Feeding Raw Diets to Family Pets

Rebecca L. Remillard, Ph.D., D.V.M., ACVN Diplomate
Angell Animal Medical Center
Boston, MA

Any discussion about feeding raw meat and eggs to pets seems to easily glide into other tangential topics such as "natural" diets, supplements, digestive enzymes, GI physiology, immunity, and ultimately evolution. This article will be confined to the two most important health issues concerning pet owners and veterinarians: food safety and nutritional integrity.

Part 1: Food Safety

Fact: Our meat and egg food supply is contaminated with microbes.
Meat from healthy animals becomes contaminated at slaughter. The meat surfaces become infected with microorganisms we associate with food poisoning during the handling, packaging, processing, storage and transportation of the products. [1,2,3] These organisms reside within the gastrointestinal tract or feathers of domestic animals. The meat product is contaminated between slaughter and the store display case. Herein lies a fundamental difference between feeding store bought meat and the "fresh kill" raw meat consumed by wild carnivores and omnivores.

The interior and exterior of the egg harbor salmonella as the organism is known to be residing with the hen. Until recently, Salmonella was associated with cracked eggs or eggs dirty with fecal matter and were controlled by cleaning procedures implemented in the egg industry. In 1988, the CDC[a] reported new cases of salmonella associated with disinfected Grade A eggs. It was then determined that the eggs were contaminated during ovulation within the hen, and thus were contaminated with the bacteria before the shell was formed. [4]

- Within the genus Salmonella, there are 5 species, 7 subspecies (spp) and an unknown number of strains causing a variety of gastro-intestinal (GI) signs.
- Salmonellosis from any source is an infection estimated to cause over 1 million cases of illness and 500 deaths in the U.S. annually.
- In 2001, the CDC estimated that 118,000 illnesses were caused by the consumption of Salmonella contaminated eggs.

Approximately one third of the poultry sold for human consumption has tested positive for Salmonella.[5] Although many procedures have been regulated into the meat and poultry industry to reduce the level of contamination, none the less, bacteria persist and we should consider all products contaminated. Some bacteria produce meat spoilage while others are pathogenic (cause disease) in people and pets.

Clarification on USDA meat inspection and grades:

- Under the Federal Meat Inspection Act, all meat and poultry products for human consumption and interstate commerce are subject to mandatory USDA inspection. There is no nutritional advantage to feeding a pet food touting the fact that they use

[a] Center of Disease Control

"100% USDA inspected" ingredients from a "USDA-inspected facility" and ingredients are not USDA "approved".

- Under the same Act, all cattle, sheep, swine, goats and horses undergo a mandatory antemortem (before death) inspection on the day of slaughter. Animals showing symptoms of disease are set apart and slaughtered separately (4D meat). Meat product determined to be fit for human consumption is labeled "Inspected and passed". Carcasses or parts of carcasses not fit for human consumption are labeled "Inspected and condemned".[6]
- The Meat Inspectors are Civil Service employees and the Federal government bares the cost of having food inspectors in the plant, so inspectors are independent of the plant management.
- Meat products are graded by the USDA based on palatability, yields and other economically important traits (appearance, fat content, edible proportions, etc). There is no "human grade ingredients" and should hope there never will be.

Fact: Raw meat diets have been on the market for many years and used by zoos, mink farms, dog racing facilities, and other professional establishments.

The FDA has presumed these purchasers were aware of the potential risk for using such products, from both a food safety and nutritional deficiency perspective and could take measures to mitigate those risks.[7,8] However, this relatively new trend of pet owners who may not be as aware of the potential for harm feeding raw meat diets to companion animals has raised concerns. The diets prepared by pet owners and companies selling raw diet product that may be contaminated with micro-organisms most often associated with food poisoning pose an increased public health risk. Raw meat consumed by household pets could be from various sources (fed intentionally, from hunting or the scavenging of garbage or carrion). Raw meat diets prepared by pet owners fed to dogs and cats have been documented to contain pathogenic Yersinia enterocolitica 4/O:3, Salmonella spp and E coli O157:H7.[9,10,11] Twenty-one commercially available raw meat diets (beef, lamb, chicken and turkey) sampled over a 4 month period from the marketplace were cultured for non-type specific E.coli, Salmonella and Campylobacter. No samples cultured positive for Campylobacter, however, E.coli was cultured from all and ten samples cultured positive for S. enterica. Ninety-nine percent of samples were aerobic bacteria positive and 79% were gram negative bacteria positive.[12] Hence the FDA has drafted guidelines for companies selling such products to pet owners.[13] One options for pet owners making a raw meat homemade diet would be to feed whole (not ground) meat that has a braised surface and then fed to the pet rare. Most of the food poisoning organisms are on the surface of the meat and searing the surface would significantly reduce the potential bacterial dose while preserving any advantages to feeding raw meat in the interior of the slab.

Fact: Dogs and cats fed contaminated raw meat diets shed viable organisms in their feces.

There is now evidence to validate this public health risk. Pets fed homemade raw meat diets have been documented to shed viable organisms in their feces. The presence of Salmonella spp. was isolated from 80% of the BARF diet samples and in 30% of the stool samples from dogs consuming those diets.[14] Greyhounds fed raw meats diets have been documented to shed the same subspecie of salmonella in their feces as that found in their diets.[15] Sled dogs have been documented to be subclinical shedders of Salmonella spp while eating a contaminated diet.[16] Campylobacter spp infected dogs excrete organisms in their feces yet can remain clinically normal.[17] However, serovars of Campylobacter isolated from the diarrhea of dogs was the same

as that isolated from the poultry carcasses fed to the dogs.[18] Therefore, pets fed contaminated raw meat diets are a source of household environmental contamination to people and other pets.

Fact: Food borne organisms fed to pets can infect people.
Feeding infected raw diets increases the likelihood of infection to others (people, children and other pets) in the household. Human infections of food borne pathogenic organisms may occur when handling contaminated meat and egg products as well products intended for pets (bones, pig ears and treats).[19] Individuals who clean the cat's litter box or pick up their dog's stool should consider the feces contaminated with viable pathogenic microbes. Extra precautions should be taken when persons (or other pets) in the household have immune suppressive diseases (HIV, Felv or FIV)[b] infections, under going chemotherapy or using anti-inflammatory medications. Household transmission of food borne pathogenic organisms from dogs to people has been documented.[20] Additional caution should be emphasized when there are young children in the household as fecal-oral contamination is possible.

- Case example: A 4-month-old male infant manifested with chronic diarrhea had Salmonella virchow isolated from his stool. The pathogen was repeatedly isolated from the infant over one month despite three regimens of treatment with antibiotics, to which the isolate was known to be sensitive. Three household dogs were kept in his home and S. virchow was isolated from two of them. The infant was admitted to hospital and was treated with antibiotic, and then the pathogen was finally eliminated from the infant. Antibiotic sensitivity and PFGE pattern of an isolate from the infant was identical to those of the isolates obtained from the dogs.[21]

Veterinarians are trained in zoonotic diseases (those shared between animals and people) and have a responsibility to inform the pet owner who wants to feed a raw meat or egg diet of the potential health dangers. Food safety practices when handling the food, feeding dish and feces should be emphasized and the need for good personal hygiene reinforced.

Fact: Pets infected with food borne organisms can be sick.
It has been stated without supporting evidence that dogs and cats have "stronger stomachs, that food borne pathogenic organisms are normal inhabitants of their gastrointestinal tract and therefore are not made sick by these organisms". The veterinary literature offers evidence to the contrary.

Dogs, cats and people have remarkably similar gastro-intestinal morphology and physiology, and all 3 species get sick with very similar clinical signs as a result of a pathogenic infection of food borne organisms.[22] Only 36% of healthy dogs and 17% of healthy cats harbor low levels of pathogenic salmonellae which indicate that most household dogs and cats would not "naturally" be harboring these pathogenic subspecies.[23] Dogs and cats infected with an effective dose of food-borne pathogens do have gastrointestinal signs similar to people.[24] There are many different subspecies of bacteria with varying degrees of pathogenicity. The severity of clinical signs is related to the dose of microbes or toxin ingested, and the condition of the host.

[b]Human immunodeficiency virus (HIV); Feline leukemia virus (Felv); Feline immunodeficiency virus (FIV).

A family pet presented to a local veterinarian for intermittent episodes of vomiting or diarrhea would initially treat the case symptomatically and not send samples for bacterial culture and identification.[22] Hence, in most, if not all, cases of food poisoning in the family pet are not diagnosed and go unreported due to a low level of suspicion and financial restraints. Even upon the death of a pet, rarely is an attempt to isolate the causative agent made although it is more likely when the owner suspects a malicious poisoning. Polymerase chain reaction (PCR) amplification and identification of a pathogenic organism is not within the reach of veterinary practitioners or owners financial commitments. Hence, it is highly unlikely that local veterinary practitioners are going to make a specific diagnosis of food poisoning, identify the organism and then the source.

However, Salmonella, E. coli and Campylobacter infections in people are notifiable diseases, i.e., physicians and health laboratories are required to report cases (even an individual case) to local health departments in accordance with procedures established by each State.[4] Veterinarians who recommend the feeding of raw meat or eggs without giving full disclosure of the risks and precautions may face serious legal ramifications.[25, 26]

Fact: Food borne infections cause illness in pets.
This is a sampling and should by no means be considered a complete list of possibilities.

- Salmonella gastroenteritis and septicemia were diagnosed in two cats presented for necropsy. Both cats resided in the same household and were fed a home-prepared, raw meat-based diet. Salmonella was isolated from multiple organs in both cats and from samples of raw beef incorporated into the diet fed to one of the cats. Subtyping of the bacterial isolates yielded S. newport from one cat and from the diet it had been fed.[27]
- Infections of Neorickettsia, also known as salmon poisoning can occur when raw salmon infected with a fluke is fed to dogs. The clinical signs become serious within days and if not treated promptly, mortality can be greater than 50%.[28]
- The syndrome “Alabama rot” in Greyhounds fed raw meat diets is closely associated with an E. coli infection because this organism is known to produce a toxin that causes large areas of skin to ulcerate.[29]
- Food-borne illnesses in dogs may also result from viruses (pseudorabies) and mycobacterium (tuberculosis) infections particularly when fed raw pork or meat from wildlife species (bear, elk, rabbits and aquatic mammals like beaver and muskrats).[25]
- There are larval forms of parasites embedded in the skeletal muscles of beef, sheep, goats and swine as part of their normal life cycles. These parasites can be killed by cooking the meat thoroughly.
    - Case example: A giant breed dog developed neurological problems that were traced to the aberrant migration of a bovine parasite. The dog was fed a raw beef diet. The larval form of the parasite, not in its normal host, had therefore an atypical migration and came to rest in the dog’s brain. It was identified using an MRI scan. The aberrant larva was killed using high doses of a common anti-parasitic drug, but the dog had permanent neurological deficients.[30]
    - Case example: Mesocestoides eggs were identified in a routine stool check on an apparently healthy 5 month old poodle. This tapeworm egg was of particular interest because the larvae borrow through the intestinal wall to invade the peritoneal cavity and there asexual proliferates causing a severe effusive peritonitis if not treated.[31]

Secondary intermediate hosts are reptiles, amphibians, rodents and birds. The only exposure this puppy had to a secondary intermediate host was that she was fed a raw frozen chicken pet food product (MSPCA Angell Animal Medical Center case files, 2004).

- Dogs fed raw fish have been infected with parasites normally found in fish such as an intestinal tapeworm, a trematode worm that infects the bile and pancreatic ducts, and the giant kidney worm.[25]

In summary, we know our meat supply is contaminated to a varying extent and so all sources of raw meat ("fit for", "unfit for" human consumption and wildlife) should be presumed infected until cooked.

Correction of "popular" notions:

- Grape seed extract itself does not kill micro-organisms and render the meat safe. "The potent as well as nearly universal antimicrobial activity being attributed to grapefruit seed extract is merely due to the synthetic preservative agents contained within." Natural products do not appear to have antimicrobial activity.[32]
- Freezing does not kill all organisms and render the meat safe. Evidence: viable E. coli cultures are stored at -70^{o}C, and the Mesocestoides eggs were from a frozen product.
- Freeze-drying also does not kill all organisms and render the meat safe. Evidence: probiotic products are stored and transported in a freeze-dried form and then warmed and re-constituted at the point of use as viable organisms.

There is clear evidence that pets consuming diets infected with pathogenic organisms can be clinical and subclinical shedders of viable organisms. New pet owners feeding a raw meat diet because they were unduly persuaded by the breeder, rather than selecting the diet on their own, admit their pet often has intermittent soft stools or diarrhea. There is evidence that transmission of pathogenic organisms from pets to people does occur in the household and we know that these organisms cause disease in people. Hence, there are health risks to feeding a raw diet to pets. The raw meat advocates do not deny but downplay the potential health risks. One must then balance the risk to benefit ratio. Are there nutritional benefits to feeding raw vs. cooked food?

Part 2: Nutritional integrity

Background:
Consumed raw, rare or cooked, the nutrient requirements of dogs and cats are well established and it has been several decades since any new nutrient has been recognized as essential to life. The term complete indicates the diet contains all of the nutrients known to prevent a deficiency and be essential for life. There are 36 essential nutrients for the dog and 38 for the cat. These nutrients either cannot be synthesized at all in the body or their rates of synthesis are not sufficient to meet total body demand. There is a small group of conditionally essential nutrients. Under certain conditions of disease or stress, a nutrient has been documented to be required in greater concentrations than under routine conditions of health, and that documented "need" decreases when health returns. An example of such a nutrient is glutamine.

Different nutrients are required in different amounts as some nutrients are stored during times of excess intake while others have no storage and must be supplied more frequently. Expression of nutrient requirements in animals uses a system of measure different than that used in human nutrition. Nutrient requirements are expressed per unit of body weight (gram/lb BW) which frustrates owners attempting to balance their pet's diet. Additionally, the requirements are not linear but curvilinear with body weight, in that a pound of mouse requires more calories and nutrients than a pound of elephant. The units of measure are not particularly important as long as they are well described and hence others can make the mathematical conversion.

Nutritional requirements may also be expressed per unit of time (gram/lb BW/day). Conventionally, the research data has been to present requirements in concordance with a circadian rhythm and hence "per day" has been commonly used. However, one may use any unit of time (per hour, per week or longer) if desired but again the time unit must specified to be universally understood. The nutrients stored in the body (such vitamin A) have stated daily requirements that on average maintain those stores, and clearly if a day should pass without an intake of vitamin A, the body would draw from those stores. Subsequently, on a day when intake exceeded the need, storage sites would be replenished. The recommended daily intake is suggested to prevent deficiency, toxicity and maintain adequate stores. Nutrients for which there are no known or very little body storage, the daily recommended intake is again an on average suggestion to prevent a deficiency.

There are consequences from feeding an unbalanced diet long-term. It may take weeks, months or years to see a nutritional deficiency or toxicity depending on which nutrient and the degree of imbalance. Even then it will most likely not be recognized as such. Nutrient imbalances affect a wide variety of body systems and do not have classic or specific presentations as is commonly believed. For example, anemia may be the result of a deficiency in one or several key vitamins or trace minerals or a combination thereof, or may not at all be related to diet intake. Unfortunately, there are no accurate tests of "nutritional status". Although one can certainly buy urine, blood or hair analyses, these are neither accurate nor specific measures. Veterinarians may perform a few routine overall evaluations of red and white blood cells, serum proteins and electrolytes as part of an annual checkup. However, these tests are only very broad overall indications of nutritional status and not specific to the balance of any nutrient.

The most useful unit of nutritional intake however, is per calorie consumed (gram/kcal) as this system accounts for both body weight and time changes. A balanced diet has nutrient concentrations in proportion to the energy density of the whole diet. Only three nutrients drive the consumption of food, a deficiency of water, calories or sodium. Animals normally stop eating when the caloric intake matches their current need. A balanced diet therefore, contains nutrients such that when the animal is satiated, has fulfilled their caloric need, and stops eating, all other essential nutrient needs (those that do not drive appetite) have been met as well.

Ideology: Feeding a consistently balanced diet contributes to optimal health.
As in human nutrition, a body needs nutrients, from ingredients, such as protein, fat and fiber to function. Ingredients are simply vehicles that deliver a mixture of nutrients to the body. No single food or food group can provide all the nutrients needed in proper proportions. When choosing a diet, it's the total or final balance of nutrients (not the ingredients) that is important.

Most pet owners request information on the "best" diet that promotes "optimal" health. Unfortunately, at this time, we do not know the exact nutrient concentration that ensures optimal health. We do know the average dietary concentrations that prevent deficiencies and toxicities. After a hundred years of research, we believe that optimal health lies within these ranges however the span between deficiency and toxicity for a nutrient ranges between be 5 and 40 fold but therein must lay the optimum. It would logically follow that feeding a balanced diet that consistently met the recommended nutrient intakes (unit per calorie) would be more conducive to optimal health than feeding a diet with wide variations and fluctuations in nutrient content over the course of weeks.

One may ask how did canine ancestors survive, or how do today's wild counterparts and feral dogs survive on a raw diet not adhering to AAFCO[c] or NRC[d] nutrient profiles? The answer is not very well and not very long. Their goal in life is to fulfill their evolutionary duty of procreation which can be accomplished in less than two years. They are opportunistic scavengers striving to live long enough to reproduce (aka: specie survival). Hence, their diet need only be good enough on average to achieve a goal far less than that of long life and optimal health.

Clarification on the term 'carnivore':

- The disagreement over whether the dog is a carnivore or an omnivore most probably originates with a misunderstanding over the term carnivore as a type of feeding behavior vs. a taxonomic classification.
- There are three feeding behaviors: carnivore, omnivore and herbivore. In this definition, carnivore does not mean the animal "has to eat meat", but rather its nutritional requirements cannot be entirely met from eating only plants, and animal products must comprise some part of the diet. Domestic dogs can meet all of their nutrient needs consuming a vegetarian and even vegan diet. This is no longer debatable.
- In the phylogenic scheme, the order Carnivora contains more than 260 species and all three feeding behaviors are represented therein. Most notably, herbivores such as the

[c] American Association of Feed Control Officials
[d] National Research Council

panda are included in the order Carnivora. Hence, the domestic dog is in the order Carnivora and has a feeding behavior best described as an omnivore.

The family pet has moved from the backyard dog house or barn cat to our kitchens and bedrooms. Pet owners expect their household pets to live well beyond two years and repeatedly request to know how that may be accomplished. Veterinarians will respond to that question making references to the advantages of a balanced diet and the protection that comes from vaccinations, parasite control, regular medial care and safe harbor from trauma. Household pets are living longer and now dying of diseases associated with the aging process such as organ dysfunction and cancer – a new frontier under exploration. One definition of aging is the decreased ability to successfully defeat life's biological challenges and to recover well. The expectation that a pet will live for 10 to 20 yrs places great demands on the diet to provide all known essential nutrients on a consistent basis to meet every biological challenge; allowing none to gain a foothold in the body.

Conversely, a diet providing an erratic or variable supply of nutrients (unit per calorie) intuitively could not be conducive of optimal health and longevity. Such a diet philosophy necessitates that there will be times of excess and times of deficiency (feast or famine). There will be moments when an imbalanced diet will not supply all essential nutrients to destroy an offending organism or detect an emerging precancerous cell. Having an essential nutrient needed to fight off an infection supplied one week after the initial invasion of a virus would not be considered optimal timing by most owners. Most clients seeking the optimal diet want more assurance than to simply hope to "achieve balance over a one to three week period" in the diet fed to their pet. Today's pet owners want a higher degree of precision and level of competency in the diets fed to their pets than to be told to feed a variety of all food groups over the course of a few weeks plus some bones. They demand to know all that is available about achieving optimal health and want that for their pets as well as for themselves. Although that answer cannot be fully described at this time, it would logically follow that supplying all known essential nutrients on a consistent basis within the recognized minimums and maximums is more likely to provide optimal health than feeding a diet with a variable, erratic and unreliable nutrient content.

Fact: Some nutrients are lost during cooking but are irrelevant.
There is truth in saying that some nutrients are "lost" when food is cooked however when placed into its proper perspective; the losses are small and individual ingredient losses are insignificant to a properly balanced diet.

- An analysis conducted by Hoffmann LaRoche, a large supplier of vitamins, eloquently demonstrated that vitamin loss during commercial production of pet foods was minimal. Thirteen vitamins were assessed in dog and cat, canned and extruded commercial pet food products before and after "processing". [33] Contrary to popular rhetoric, most of the vitamin concentrations remained unchanged during processing. The only vitamin that was 100% lost between pre and post processing was vitamin C which is irrelevant given the dog and cat make ample quantities of this vitamin from glucose in their liver.[e] The

[e] No cases of "scurvy" have been reported in the dog or cat even in prolonged end stage liver disease where remaining functional mass is questionable.

next greatest loss was 50% of thiamin in the canning process. Once the rate of loss is known, additional sources can be appropriately added pre-processing to account for the expected losses and more, if necessary, such that the final product is complete and balanced or fortified.

- In comparing the nutrient profile of 100 grams raw beef vs. 100 grams of the same cut cooked (broiled) from the USDA National Nutrient Database,[34] there is on average less than a 5% loss in nutrients on a dry matter basis after cooking. Some nutrients are increased in concentration while others are decreased.
  - Vitamins B_{12}, B_6, thiamin and pantothenic suffered the greatest percent losses (28-42%) however; one does not use meat as a major supplier of vitamins to the diet.
  - The meat portion is expected to contribute protein and essential amino acids to the diet. Less than 15% of the protein and essential amino acids were lost during cooking which can easily be accounted for in a re-formulation.
  - No amount of cooking less than 1100^{o}F will destroy a mineral, however, some mineral concentrations decreased (total ash, zinc and iron) probably due to the physical losses in the pan. In fact, trace minerals (copper and selenium) were increased while others are likely to be more bioavailable given the collagen matrix is broken down by heat, water and time.
- The nutritional alterations in the food product before and after cooking are so minimal; it makes no practical difference in the recipe even when balancing the diet with a sophisticated computerized assimilation program.[f] The recipe given to the owner can use the raw or cooked version of the same amount of meat interchangeably because the difference in nutrients "lost" from the meat during cooking are so small and the changes are irrelevant.
- With reference to commercially made complete pet foods, the argument is moot because the final product is guaranteed to meet a certain nutritional standard. If the thiamin content of the meat is 50% less after cooking, then thiamin from a different source must be increased to cover the expected loss. Again the final product is complete and balanced, regardless of what losses may have occurred within individual ingredients.
  - Pet food manufacturers have been portrayed as purveyors of an uncontrollable bad event called "processing". Quite the contrary. Anyone who has been inside a pet food plant could not help but be impressed with high degree of finite control and technological sophistication they maintain over the making of their products. Unfortunately very few of the industries' critics have actually visited a U.S. plant, and extrapolating from experiences in other countries is seriously flawed.

Correction of "popular" misstatements:

- The temperature range used in making extruded or dry kibble is between 80 and 200^{o}C or 175 to 390^{o}F for less than 5 minutes. In canning pet foods, a core temperature in the can of 116^{o}C or 240^{o}F is achieved for 60 to 90 minutes.[35]
- These temperatures and times are less than or comparable to cooking temperatures used in the home. Therefore, it is misleading to say that "extreme heat [is] common to the preparation of commercial pet foods"[36] when in fact the temperature and times are comparable to baking a casserole dish at home.

[f] Mixit 2 Plus. Agricultural Software Consultants, San Diego, CA. 2005.

- There is no demonstrable difference in the nutritional profile of meat from raised by conventional methods vs. those raised "organically". The nutrient profile of chicken meat from a conventional grower is not different from the "free range" chickens. There may be other differences between the two methods but it is not nutritional.

Cooking foods improves food safety as it more reliably kills pathogenic bacteria, viruses and parasites, and increases diet digestibility when plant and connective tissue are broken down. To my knowledge there are no case reports of documented nutritional deficiencies due to cooking the diet. There are some nutrients lost during cooking; however, the quantities are small and insignificant to the overall nutritional profile of the diet if the formulation has been properly balanced.

Fact: Homemade diets may or may not be complete and balanced.
Homemade diets can be complete and balanced when properly formulated and prepared, and consistency is debatable. Based on what little published data exists, there is evidence to suspect that pets fed homemade recipe are not receiving a complete and balanced diet. Owners need directions in providing a balanced nutrient intake. Having raised a few children is not proof of concept that they can provide optimal nutrition to their pets (or their children). There is no food product designed to be complete and balanced for people, hence we were taught to strive for variety in the hopes of randomly hitting upon the optimal diet 'on average'. However, there is ample evidence in the medical literature that we in the U.S. are not providing ourselves even a rough approximation of an optimal diet.

- 73% of U.S. children eat an unhealthy diet high in fat and deficient in calcium. *National Institute of Child Health and Human Development 2002.*
- 40% of people who rated their diet as 'good to excellent' had 'poor' diets when reviewed by a nutritionist. *Tufts Health & Nutrition 2002.*
- 50 million Americans (20%) were obese in 2001. *CDC.*
- Vitamin D insufficiency among free-living healthy young adults. *Am J Med 2002.*

Veterinarians receive on average about 4 hrs of animal nutrition of which maybe half is canine and feline.[37] Ninety percent of the homemade diets prescribed by veterinarians for the control of food allergy skin disease were not balanced for long term maintenance.[38] Popular selling recipe books written by veterinarians offer little to no assurances recipes are complete or balanced.[39,40,41,42,43] Not one of the many publications sold to pet owners recommending homemade recipes and giving nutritional advice has been authored by an animal or veterinary nutritionist, although a few publications have asked for nutritional oversight by a qualified nutritionist. Clearly anyone can publish a pet nutrition book; the public will pay the royalties while the pets pay the ultimate price.

Dietary recipes or instructions published by lay writers and even veterinarians do not sufficiently describe the ingredients to ensure a balanced diet. Most often vitamins and trace mineral are imbalanced. A company selling a frozen raw meat product [www.shaggypaws.com] informs the owner that they "can decide which oils, trace minerals, vitamins and other supplements should be added to your pet's diet." It is quite probably that no qualified person is checking the nutritional integrity for the pets on the receiving end of this product. Most recipes carry a "catch-all" statement for the owner to feed a "complete multiple vitamin-mineral supplement" and to

feed the supplement "according to the label instructions". However, there is no such veterinary product(s) available on the market and the owner is left in the void. "Healthy powder", a mixture of yeast, lecithin, kelp, bone meal and vitamin C, has been touted presumably as a vitamin and trace mineral supplement, however, no nutritional analysis can be found.[39] A computer assimilation[f] or lab analysis of the mixture is not realistic due to the great variability in the yeast, lecithin and kelp ingredients, and exact ingredient information is not described.

Here follows 4 case examples of owners attempting to follow a prescribed recipe but calcium deficiency was documented.

- A 3 month old American Bulldog puppy fed a homemade diet presented for generalized weakness, inability to stand on his own, and very sore left hind leg. Radiographs reveal generalized bone decalcification, thin cortices, and a folding fracture of left femur. Diagnosis is classic calcium deficiency [VIN Clin Nutrition 2002].[30]
- A 15 wk old English Mastiff presented for stunted growth, 4-legged lameness, short stride, difficulty moving and a large head disproportionate to rest of body. The "BARF" diet was fed to the whole kennel. Diagnosis is chondroepiphysis with incomplete ossification due to a calcium deficiency [VIN Diag Imaging 2000].[30]
- A 4.5 month old male Newfoundland dog fed a modified "BARF" diet per the breeder's instructions but the owner wanted a second opinion on the nutritional integrity. Analysis of breeder's diet revealed 0.17% calcium and 1.31% phosphorous on a dry matter basis with an inverse Ca:Phos ratio. AAFCO recommended minimum is 1.0% calcium and 0.8% phosphorous. The breeder's diet was also deficient in Vitamin D with only 7.5 IU/kg while 500 IU/kg is the AAFCO minimum recommended [MSPCA Angell Animal Medical Center case files, 2004].
- A 3 yr CM mixed breed dog was fed a diet described on the internet [www.patmckay.com 8/5/02]. Owner indicated the "supplement costs are killing me at about $100 per month" and asked for a second opinion. Although the owner was buying the calcium supplement at $1.61 per day prescribed in the recipe and feeding it according to label directions, the diet contained only 25% of the AAFCO recommended calcium and 41% of the phosphorous, and the diet had an inverse Ca:Phos ratio. After balancing the diet with more concentrated and locally available supplements, the monthly supplement cost was reduced to $15.[44]

Reality check on feeding of bones:

- About 10-30% of a ground calcium supplement may be bioavailable and therefore the bioavailability of a large hunk of bone in the gut must be questioned. Bones (cooked or raw) are recommended in some recipes as the only source of calcium yet clinical calcium deficiency has been documented in puppies eating these diets.
- There is a serious problem if a bone should obstruct and perforate the esophagus or small intestine. Veterinary surgeons do remove bones from the esophagus and small intestine of dogs, and to deny this possibility is foolish. The incidence of obstruction with bones is small, but is life threatening and an expensive emergency surgery. GI obstruction due to bones does create a "short bowel syndrome" when the segment of bowel removed approaches 80% of the total available bowel. Such cases are difficult to reconcile for owners who were following the feeding instructions written by another veterinarian [MSPCA Angell Animal Medical Center case files].

- There have been cases of dogs presented for constipation, but on rectal palpation were found to have a normal stool with many small sharp bones fragments that caused pain so the dogs resisted defecation [MSPCA Angell Animal Medical Center case files].
- Bones consumed by dogs do cause morbidity and morality, and bioavailability as a source of minerals is low, so one has to weigh these risks against the 'benefits". The potential downsides can be eliminated by feeding bone meal and oral health could be achieved through other safer means.

Many dogs are fed homemade diets and show no ill-effects. In some cases, a homemade diet formulated specifically for that pet is the only or best nutritional option. I formulate several hundred homemade diets annually for clients for a wide variety of reasons but medical is the most common. A patient-client-doctor relationship is established and each client is made aware of the risks and understands their responsibility in making the pet's diet. They are given feeding guidelines specific for their particular pet and each recipe is accompanied with 5 to 8 pages of instructions including how to monitor the pet and recommended diet rechecks. Owners are not charged for follow-up questions which encourages them to communicate often and on every detail if needed. However, even under these circumstances, it is not unusual to discover in follow-up visits instances where owners have elected to make substitutions or omissions that seriously imbalances the diet.

There are other examples of nutrient imbalances in the homemade diets made by well intentioned owners.[10,45,46] Regardless of how the authors intended their recipes to be made or fed, in future studies assessing the nutritional integrity of homemade diets, the nutrient analysis should be performed on the actual food made by the owner and fed to the pet because that is our actual point of concern.[11, 47] The food fed to the pet is the accumulation of all the errors of deficiencies and excesses. Hence, feeding a cooked homemade diet decreases the public health risk, but nutritional integrity remains uncertain. And feeding a raw homemade diet does not ensure nutritional balance or decrease the public health risk.

Fact: Commercial raw diets may or may not be complete and balanced.
Manufacturers of raw food products make a wide variety of nutritional claims. Some products are sold complete and balanced with no need for other foods or supplements, while other raw food products must be mixed with other foods and supplements to be complete. And there are some sold as complete and balanced but recommend the mixing in of other foods. But why would that be necessary if the product is complete?

These raw meat diets (frozen or freeze-dried) are promoted as "fresh" or "natural" or said to contain "functional" foods or "unknown and yet to be discovered nutrients". These concepts are ill-defined and vague, have no scientific or demonstrable nutritional significance, and therefore are difficult to address in any meaningful discussion. It would appear they are promoting a feeding plan that has an "advantage" that they themselves cannot describe. "The mystery of good health and nutrition is locked within the fresh, raw foods provided by nature" claims one raw meat processor. Nutrition is not a locked mystery but a science and therefore amenable to exploration and verification using time tested methods of scientific investigation. Raw meat advocates might be correct in some form or another, but at this time, they have neither identified nor measured any nutritional advantage to feeding a raw meat product over any fully cooked pet food product. In the meantime, if their product is positioned as a "complete and balanced" diet,

they must substantiate that claim by conventional means (laboratory analysis or feeding trial) according to AAFCO guidelines. Those not making a complete and balance claim must carry an AAFCO statement indicating the product is for supplemental or intermittent use only.

These raw products (complete or incomplete) are sold frozen or freeze-dried and carry no claim to be pathogen free, in fact, recent work would strongly suggest handling them as if they were contaminated.[12] Freezing does not render the meat safe and maintaining the product frozen during transport is essential as partial thawing may allow organisms to proliferate thereby delivering a large dose of organisms or toxin at the first meal.

In summary:

- Feeding a raw homemade diet does not ensure nutritional balance or decrease the public health risk.
- Feeding a cooked homemade diet decreases the public health risk, but the nutritional balance remains debatable.
- Feeding a raw commercial diet may or may not be a complete and balanced diet, but if so, then it provides nutritional balance however the public health risk remains.
- Feeding a cooked commercial diet (in the U.S.) is likely to be a complete and balanced diet, and if so, then provides nutritional balance and decreases the public health risk.

In conclusion, given there has yet been a benefit demonstrated to feeding a raw diet over any dry or canned pet food, as measured by universally accepted scientific methods, the public health risk appears to be a significant downside with no nutritional upside. I would be most willing to review the data and reconsider my position when such becomes available.

References:

1 Atanassova V, Meindl A, Ring C. Prevalence of Staphylococcus aureus and staphylococcal enterotoxins in raw pork and uncooked smoked ham – a comparison of classical culturing detection and RFLP-PCR. Int. J. Food Microbiol. 68:105-113, 2001.

2 White DG, Zhao S, Sudler R, et al. The isolation of antibiotic-resistant Salmonella from retail ground meats. N. Engl. J. Med. 345:1147-1154, 2001.

3 Zhao C, Ge B, de Villena J, et al. Prevalence of Campylobacter spp., Escherichia coli, and Salmonella serovars in retail chicken, turkey, pork, and beef from the greater Washington, D.C., area. Appl. Environ. Microbiol. 2001;67: 5431-5436.

4 Federal Register: September 22, 2004 (Volume 69, Number 183). http://www.cfsan.fda.gov/~lrd/fr04922b.html

5 Bailey JS. Detection of Salmonella cells within 24 to 26 hours in poultry samples with the polymerase chain reaction BAX system. J Food Protect 1998;61:792-795.

6 Federal Meat Inspection Act. Title 21; Food and Drugs. Chapter 12; Meat Inspection. http://www.fda.gov/opacom/laws/meat.htm.

7 Chengappa MM, Staats J, Oberst RD, et al. Prevalence of Salmonella in raw meat used in diets of racing greyhounds. J. Vet. Diagn. Invest. 1993;5:372-377.

8 Machlik S. Raw risk. Petfood Industry 1999;41(4):56-57.

9 Fredriksson-Ahomaa M, Korte T, Korkeala H. Transmission of Yersinia enterocolitica 4/O:3 to pets via contaminated pork. Lett Appl Microbiol 2001;32[6]:375-378.

10 Joffe DJ, Schlesinger DP. Preliminary assessment of the risk of Salmonella infection in dogs fed raw chicken diets. Can Vet J 2002;43[6]:441-442.

11 Freeman LM, Michel KE. Evaluation of raw food diets for dogs. J Am Vet Med Assoc 1991;218[5]:705-709.

12 O'Rourke K. Raw meat diets spark concern. J Am Vet Med Assoc 2005;226[2]:187.

13 FDA. Guidance for Industry. Manufacturer and Labeling of Raw Meat Foods for Companion and Captive Noncompanion Carnivores and Omnivores. http://www.fda.gov/cvm/guidance/Guide122.doc.

14 Joffe DJ, Schlesinger DP. Preliminary assessment of the risk of Salmonella infection in dogs fed raw chicken diets. Can Vet J 2002;43[6]:441-442.

15 Stone GG, Chengappa MM, Oberst RD, et al. Application of polymerase chain reaction for the correlation of Salmonella serovars recovered from Greyhound feces with their diet. J Vet Diagn Invest 1993;5:378-385.

16 Cantor GH, Nelson S, Vanek JA, et al. Salmonella shedding in racing sled dogs. J Diagnostic Invest 1997;9:447-448.

17 Hald B, Madsen M. Healthy puppies and kittens as carriers of Campylobacter spp. with special reference to Campylobacter upsaliensis. J Clin Microbiol 1997;35:3351-3352.

18 Varga J, Mese B, Fodor L. Serogroups of Campylobacter jejuni from man and animals. Zentralbl Veterinarmed [B] 1990;37:407-411.

19 Grimsrud K. Public Health Advisory. Edmonton, Canada: Alberta health and Wellness. 1999.

20 Gutman L, Ottesen E, Quan T, et al. An inter-familial out break of Yersinia entercolitica enteritis. NE J Med 1973;288:1372-1377.

21 Sato Y, Mori T, Koyama T, Nagase H. Salmonella virchow infection in an infant transmitted by household dogs. J Vet Med Sci. 2000;62(7):767-769.

22 Guilford WG, Center SA, Strombeck DR, et al. Strombeck's Small Animal Gastroenterology. 3rd ed. Philadelphia:WB Saunders, 1996.

23 Morse EV, Duncan MA. Canine Salmonellosis: Prevalence, epizootiology, signs, and public healthy significant, J Am Vet Med Assoc 1975;167[ ]:917-820.

24 FDA. Bad Bug Book at http://vm.cfsan.fda.gov.

25 Lejeune JT, Hancock DD. Public health concerns associated with feeding raw meat diets to dogs. J Am Vet Med Assoc 2001;219[9]:1222-1225.

26 Jack DC. The legal implications of the veterinarian's role as a private practitioner and health professional, with particular reference to the human-animal bond: part 2, the veterinarian's role in society. Can Vet J 1997;38:653-659.

27 Stiver SL, Frazier KS, Mauel MJ, Styer EL. Septicemic Salmonellosis in two cats fed a raw-meat diet. JAAHA 2003;39[6]:538-542.

28 Gorham JR, Foreyt WJ. Salmon poisoning disease. In: Clinical Microbiology and Infectious Diseases of the dog and Cat. Green CE (ed). Philadelphia, WB Saunders. 1084 538-544.

29 Fenwick BW, Cowan LA. Canine model of hemolytic uremic syndrome. In: Kaper JB, O'Brien AS, eds. Escherichia coli O157:H7 and other shigatoxin-producing E. coli strains. Washington, DC:Amercian Society for Microbiology Press. 1998. pp268-277.

30 Veterinary Information Network (www.vin.com).

31 Stern A, Walder, EJ, Zontine WJ et al. Canine mesocestoides infections. Compend Cont. Ed 1987;9:223-228.

32 von Woedtke T, Schluter B, Pflegel P, et al. Aspects of the antimicrobial efficacy of grapefruit seed extract and its relation to preservative substances contained. Pharmazie. 1999;54(6):452-6.

33 Frye T. Vitamin stability in canned and extruded pet food. Hoffmann LaRoche, Nutley NJ. 1995.

34 USDA National Nutrient Database for Standard Reference. http://www.nal.usda.gov/fnic/foodcomp/search.

35 Cowell CS, Stout NP, Brinkmann MF, et al. Making Commercial pet foods. In Small Animal Clinical Nutrition. Mark Morris Institute. ML Hand, CD Thatcher, RL Remillard, P Roudebush (eds). 4th ed, Marceline, Missouri: Wadsworth Publishing Company. 2000. pp 127-146.

36 Johnson W, Sinning C. Differing opinions of raw food diet research. J Am Vet Med Assoc 2001;218[10]:1553-1554.

37 Bataller N, Thatcher CD, Pelzer KD, Remillard RL. Nutritional education at Veterinary Colleges of North America. J Vet Med Ed. 1991;18 (1):11-16.

38 Roudebush P, Cowell CS. Results of a hypoallergenic diet survey of veterinarians in North America with a nutritional evaluation of homemade diet prescriptions. Vet Derm 1992;3:23-28.

39 Pitcarin RH, Pitcairn SH. Dr. Pitcairn's Complete Guide to Natural Health for Dogs and Cats. Emmaus, Pennsylvania: Rodale Press, inc. 1995.

40 Strombeck DR. Home-prepared Dog and Cat Diets. Ames:Iowa State University Press.1999.

41 Zink MC. Dog Health and Nutrition for Dummies. New York: Hungry Minds. 2001.

42 Volhardt W, Brown K. The Natural Diet. The holistic guide for a healthy dog. New York; Howell Book House. 1995.

43 Billinghurst I. Give your Dog a Bone. Alexandra, Australia: Bridge Printery. 1993.

44 Veterinary Nutritional Consultations. http://www.petdiets.com

45 Streiff EL, Zwischenberger B, Butterwick RF, et al. A Comparison of the Nutritional Adequacy of Home-Prepared and Commercial Diets for Dogs. J. Nutr. 2002;132:1698S-1700S.

46 Donoghue S, Kronfeld DS. Home-made diets. The Waltham Book of Clinical Nutrition of Dogs and Cats. London: Pergamon. 1994 pg 445.

47 Letters to the Editor. J Am Vet Med Assoc 2001;218[9]:1415-1416 and 218[10]1554.