for taurine are almost double for canned products compared to extruded diets). Therefore one can speculate that similar examples may exist for dogs and cats consuming raw diets and that further research is needed.

The literature contains a variety of papers documenting the palatability, chemical composition, digestibility and bioavailability of many traditional animal and plant-based pet food ingredients. There are also a number of papers examining the effect of animal and plant-based ingredients on fecal quality and quantity. Recently more information with respect to ingredient and diet characteristics and qualities for raw diets are becoming available in the scientific literature. One research group at the University of Illinois has done several studies looking at macronutrient digestibility, nitrogen metabolism, fecal microbial populations and fecal fermentative products in both captive exotic and domestic cats.[5–8] This group is currently performing similar studies in dogs.[9] Many of the studies examined raw food feeding in exotic cats but a few also fed raw diets to domestic cats.[6,8] There was a substantial amount of data generated from these studies, some of which will be summarized here. In a recent study using both exotic and domestic cats, animals were fed either a beef or horse-based raw diet in a crossover design.[6] Food intake did not differ between diets but fecal output was greater when the horse-based diet was consumed. Total tract apparent dry matter digestibility was higher but organic matter and crude protein digestibilities were lower when cats were eating the beef-based diet, compared to the horse-based diets. Fecal scores were lower and fecal dry matter was greater when cats consumed the horse-based diet. Fecal ammonia concentrations were lowest when cats consumed the horse-based diet and overall domestic cats had lower ammonia concentrations. Fecal total short-chain fatty acids, branched-chain fatty acids and butyrate were higher in the cats when consuming the beef-based diet. One confounding factor in this study was that the horse and beef-based diet contained different sources of fiber, using powdered cellulose and beet pulp respectively. A recent abstract reported nitrogen metabolism data in domestic cats fed

four different raw animal protein sources, beef (crude protein (CP) 66%), bison (CP 49%), elk (CP 79%)and horse (CP 60%).[8] The researchers found that dietary nitrogen was highly digestible for all treatments. Since all the diets were highly digestible, urinary nitrogen accounted for the majority of total nitrogen excretion. Differences in nitrogen and total amino acid intake and the amount of nitrogen absorbed were due to differences in dietary crude protein. Nitrogen retention was similar to values reported in the literature for domestic cats.

Based on some of the previous studies, it appears as though raw protein sources are highly digestible, but these studies do not provide information about availability of the nitrogen or the amino acids from these protein sources. With respect to cats, taurine is one amino acid of concern because the consequences of a deficiency are frequently fatal. The taurine content in animal proteins can vary significantly, with muscle generally containing less taurine than organ meats.[10] A recent survey of commercial raw diets intended to be fed to captive exotic cats found that some contained taurine concentrations lower than 0.1%.[11] Cooking also influences taurine concentrations, and it can be lost to a significant extent when using cooking methods that expose proteins to water, thereby leaching the taurine from the food.[10] These findings imply that if one doesn't cook the protein source, taurine deficiency is less of a concern; however, the literature does not support this thinking. Taurine deficiency has been recognized in cats consuming home-prepared diets using raw protein. One research update reported dilated cardiomyopathy associated with taurine deficiency in a group of growing cats fed a diet consisting solely of whole ground raw rabbit.[12] Cats were fed either whole, ground rabbit or a commercial kibble diet that had passed AAFCO feeding trials for growth. Rabbits were selected over mice for ease of processing and in places where rabbits are abundant, feral cats are known to prefer them as prey.[13] The growth curves of cats on both diets were identical, indicating the raw rabbit diet supported normal growth. Coat quality was better (by subjective assessment) and stool quantity smaller (with less water) in the cats that were consuming the raw rabbit diet. However, the reason(s) for the differences in stool consistency of the respective diets is unknown. The investigators could find no relationship between the type of diet consumed and: 1) the rate of growth, 2) degree of inflammation in the tissue lining the intestinal tract, or 3) the numbers of bacteria in the upper small intestine. After consuming the raw rabbit diet for 10 months one of the cats died from dilated cardiomyopathy and was determined to be taurine deficient. Moreover, 70% of the remaining cats consuming the raw rabbit diet, which appeared outwardly healthy, also had heart muscle

changes compatible with taurine deficiency. For the remaining three months of the study, the raw rabbit diet was supplemented with taurine and blood taurine concentrations returned to normal. The investigators concluded there were no other significant benefits to feeding the raw rabbit diet, even when supplemented with taurine compared to a traditional feline kibble. A second study evaluated plasma taurine concentrations in sand cats (*Felis margarita*) fed either a commercial feline kibble or a raw, horsemeat and meat by-product based diet.[14] Despite a 15% increase in digestibility and a 40% increase in taurine content compared to the kibble diet, cats consuming the raw food diet had significantly lower plasma taurine concentrations. Although the plasma taurine concentrations were not below the point at which clinical taurine deficiency would be seen, they were reduced by approximately 25% during the 12 day study period. Arguably a crude estimate at best, but if one were to project the continued rate of decline, plasma taurine would fall below the concentration where the clinical signs of taurine deficiency are frequently noted at approximately day 20 of raw food consumption. These effects would likely be more pronounced under the conditions of a more demanding life stage than maintenance, such as during growth or reproduction.

The exact mechanism of how raw diets can potentiate taurine deficiency is unknown at this time. The amount of taurine available to the cat from its diet is dependent upon a number of factors including the quality and quantity of dietary protein, as well as how that protein is processed.[15–18] These factors in turn influence gastrointestinal microbial numbers and/or species that can cause taurine loss by accelerating turnover of bile acids conjugated with taurine and decrease recycling of taurine by the enterohepatic route. These factors may influence changes in bacterial populations that favor those that degrade taurine. One study supports that even the amount of protein in the diet can influence feline bacterial populations.[19] Adult cats fed a medium protein (34.34% crude protein) extruded diet had higher concentrations of fecal *Bifidobacterium* populations and lower concentrations of *Clostridium perfringens* compared to cats consuming a high protein diet (52.88% crude protein). Although a second study by the same group did not see any effect in cats fed either a raw horse or beef-based diet on *E. coli, Bifidobacterium, Clostridium perfringens* or *Lactobacillus* species.[7] One rationale provided for the different findings was that the second study reported results on a dry weight basis compared to the earlier study where results were reported on a wet weight basis. This same group also suggested that more sensitive techniques may be required to further differentiate any dietary effects and how one might interpret these findings with respect to taurine availability is unknown. In

addition to these factors, low levels of vitamin E in a diet can cause meat to lose taurine when it is processed and ground.[20]

Oral Health

One of the many claims made by those who support a raw meat and bone feeding method is that feeding of raw bones is beneficial to the oral and dental health of the animal. Dental disease, including calculus, gingivitis and periodontitis, is considered to be one of the most common diseases diagnosed in dogs and cats.[21,22] Periodontal disease is of most concern as it can result in tooth loss. Current research supports that dogs and cats consuming commercial diets are at risk for eventually developing periodontal disease. It appears that softer diets (including canned, semi-moist or even home-prepared foods) are even worse than dry diets.[23,24] The supplementation of an oxtail to a commercial diet feeding regime appeared to slow down the development of periodontal disease.[25] So one might surmise from these findings that the consumption of a more "natural" diet, such as a BARF diet, might be beneficial in the prevention of dental disease, particularly periodontitis. However, current research doesn't necessarily support that thinking. One study in African wild dogs, whose diet is largely small antelope, found that 41% of the skulls examined had evidence of periodontitis, while only 2 had dental calculi.[26] A study in feral cats from Marion Island, where the main source of food is birds, reported evidence of periodontitis in approximately 62% of cats while only 9% had calculus.[27] It has been speculated that the highly specific diet of sea birds favored the development of periodontal disease in these cats secondary to gum trauma induced by the sharp bones in the carcass.[27,28] A smaller study in Australia established that the prevalence of oral disease was no different in cats fed a commercial diet versus those whose diet was mainly small prey.[29] So while a natural diet of raw meat and bones may reduce dental calculi, it does not appear to protect against periodontal disease.

Zoonotic Concerns

The veterinarian's job is not only to care for the health and well-being of their animal patients but also those who are the guardians of these pets as well. From this perspective concerns regarding pathogenic bacteria in raw diets and subsequent environmental contamination are paramount. There are numerous publications documenting pathogenic organisms in raw meat and raw food diets. A few that are particularly relevant to the veterinary practitioner or are very recent are highlighted below.

There is growing evidence to support these concerns. Evidence for transmission of food-borne pathogenic bacteria from dogs to

humans exists.[30–32] In Alberta, Canada, 9 of 12 case patients with *S. infantis* infection had been exposed to pig ear treats and *S. infantis* was isolated from a pig ear treat collected from one of the case patients. The isolate recovered from the pig ear was indistinguishable from *S. infantis* isolates recovered from fecal samples obtained from humans with salmonellosis.[33,34]

Potential human pathogens have been isolated in both commercial and home-prepared raw diets.[1,35–39] Animals fed raw diets have been reported to shed the same viable organisms that were isolated in their food.[40] There have been reports of racing greyhounds, sled dogs, guard dogs and cats with *Salmonella* infections due to consumption of contaminated raw meat.[41–45] A recent publication supports testing fecal samples on more than one occasion if one is suspect of contamination in an animal's feces.[39]

Arguably, while many animals never become ill while consuming raw food diets, they still pose a risk to humans and other animals through environmental shedding.[34,40] Individuals preparing raw diets are also at risk by handling contaminated meat and egg products. Those greatest at risk are the very young and old, in addition to the immunocompromised.

In some cases, despite understanding all of the risks, an owner may wish to continue to feed a raw diet. Practitioners should refer their clients to the FDA's website and go over safe handling and preparation of food, as well as cleaning practices. It has been shown that simple routine washing may not be enough to eliminate potential food-borne pathogens in the pet's food bowl and environment.[46] It is also important to document any discussions one has on this subject, as it may have legal ramifications.[47]

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Andrea J. Fascetti, VMD, PhD, DACVIM (Small Animal Internal Medicine), DACVN
University of California, Davis
Davis, CA, USA

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