

Evaluating Pets' nutritional needs

Practitioners should take a proactive approach to help owners choose age- and breed-appropriate food.



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Hippocrates said more than 2,000 years ago, “Let food be your medicine.” Today, scientific research supports this valuable message. Despite the widespread knowledge that food affects the health and longevity of both Pets and people, nutritional education has often been limited or absent in the veterinary curriculum.¹ Frequently, we only learn how to treat specific illnesses with therapeutic diets. As we follow human medicine in its paradigm shift toward preventive medicine, it is crucial that veterinarians play a more central role in helping clients choose a diet for their Pets. This will allow us to provide Pets with longer and healthier lives.

Historically, we know feeding an inappropriately formulated food can impact a Pet's health. For example, cats can experience blindness due to a taurine deficiency, and large breed dogs can develop hip dysplasia when they are fed diets excessively high in energy. Although numerous diseases have been linked to

poor nutrition, studies have also proven that feeding a proper diet in appropriate quantities can extend a Pet's life. Veterinary therapeutic diets have also been shown to increase survival times in ill Pets.

Limited nonbiased nutritional information exists for veterinary clients to review, and most clients obtain information from Pet stores, breeders or the Internet. It is our responsibility to take a more proactive approach in educating clients about the importance of feeding a high-quality, age- and breed-appropriate diet. We need to assist clients with making an informed Pet food decision. The scope of this article is to define some special dietary needs and ways to evaluate which diets may be appropriate for Pets in different life stages.

Evaluating Pet food

The information panel printed on Pet food bags can be very confusing and somewhat misleading. While certain dietary statistics can be acquired by reading the information panel, key data, such as quality, digestibility and energy (kilo-

calories per cup), are typically only available from the manufacturer.

When evaluating a food label, first look for the nutritional adequacy claim, a statement verifying that the diet meets the requirements established by the Association of American Feed Control Officials (AAFCO). AAFCO, which is the most widely recognized regulatory body govern-

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ing animal nutrition, has two levels of standards. The first is a formulation claim used to verify the diet meets or exceeds nutritional requirements for the AAFCO nutrient profile. Required levels are set forth on fat, protein, vitamins and minerals and vary based on the life stage for which the diet is made. But this claim says nothing about the availability of the ingredients to provide the required nutrient levels, nor does it take into account the loss of nutrients that can occur during processing.

AAFCO's second method for verifying nutritional adequacy is a feeding trial.² A minimum of eight Pets are fed the diet for six months while researchers monitor specific biochemical, hematologic and physical parameters. Although this time frame is not sufficient to determine if the food is effective for long-term use, it does allow the manufacturer to determine if there are any short-term, deleterious effects of feeding the diet.

It is also important to review the guar-

anteed analysis on the bag. This analysis is difficult to interpret because it only displays maximums or minimums and does not include the percentages of nutrients that are actually in the diet. The numbers reflect nutrient levels as a percentage of the food on an as-fed basis, and they do not account for the food's moisture content. These values must be converted to a dry matter basis to compare protein and fat levels between different foods (see *Figure 1*, page 25).

The guaranteed analysis can be very misleading, as it gives no indication of the ingredients' quality or digestibility. For example, egg protein is considered to be 100 percent digestible and bioavailable, soy protein is 67 percent digestible and gelatin from animal collagen is 0 percent bioavailable. However, all of these ingredients can contribute to the food's guaranteed protein levels.

Reading the label is not an accurate way to differentiate high-quality and poor-quality Pet foods. High-quality ingredients are an essential element of a good Pet food. Inexpensive brands are often made from cheaper ingredients, which may have lower bioavailabilities because of poor digestibility, even though they meet all the AAFCO specifications, have a guaranteed analysis and contain ingredients that appear to be the same as higher-end brands. For example, the term *meat by-products* could mean internal organs, which have high-quality protein and fat and are highly digestible, or it could mean poor-quality ingredients like the skull, bones and feet.

Some Pet food companies use variable formulations, so the type and quality of ingredients can change based on market availability and cost. Other companies

Figure 1: Formula for Calculating Dry Matter

To convert nutrient values to a dry matter basis, calculate:

$$\frac{\text{Protein or fat content of food}}{(100 \text{ percent} - \text{percentage of moisture in the food})} \times 100 = \text{Percentage of each nutrient as dry matter}$$

For example, assume a diet has a guaranteed analysis of 15 percent moisture and 20 percent protein:

$$\frac{20 \text{ percent}}{(100 \text{ percent} - 15 \text{ percent})} \times 100 = 23.5 \text{ percent protein on a dry matter basis}$$

This corrected protein value can now be used for comparison with other diets.

Body Condition Scoring

Figure 2A



Emaciated

Easily visible ribs, lumbar spine and pelvic bones with no fat covering. Obvious waist when viewed from above and abdominal tuck when viewed from the side. Very limited muscle mass.

Figure 2B



Thin

Easily felt ribs with minimum covering of fat. Obvious waist and visible abdominal tuck.

Figure 2C



Ideal

Ribs felt but with appropriate fat covering. Waist noted behind ribs and abdominal tuck present.

Figure 2D



Overweight

Ribs felt but with an excess covering of fat. Waist less pronounced and abdominal tuck may be present or absent.

Figure 2E



Obese

Ribs not easily felt due to heavy covering of fat. Waist and abdominal tuck not obvious. Fat deposits on lower back and base of tail.

use fixed formulations, which always contain the same ingredients, regardless of cost or availability. High-quality foods typically use a fixed formulation. The only way to know if a company uses a fixed or variable formulation is by contacting the manufacturer. This factor becomes especially important when Pets with food allergies or food intolerance are fed variable-formulation diets.

Different Pets tolerate foods differently. It is prudent, therefore, to recommend foods from quality companies that provide extra research to support the safety of their foods beyond the AAFCO standards. It is important to ensure that the supplementation levels are appropriate for long-term use and that the diet is a fixed formulation. Even with high-quality

foods, personal tolerances for ingredients vary, as do tastes. The final choice of diet must be based on palatability and how well the Pet tolerates the food.

Specific life stage needs

Diets need to be age-appropriate and have the right balance of energy and nutrients. When a Pet has ingested enough food to meet its energy requirements, it is critical that the requirements for protein, minerals, vitamins and essential fatty acids are also met by that same quantity of food. For example, if a puppy is fed a high-fiber diet, it may reach satiety before getting the necessary energy or nutrients. This same principle applies to weight loss. Just reducing the amount of food fed to an obese Pet may have the

desired effect of reducing caloric intake, but that reduction can result in a deficiency of essential minerals, vitamins and protein.

Poor or inappropriate nutrition, especially during a rapid growth phase, can have serious effects on a puppy's development. Obesity in puppies has been correlated to insulin-like growth factors, which, in turn, have been linked to the

Because restriction of dietary protein limits growth and increased caloric energy is associated with increased orthopedic complications, it is advisable to feed puppies a higher protein to energy ratio than adults.

development of osteochondrosis.³ Additionally, if a Pet is allowed to become overweight during a rapid growth phase, excessive adipocytes are produced, making it more difficult to maintain a lean body mass as an adult.⁴ Many other factors also affect energy needs, including sex, breed, activity level and environment.

For puppies, the first of two development phases is an exponential growth period when most skeletal changes occur. The growth in this phase is similar for most breeds but shorter for small breeds. Energy requirements at this time are three times that of adult maintenance. The second growth phase is slower, during which the majority of muscle development occurs.⁴ Even large breed puppies vary in their stages of development and weight, so it is not appropriate to generalize that all 50-lb puppies require

the same amount of nutrition. For example, a 50-lb Great Dane may be in the exponential growth stage while a 50-lb Golden Retriever may have much lower nutritional requirements in the slow growth stage. It has been suggested that feeding guides would be more accurate if the Pet's weight, breed and sex were included.⁵

Puppy foods are higher in fat and protein than adult foods. Protein deficiencies can affect structural growth and limit size gain in puppies. There is no evidence that excessive protein causes any adverse effects, structural or otherwise, in puppies.³ Because restriction of dietary protein limits growth and increased caloric energy is associated with increased orthopedic complications, it is advisable to feed puppies a higher protein to energy ratio than adults. AAFCO recommends a minimum 22 percent crude protein on a dry matter basis for puppies versus 18 percent for adults.

Senior Pets

Senior dogs experience an age-related decline in energy requirements due to a combination of decreased activity as well as a decreased lean mass (skeletal muscle) to fat mass ratio. Although older Pets may not gain weight, they have a reduction in lean mass and an increase in fat mass. Senior dogs do not generally have a significant reduction in digestive efficiency and, therefore, require a 20 percent reduction in energy requirements in their diet.⁶

Senior cats have similar energy requirements as adult cats. It is hypothesized that because cats are fairly sedentary throughout their adult life, they do not expend significantly less energy as they age.⁹ Furthermore, they tend not to

experience the same decrease as dogs in lean body mass to fat mass ratio. However, evidence suggests that their digestive efficiency decreases,⁷ which has a significant effect on energy and nutrient absorption. Research has shown that cats with decreased digestive ability increase their food consumption to make up for the loss in digestibility.⁶ Senior cats also have a decreased ability to digest fat. This suggests that while senior dogs require about 20 percent less energy as they age, cats may actually require increased energy to maintain the same body weight.⁶

Nutritional disorders

In large breed puppies, a strong link exists between excessive caloric intake, dietary calcium imbalance and various muscu-

loskeletal disorders.^{4,8} Therefore, the primary goals are to control energy intake and carefully balance calcium and phosphorus. The energy density of large breed dog foods is decreased, allowing them to eat more and feel full while controlling energy intake. Large breed diets also have a calcium to energy ratio that is 20 percent lower than in small breed diets to make up for their increased food intake and prevent oversupplementation. Puppy foods have increased levels of calcium and phosphorus when compared to adult foods, although the ratio remains the same. Calcium and phosphorus needs decrease as puppies reach a greater percentage of their adult body weight. With large breed dogs, this occurs much later in puppyhood, and the need for calcium

and phosphorus is greater than in small breed dogs.

Deficiencies in calcium can lead to nutritional secondary hyperparathyroidism. This is more commonly seen with homemade diets based principally

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on meat than with commercial diets because meat is deficient in calcium.⁸ In an attempt to regulate serum calcium, the body leaches calcium from the bones, causing malformations or fractures. Excessive calcium levels cause hypercalcitoninemia, leading to inhibition of cartilage maturation. This results in such conditions as hip dysplasia, osteochondrosis and other osteodystrophic disorders. Studies have shown that the major cause of developmental skeletal abnormalities in large or giant breed dogs is excessive calcium intake.⁸ Small breed dogs can handle a much wider range of calcium without any detrimental effects.

The ratio of calcium to phosphorus (Ca:P) is also very important, as a high Ca:P ratio decreases phosphorus absorption. The ideal Ca:P ratio is about 1:1 to 1:2. AAFCO has set a minimum and maximum level for calcium and phosphorus, as well as a recommended ratio. In puppies, the minimum for calcium is 1 percent and phosphorus is 0.8 percent, and in adults, the minimums are 0.6 percent and 0.5 percent, respectively. The mini-

mums take into account the poor bioavailability of some calcium sources.

Hypertrophic cardiomyopathy and orthopedic conditions, such as hip dysplasia, do not appear to be attributable to the growth rate or eventual size of specific cat breeds. Obesity causes an increased risk for lameness, diabetes mellitus and nonallergic skin conditions in cats.⁹ AAFCO has established the same fat levels for growth and maintenance in the cat.⁹ The protein requirement for cats is much higher than in dogs and is set at a minimum of 30 percent for growth and 26 percent for adult maintenance.

Decreased calcium in the diet of kittens also causes metabolic bone disease, especially in cats fed meat-based diets, because they contain relatively low calcium levels. This is mainly seen in homemade diets, as commercial diets that follow the AAFCO specifications have a minimum of 1 percent calcium for growth and 0.6 percent calcium for maintenance. Maximum levels for calcium and phosphorus are not given in feline diets, as oversupplementation does not appear to cause clinical disease. There is some evidence, however, that it may decrease the growth rate and increase bone density in kittens.⁸

Supplementation

While supplementation is usually not necessary when feeding a high-quality Pet food, there are some important vitamins and amino acids that should be supplemented where deficiencies or disease exist. Excesses can be just as harmful, so caution should be used when supplementing AAFCO-approved diets.

Vitamins A and D. Vitamins A and D are very important in growth and development. Deficiencies can lead to

decreased growth, reproductive problems and ataxia, among others. While excessive amounts have been reported to cause metabolic bone disease and growth retardation, the levels at which this occurs are very high, and dogs appear to be relatively resistant to excessive amounts.¹⁰ AAFCO increased the

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acceptable range of vitamin A for all life stages. Vitamin D is important for the absorption and intestinal transport of calcium. The need is very small if the Pet is fed a diet with balanced calcium and phosphorous. Vitamin D deficiency can lead to rickets, osteomalacia and, in old Pets, osteoporosis. Excessive vitamin D levels are more problematic and can lead to dystrophic calcification in numerous organs and death.

Although vitamins A and D are considered to be the most toxic vitamins in large amounts, cats are much more tolerant of high doses than dogs and have a wider range of 9,000 IU/kg to 750,000 IU/kg for growth and 5,000 IU/kg to 750,000 IU/kg for maintenance. Cats can tolerate excesses that are 50 times the required amounts without any deleterious effects.²

Vitamin C. There is no evidence that vitamin C is needed in the diet. The liver of dogs and cats can synthesize adequate amounts on its own.³

Taurine. Taurine is the main conjugate of bile acids in cats and dogs. It is

also necessary for normal retinal, cardiac, neurologic, reproductive, immune and platelet function.¹¹ Taurine is only found in animal tissues; plant tissues contain no taurine. Although it is synthesized in cats from methionine and cysteine, it is at a low rate, and cats will become deficient if fed a low-aurine diet. This can lead to retinal degeneration, dilated cardiomyopathy and reproductive failure or developmental defects. Hearing loss, platelet hyperaggregation and impaired immune function have also been found.¹¹

Whole blood levels of taurine in the cat and plasma levels in the dog can be measured to rule out taurine deficiency as the cause of dilated cardiomyopathy. In addition to dietary causes of deficiency, there are breed associations between taurine deficiency and dilated cardiomyopathy in the American Cocker Spaniel and Golden Retrievers.¹¹ If low levels are confirmed on blood work, supplementation should occur at the rate of 250 to 500 mg orally once a day in cats and 500 to 1,000 mg orally three times a day in dogs, or the Pet can be placed on a cardiac diet already formulated to meet these levels. In cats, clinical signs and echocardiographic changes can be expected to improve within 12 to 16 weeks.

Feeding guidelines and body condition scoring

As with people, the amount of kilocalories (kcal) needed is highly variable based on the Pet's breed, life stage, activity level, environmental temperature and reproductive status. Different foods have vastly different kcal amounts per cup, making it difficult to offer general recommendations on how much to feed a Pet.

This difficulty is further compounded

because the food's kcal (energy) value is usually not listed on the bags. The only accurate way to calculate how much food a Pet needs is to calculate average energy requirements (about 60 kcal/kg/day in mature dogs and cats) and contact the manufacturer for clinical data sheets showing the kcal/cup or kcal/kg. This must then be adjusted based on the Pet's lifestyle, environment and other factors. It is important to base the kcal needed on lean body weight.

Regardless of recommended or calculated energy needs, only a clinical examination of the Pet can help you determine the appropriate level of energy intake. An evaluation of the dog's body condition needs to be performed to monitor excesses and deficiencies. Body condition scoring can be

used by the veterinary team and owner to evaluate when adjustments in food intake are needed (see *Figures 2A to 2E*, page 26). While subjective, body condition scoring is easy to learn and is repeatable and consistent among different observers.² Using a scale from one to five, scoring is based on the palpation of body fat and observance of the Pet's silhouette, which indicate its energy reserves. A separate evaluation of muscle mass is also recommended to evaluate possible protein deficiencies.² Muscle mass evaluation involves careful palpation of the skeletal and temporal muscles. The other method to assess obesity or emaciation in cats is to use a body mass index, which compares the length of the lower hind leg from the middle of the patella to the point of the hock on one axis (x) and the rib cage

circumference. The percentage of body fat can then be calculated from this.⁹

Another good method for monitoring weight control is weighing a Pet at every visit. For instance, it has been suggested that a Pet that will reach 30 to 35 kg in adulthood should not be allowed to gain more than 150 g/day and not weigh more than 65 percent of the adult weight at 6 months of age. For a Pet that will reach 50 to 70 kg in adulthood, it is suggested that weight gain be less than 250 g/day and the Pet not weigh more than 60 percent of its adult weight at 6 months.³ As long as vitamins and minerals are balanced to the energy density by the food manufacturer, then evaluating energy needs based on body condition scoring and adjusting the amount fed to maintain a normal body condition will ensure that all nutritional needs are met.

Summary

In conclusion, Pets have different nutritional needs based on their breed, life stage and size. It is our responsibility to be more proactive, educating owners about these differences and helping them choose a food that is appropriate for their Pet. Evaluating different foods simply by reading the information panels can be misleading, and it is important to recommend food from reputable companies that provide information on their diets and the quality of their ingredients. After choosing an age- and breed-appropriate food, it is very important to perform body condition scoring at all veterinary visits and to educate owners on how to do this at home. Adjustments of food intake should be done with the veterinarian's supervision. Feeding an inappropriate food or excessive amounts can have dele-

terious effects on health beyond obesity. By incorporating nutritional counseling into the services that we provide, we can have a profound effect on the health and well-being of our patients, helping them to live a healthier and longer life. 

References

1. Kirk CA, Badges JW. *Veterinary nutrition today: The U.S. perspective*. Nestle Purina Forum, 2004.
2. Ettinger SJ, Feldman EC. *Textbook of veterinary internal medicine*. 6th ed. St. Louis, Mo: Elsevier, 2005:555-560.
3. Martin L. Classic pitfalls in puppy nutrition. *Waltham Focus* 2004;14(3):13-18.
4. Royal Canin Research and Development. Estimating the adult weight of a puppy based on its breed and sex. *Waltham Focus* 2004;14(3):40-41.
5. Hawthorne AJ. Breed-specific variations in puppies growth patterns. *Waltham Focus* 2004;14(3):23-27.
6. Hawthorne AJ. Nutritional requirements of aging dogs and cats. *Waltham Focus* 2002;12(1):28-34.
7. Perez-Carmargo G, Young L. *Nutrient digestibility in old versus young cats*. Nestle Purina Nutrition Forum, 2004.
8. Kalfelz FA. Calcium and phosphorus requirements of puppies and kittens. *Waltham Focus* 2004;14(3):4-9.
9. Scherk MA. Problems related to rate of growth and size in the cat. *Waltham Focus* 2004;14(3):34-39.
10. AAFCO. AAFCO dog and cat food nutrient profiles. *Model Regulations* 2004;128-143.
11. Hand MS, Thatcher CD, Remillard RL, et al. *Small animal clinical nutrition*. 4th ed. Marceline, Mo: Walsworth Publishing Co, 2000.

Suggested Reading

1. Lawler DF, Evans RH, Larson BT, et al. Influence of lifetime food restriction on causes, time, and predictors of death in dogs. *J Am Vet Med Assoc* 2005;226(2):225-231.
2. Elliot J, Rawlings GM, Markwell PJ, et al. Survival of cats with naturally occurring chronic renal failure and the effect of dietary management. *J Sm Anim Pract* 2002;235-242.

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