MEET THE AUTHOR

***Victoria L. Kerby**, LVT, VTS (SAIM, Nutrition)*
BluePearl Veterinary Partners, Southfield, MI

Victoria (Tori) is a 2007 graduate of Bel Rea Institute, Denver, CO, with an Associates in Applied Animal Science.

She has worked at BluePearl Veterinary Partners with in the Internal Medicine Department as a primary technician since 2007.

Tori obtain her first veterinary technical specialty in Small Animal Internal Medicine in 2011, her second in Nutrition in 2017. She is also a past board member for the Academy of Internal Medicine Veterinary Technicians, as Small Animal Director at Large.

Clinical interest include clinical nutrition and its use in disease management and prevention, feline hyperthyroidism, and acid-base disorders.

shutterstock.com/demanescale

Starting Strong: Puppy and Kitten Nutrition

The average puppy or kitten enters its new home between 7 and 9 weeks of age. During the subsequent months, the veterinary team must impart a strong nutritional foundation to help to support the growth and development of the patient throughout this demanding period.

PEER REVIEWED

Puppies and kittens are gradually weaned from the mother's mature milk to solid food. Weaning occurs at weeks 5 to 7 for puppies and weeks 6 to 9 for kittens. This timing coincides with eruption of the deciduous teeth.

In cats and small to medium-sized dogs, adult body weight is reached between 9 and 10 months of age and skeletal maturity, between 9 and 12 months. Large- and giant-breed dogs continue to grow until age 18 months, reaching skeletal maturity between 18 and 24 months. For both dogs and cats, ages 3 to 6 months mark the period of most rapid growth.

DIET SELECTION

Commercially available food products undergo strict regulation under the Food and Drug Administration as well as state and local feed control officials. These organizations use feed guidelines established by the Association of Animal Feed Control Officials (AAFCO), which sets strict nutritional requirements and rules for product labeling and ingredient definitions. The use of a nutritionally balanced food product that conforms to AAFCO feeding practices is strongly recommended to avoid complications associated with nutrient deficiencies and excesses.

VITAL KNOWLEDGE

During the first 4 months of development, energy needs are two times higher than those of a mature adult of the same body mass.

In selecting a diet for growth, it is important to first assess the diet's AAFCO statement. This statement is located on the information panel on the packaging of commercial pet foods. It provides information on the lifestage the diet is intended to support. Moreover, the statement reflects whether the diet has undergone a feeding trial or has been formulated to meet the nutrient needs as outlined by the AAFCO. A diet intended for growth will be listed as meeting the needs for growth or for all life stages. The most critical determination for the safe use of a pet food is successful feeding trials for the intended population. Diets formulated to meet AAFCO recommendations have been analyzed to contain nutrients within the AAFCO's recommended allowances.

TABLE 1 Daily Energy Requirement Chart

AGE	PUPPY/KITTEN MER/DER FACTOR
Weaning–4 mo	3.0
4–6 mo	2.5
9–12 mo	1.8–2.0

DER = daily energy requirement; MER = metabolic energy requirement

Without feeding trials, digestibility and untoward interactions between ingredients and nutrients may go undetected.

In addition to the AAFCO statement, the veterinary team should assess each diet and its provided nutrients to ensure that the product best fits the needs of the growing pet. Key nutritional factors to consider during growth include energy; protein; the macrominerals calcium, phosphorus, and omega-3 fatty acid docosahexaenoic acid (DHA); and antioxidant support.

Energy

During the first 4 months of development, energy needs are two times higher than those of a mature adult of the same body mass. This metabolic energy requirement, also called the daily energy requirement (**TABLE 1**), reduces gradually after the first 4 months. This metabolic reduction often coincides with a second reduction in caloric requirement following neutering. It is estimated that energy requirements decrease by about 25% within weeks of neutering. If calories are not reduced after neutering, the development of obesity is likely. The best method to determine patient energy needs is to calculate calorie requirements and monitor the patient's body condition score throughout growth. The veterinary team can encourage owners to learn about body condition scoring and how it can be used to prevent aplastic obesity and maximum growth rates.

Aplastic obesity is defined not only by an increase in adipose volume but also by an increase in the number of adipocytes, both of which occur during juvenile obesity. This is in contrast to general obesity, which is

VITAL KNOWLEDGE

Dietary fat provides not only essential fatty acids but also twice the amount of metabolic energy per gram than do protein and carbohydrates.

defined only by an increase in adipose volume. Weight loss and weight management in patients with aplastic obesity may be more difficult because of the higher number of existing fat cells. Once a fat cell has formed, it will actively try to store additional fat through production of hormones that stimulate appetite. To prevent aplastic obesity, it is recommended to maintain a body condition score of 4-5/9. Body condition should be scored by using body condition score charts available through the American Animal Hospital Association and World Small Animal Veterinary Association. Avoiding overnutrition can also help to prevent maximum growth rates. Such rates increase the risk for developmental orthopedic disease and do not affect the final size of the pet; this is especially true of large- and giant-breed puppies (**FIGURE 1**).

FIGURE 1. Treats are a useful aid when assessing body condition score in young puppies as shown in the above picture.

Because of the high energy needs of pets during development, diets that support growth are generally higher in fat than are maintenance diets, which instead are intended for fully grown adult animals. Dietary fat provides not only essential fatty acids but also twice the amount of metabolic energy per gram than do protein and carbohydrates. Metabolic energy is the percentage of energy that each macronutrient, such as protein, fat, or carbohydrates, supplies to the diet (**TABLE 2**). Thus, increasing the amount of fat supplied in the diet allows for smaller amounts to be fed in order to meet energy requirements. Diets low in fats may be unable to provide the necessary nutrients in a small enough volume for the patient to consume. The recommendation for dietary caloric density, the amount of calories per weight of food, during growth is 3500 to 4500 kcal/kg for puppies and 4000 to 5000 kcal/kg for kittens.[1,2]

Protein

Protein provides essential and nonessential amino acids, as well as nitrogen, to the diet. It also plays many roles in the body both physiologically and structurally. Dietary protein provides structure for hair, nails, ligaments, tendons, cartilage, and new tissue during growth. In the immune system, protein is used to create immunoglobulins responsible for the production of antibodies, which help to ward off infection after exposure to vaccinations or natural exposure. The body constantly replaces and repairs these proteins through a process called protein turnover. Excess dietary fat will be used as energy or stored as energy in the form of fat or glycogen.[3]

Kittens have a higher requirement for protein and essential amino acids than do puppies. The percentage of the metabolic energy supplied by protein that should be provided to kittens is 30% to 36%, compared with 25% to 29% for puppies. There are 10 essential amino acids in dogs and 11 in cats. Dietary protein should be provided through a high-quality protein source with high digestibility (>85% digestibility).[4,5] Quality, as it applies to protein, refers to protein's ability to provide all essential amino acids to the target species. A high-quality protein source supplies all the essential amino acids, whereas a poor-quality protein source is limited in certain essential amino acids and will necessitate a second protein source to provide all the necessary amino acids. Protein digestibility can be determined only indirectly through measurement of nitrogen and assessment of long-term effects of growth during a controlled feeding trial.

PEER REVIEWED

Calcium and Phosphorus

Until 6 months of age, calcium absorption remains passive within the small intestinal tract, where fixed absorption of 70% of total dietary calcium occurs. Additional supplementation of calcium supplied in dairy, bone meal, and over-the-counter supplements to an already balanced diet is therefore contraindicated because it may adversely affect growth and skeletal formation.[6,7]

Conversely, calcium deficiency may result from unsupplemented home-cooked diets, meat-only diets, or poor-quality diets high in plant-based phytates, which bind calcium and thereby make it unavailable for digestion. This may result in nutritional hyperparathyroidism, osteomalacia, and associated pathologic fractures.

Dietary calcium and phosphorus are considered together and must be provided in a ratio of 1.1:1 to 1.5:1 in order to maintain an appropriate hormonal balance.[1,2,8] Relative deficiency in phosphorus, although rare, may occur when excess calcium is supplemented, resulting in widening of growth plates and hypophosphatemic rickets.

DHA

DHA is an omega-3 essential long-chain polyunsaturated fatty acid crucial to retinal, neural, and auditory development. DHA also improves trainability and learning in puppies.[1] The percentage on a dry-matter basis that should be provided is ≥0.02% in puppies and ≥0.004% in kittens.[1,2] Although DHA is an omega-3 fatty acid, not all sources of omega-3 fatty acids contain DHA in acceptable levels: Marine fish supplements are considered ideal sources of DHA and EPA (eicosanoic pantothenic acid), and sources such as flaxseed do not contain DHA and EPA in forms metabolized by cats and dogs. Moreover, cod liver oil should be avoided as a source of omega-3 fatty acids because this product often contain high levels of fat-soluble vitamins A and D and may lead to toxicity.[9]

Antioxidants

Early studies in puppies that addressed the health benefits of antioxidants (such as vitamins A and C, β-carotene, lutein, zinc, and selenium) have demonstrated positive effects on active immunity during growth. They have an increased number of immune cells, increased antibody response after vaccination, and modulated nonspecific cellular defense mechanisms. Antioxidants help to maintain cell membrane fluidity and protect against free radicals

TABLE 2 How to Determine Metabolic Energy

Using the guaranteed analysis, multiply the following by the corresponding modified Atwater factor
Crude protein (minimum) ____ % × 3.5 = _____ kcal (per 100 g) Fat (minimum) ____ % × 8.5 = _____ kcal (100 g) Carbohydrate (NFE) ____ % × 3.5 = _____ kcal (100 g)
Add the totals together to get the total kcal of ME ____ kcal protein + ____ kcal fat + ____ kcal carbohydrates = _____ kcal/100 g
To determine what percentage of metabolic energy is provided by the diet, take the total number of kcal provided by the macronutrient and divide it by the total number of kcal, then multiply by 100 ____ kcal (protein) / ____ total kcal = ____ % ME protein ____ kcal (fat) / ____ total kcal = ____ % ME fat ____ kcal (carbohydrate) / ____ total kcal = ____ % ME carbohydrate
If your guaranteed analysis does not contain the amount of carbohydrates, subtract the following from 100; the remainder will be an estimate of the percentage of carbohydrates. 100% − ____ % moisture − ____ % crude protein (minimum) − ____ % fat (minimum) − ____ % Fiber − ____ % Ash = ____ % Carbohydrates (NFE)

ME = metabolic energy; NFE = nitrogen-free extract

created by immune cells when performing their normal functions.[10]

DIET TRANSITION AND FEEDING FREQUENCY

When an animal is transitioning into a new environment, dietary transition should not be implemented the first day in the new environment. During any dietary transition, a gradual approach should be taken. The new diet should be introduced incrementally by adding a quarter of the daily intake each day over a 4-day period, and the prior diet should be simultaneously removed in the same increments. Diet transition will help to minimize gastrointestinal distress and improve diet acceptance.

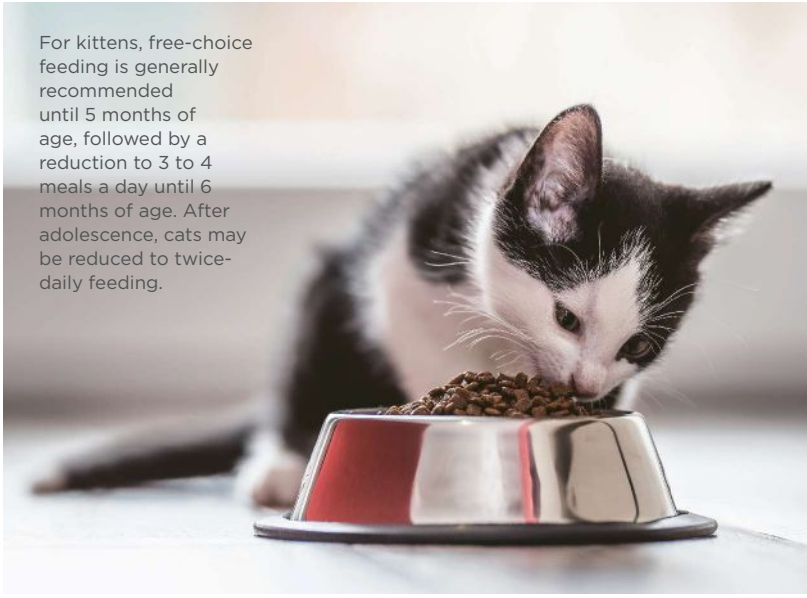
In discussing feeding regimens with a family, it is also important to discuss feeding frequency. For puppies postweaning, restricted feeding, defined as 2 to 4 meals a day, is ideal to maintain a healthy body condition. Small, toy, and teacup breeds may require 3 to 4 feedings per day until they are 3 months old to avoid hypoglycemia.

For kittens, free-choice feeding is generally recommended until 5 months of age, followed by a reduction to 3 to 4 meals a day until 6 months of age. After adolescence, cats may be reduced to twice-daily feeding. Neutering, high-fat foods, free-choice feeding, and an indoor living environment commonly contribute to the development of obesity. Owners may allow cats to eat ad libitum, but cats should be monitored carefully for excessive weight gain. Feeding amounts should be adjusted as needed to maintain ideal body condition scores.

Early introduction of cats to individual feeders in multicat households may aid acceptance to this feeding practice later in life, allowing the family more control over the amount and type of food the patient is eating. Individual feeding systems may also help to prevent kittens from sharing food formulated for adult cats—some foods for young adult cats may be overly acidifying, resulting in reduced bone mineralization.

CONCLUSION

Early nutritional intervention is paramount to improving the quality and longevity of our patients' lives, as well as preventing orthopedic problems later in life. It is up to the veterinary team to stress the importance of healthy feeding practices at every visit. Our responsibility lies in providing families the information that will guide them in making sound decisions for the well-being of the pet. TVN



For kittens, free-choice feeding is generally recommended until 5 months of age, followed by a reduction to 3 to 4 meals a day until 6 months of age. After adolescence, cats may be reduced to twice-daily feeding.

shutterstock.com/Marian Weyo

References

1. Debraekeleer J , Gross K , Zicker S. Feeding growing puppies: postweaning to adulthood. In: Hand MS, Zicker SC, Novotny BJ, eds. *Small Animal Clinical Nutrition Quick Consult*. Topeka, KS: Mark Morris Institute; 2011:16-18.
2. Debraekeleer J , Gross K, Becvarova I. Feeding growing kittens: postweaning to adulthood. In: Hand MS, Zicker SC, Novotny BJ, eds. *Small Animal Clinical Nutrition Quick Consult*. Topeka, KS: Mark Morris Institute; 2011:41-43.
3. Case LP, Daristotle L, Hayek MG, Raasch MF. Protein and amino acids. In: *Canine and Feline Nutrition: A Resource for Companion Animal Professionals,* 3rd ed. St. Louis, MO: Mosby: 21-25.
4. Wortinger A, Burns K. Growth in dogs. *Nutrition and Disease Management for Veterinary Technicians and Nurses*, 2nd ed. Oxford, UK: John Wiley & Sons; 2015:113-117.
5. Wortinger A, Burns K. Growth in cats. *Nutrition and Disease Management for Veterinary Technicians and Nurses*, 2nd ed. Oxford, UK: John Wiley & Sons; 2015:118-120.
6. Lauten SD. Nutritional risks to large-breed dogs: from weaning to the geriatric years. *Vet Clin Small Anim Pract* 2006;36:1345-1359.
7. Hazewinkel H. Nutritional management of orthopedic diseases. In: Fascetti AJ, Delaney SJ, eds. *Applied Veterinary Clinical Nutrition*. Oxford, UK: John Wiley & Sons; 2012:125-155.
8. Richardson D, Zentek J, Hazewinkel H, Nap R, Toll P, Zicker S. Developmental orthopedic disease of dogs. In: Hand MS, Zicker SC, Novotny BJ, eds. *Small Animal Clinical Nutrition Quick Consult*. Topeka, KS: Mark Morris Institute; 2011:91-94.
9. Gross K, Yamka R, Khoo C, Friesen K, Jewell D, Schoenherr W, Debraekeleer J, Zicker S. Macronutrients. In: Hand MS, Thatcher CD, Remillard RL, Roudebus P, Novotny BJ, eds. *Small Animal Clinical Nutrition*, 5th ed. Topeka, KS: Mark Morris Institute; 2010:103-104.
10. Case LP, Daristotle L, Hayek MG, Raasch MF. Growth. In: *Canine and Feline Nutrition: A Resource for Companion Animal Professionals,* 3rd ed. St. Louis, MO: Mosby:221-237.