



# Physiological Nutritional Needs of Cats and Dogs

Excerpts from the white paper *Natural Solutions*

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*Lifestyle, life stage and body size—especially in dogs—dictate specific nutritional requirements of companion animals. Evolving knowledge of animal physiology and developments in natural aspects of nutrition ensure the optimal health of dogs and cats.*

## Lifestyle or Activity Level

An average pet activity level is one of low-intensity activity up to three hours per day. An active pet is one that takes part in high-intensity activity one to three hours per day. A highly active level is one of high-intensity activity for three to six hours per day.

Apart from different energy requirements among dogs with different levels of activity, source of energy is also important. In working dogs, the main fuel source is fat. Muscle fibers produce energy through aerobic fatty acid oxidation. A carbohydrate-free, high-fat diet conferred advantages for prolonged, strenuous running performed by a group of sled dogs!<sup>1</sup>

The Waltham Centre for Pet Nutrition provides excellent guidelines for daily energy requirements of dogs and cats at each activity level, including recommendations for low activity, neutered and overweight pets.

Certain health issues are associated with an inactive lifestyle, including the potential for obesity. It is important that inactive cats and dogs are fed a well-balanced diet and that feeding guidelines are followed and the pets' weights are monitored. Inactive, neutered males are prone to poor urinary tract health and can benefit from diets designed to deliver urinary acidification, maintain a mildly acidic urine pH and reduce the risk of struvite or calcium oxalate formation. Studies have shown that increasing dietary magnesium, phosphorus and calcium levels can result in the formation of crystalline material and obstruct the lower urinary tract in cats.<sup>2</sup>

## Life Stage: Puppy and Kitten

Adult body size figures significantly on the age at which different life stages begin.<sup>3</sup> Small-breed dogs reach adulthood by 12 months of age; large breeds at about 18 months and giant breeds in up to 24 months.

Female cats reach adult body weight at about 12 months, whereas large males do not reach full adult body weight until 18 months of age. The age at which a cat's energy requirement achieves adult level is around 40 weeks, but this varies according to sex and whether neutered or intact.

There are certain risks associated with switching to adult diets too early, as pets may not receive enough nutrients and energy for growth. Adult food may contain higher calcium than the maximum requirement for a growing animal, which could lead to skeletal problems, especially with giant-breed puppies. Kittens should not be fed any adult diet that has been acidified to produce a urine pH in adult cats between pH 6–6.5 until they are 12 months old. This is because of the increased risk of metabolic acidosis and slower development, especially for larger cats that are still growing.<sup>4</sup>

### Protein Requirement

Puppies need 4.4 times more protein than adult dogs, and kittens need 2.1 times more protein than adult cats on a per-kilogram of body weight basis.<sup>2,3</sup> Rapidly developing body systems increase the demand for protein in building body tissues and muscles, producing skin and hair, regulating metabolism and as an energy source. A high quality protein source is essential to maximize bioavailability of nutrients.

### Calcium and Phosphorus Requirement

Puppies need 5.8 times more calcium (Ca) and 6.4 times more phosphorus (P) than adults, and kittens need about five times more Ca and P than adults.<sup>2,3</sup> to develop healthy bones and teeth. Insufficient calcium results in tooth loss, skeletal deformity and lameness in growing animals. However, maximizing calcium is not the best practice; rather, it is the Ca:P ratio that is important. A Ca:P ratio of up to 2:1 can be safely tolerated during growth by small and medium dog breeds. In giant breeds, a lower value of 1.5:1 is prudent because of susceptibility to osteochondrosis. A more precise Ca:P ratio is needed for dogs than cats, and puppies require an even more precise Ca:P ratio.

### Fatty Acids Requirement

In humans, the omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are derived from alpha linolenic acid. Alpha linolenic acid is found

in flaxseeds (linseeds), soybeans, walnuts and green leafy vegetables. EPA and DHA are highly concentrated in oily fish. The omega-6 fatty acid arachidonic acid is derived from linoleic acid. Linoleic acid is found in fruits and vegetables as well as in certain nuts and seeds, however, arachidonic acid is only found in meat.

Puppies and kittens are limited in regards to converting linolenic acid into EPA and DHA;<sup>6</sup> therefore, these should be provided in the diet where a minimum requirement is recognized. Alternative sources of EPA and DHA include organ meats like liver, algae (used to produce DHA supplements for vegetarians), poultry and egg yolks. Kittens as well as adult cats are unable to synthesize arachidonic acid from the precursor linoleic acid, therefore arachidonic acid found only in meat must be provided in the diet.<sup>6</sup>

## Life Stage: Senior

Dogs and cats are considered senior in the last third of their expected lifespan. Toy, small and medium dog breeds are considered senior around the age of 10; larger breeds are senior around eight years and giant breeds around five years. For cats, senior life stage is considered to be around eight years. A super-senior phase is designated for geriatric pets: 11+ years for toy, small and medium dogs and cats, 9+ years for large dogs and 7+ for giant breeds.

Physiological changes occur with aging and are reflected in specific nutritional needs of senior cats and dogs. In senior cats, digestive function declines<sup>7</sup> and risk of chronic renal failure increases, but there is no change in energy requirement. Conversely, in senior dogs digestive function tends to remain stable,<sup>7</sup> the risk of chronic renal failure is less than in cats and energy requirement decreases.

### Senior Cats

The recommended energy requirements for thin, normal or overweight cats remain the same as for the adult life stage. Senior cats need increased amounts of protein, fat and the essential amino acids to compensate for reduction in digestibility. Senior cats may have a reduced appetite, therefore providing a highly palatable food helps to ensure adequate nutrition. Kibble shape is also important to help prevent oral health problems.

Senior cats are prone to developing renal and cardiac issues. Super-senior cats often develop cataracts and their hearing may deteriorate. Often, there are no outward signs of these problems until they are serious. Antioxidants help to boost the immune system and maintain a senior cat's health. Taurine, essential fatty acids, lutein and other antioxidants help support vision; taurine, flavanols and green tea help to maintain a healthy heart. Senior cats are also prone to hyperthyroidism, which can lead to increased hunger, hyperactivity and a decrease in body composition.<sup>8</sup>

Senior cats often have poor skin and coat quality because of reduced absorption of nutrients from diet and less frequent grooming. Skin may become flaky and the coat may develop gray or white hairs. Sunflower oil, safflower oil, flaxseed oil, marine fish oil, vitamin A, zinc, vitamin E, and the B vitamins are all widely accepted as good natural ingredients that are beneficial for skin and coat health.

### Senior Dogs

Energy requirements for senior dogs are 20% lower than those for adult maintenance,<sup>2</sup> reflecting decreases in activity and changes in body composition. However, some dogs may need considerably fewer calories per day. Diets for senior dogs need to contain many nutrients at increased amounts to compensate for the energy reduction, including more essential amino acids, vitamins and minerals.

Some believe that senior dogs should be given a reduced protein diet. However, WALTHAM<sup>®</sup> research has shown that the lean body mass of senior dogs is reduced compared to non-senior adults, and thus it would not be advisable to reduce dietary intake of protein.

Although studies have not shown an age-related decrease in digestive function, senior dogs may trend toward malabsorption of B vitamins, copper and zinc.<sup>8</sup> To counter this effect and also to account for decreased energy requirements, senior dogs need increased levels of B vitamins, copper and zinc. It can also be advantageous to feed senior pets glucosamine, chondroitin, antioxidants and omega-3 fatty acids<sup>9</sup> that have nutritional anti-inflammatory properties.

## Size: Small-breed Dogs

Small-breed dogs have unique characteristics and physiological differences that provide an opportunity for specific nutritional solutions to promote optimal health. Differences in small dogs include urinary tract health, growth and aging rates, oral health, weight maintenance and fussiness with eating preferences.

### Urinary Tract Health

Small breeds are more prone to canine lower urinary tract disease (CLUTD) compared to large breeds because they urinate less often, have higher urine pH, lower urine volume and higher urinary calcium concentration. Nutritional solutions for reducing the risk of CLUTD include wet food to increase water intake. WALTHAM<sup>®</sup> research recommends feeding small dogs at least 25% of daily calories as wet food to reduce the risk of calcium oxalate or urinary stone formation.<sup>2</sup>

### Life Stage

On average, the life expectancy of small breeds is 15 years, compared to eight years for large or giant breeds. Small dogs are older for longer and can benefit from

the protective effects of antioxidants. Antioxidants help to protect against cell damage by free radicals, unstable molecules produced by normal metabolic processes as well as by injury, disease and environmental factors.

Small-breed puppies have a short, rapid growth period of approximately eight months, compared to 24 months for giant-breed puppies.<sup>5</sup> Birth weight is multiplied approximately 20-fold during the first year. It is important to ensure that puppy diets contain optimal levels of energy for growth and that adult diets are started at the correct age—12 months—for healthy growth and maintaining optimal body condition.

### **Oral Health**

Small dogs are at greater risk of oral health problems. Periodontal disease is the most common disease in smaller breeds, present in approximately 14% of small-breed dogs between the ages of ten and 25 years. Small dogs' teeth are relatively larger compared to body size and the teeth are more tightly packed in the mouth. Longevity may contribute to poor oral health as the incidence of periodontal disease increases with age.

Specific treats and main meals support oral health by helping to maintain healthy teeth and gums. Dental chews and specially designed kibbles reduce plaque and calculus build-up that lead to gingivitis and periodontal disease. Specific kibble sizes and shapes may improve oral health; feeding large kibble to small dogs reduced calculus build up by 33% in four weeks.

### **Weight Maintenance**

Small dogs normally require more energy per kilogram of body weight; however, owner behavior, such as overfeeding energy-dense foods or treats, may increase the risk of obesity. Additionally, many small dogs expend less energy due to urban living and owner belief that they require minimal exercise. The Waltham Centre for Pet Nutrition recommends introducing an exercise regimen and restricting energy intake to maintain a healthy body weight. Potential functional ingredients that promote healthy weight maintenance include L-carnitine to promote fat utilization rather than fat storage, B vitamins to increase energy metabolism and conjugated linoleic acid.

### **Appetite**

Small breeds are notoriously fussy about food choices and toy breeds are fussier than small breeds. WALTHAM® studies have determined optimal kibble size, shape, moisture and nutrient profile to provide small dogs with a highly palatable kibble. The optimal energy ratio of macronutrients naturally preferred by dogs is 60% fat, 30% protein and 10% carbohydrate.<sup>9</sup>

## **Size: Large-breed Dogs**

Large-breed dogs also have unique differences that provide opportunity for specific nutritional solutions. These differences include slower growth rates, quicker aging,

exercise needs, feeding behavior, obesity, joint health, heart health, digestive health and hereditary diseases.

### **Life Stage**

Large dogs' growth must be controlled during puppyhood to prevent abnormalities. A diet with reduced energy content will result in less rapid growth and consequently reduce the risk of skeletal disorders. Additionally, adult diets should be fed at the correct age—18 months for large breeds and 24 months for giant breeds.

Excessive calcium intake should be avoided because it can affect bone structure until the end of the growth stage. Calcium and phosphorus concentrations are reflected in bone mineral content until six months old, at which time hormonal regulation adjusts absorption and excretion of these minerals.

Antioxidants can help reduce the risk of age-related diseases caused by cell and DNA damage, and help reduce susceptibility to degenerative disorders associated with aging, such as cancer. Large dogs are senior at a young age and therefore require additional antioxidants at an earlier age.

### **Exercise and Weight Maintenance**

It is recommended that large breeds not receive any forced exercise until bone and muscle growth has ended. Large dogs are prone to joint problems; too much exercise may increase the risk. Exercising post-feeding is also not recommended because large dogs are prone to gastric dilation-volvulus.

Large dogs fed high-energy dry foods increases the potential for overfeeding and obesity. The volume of dry food required to fulfill energy requirements is much smaller than the volume of wet food. Large kibble sizes and shapes help to slow down consumption and to provide the optimal levels of nutrients. An appropriate exercise regimen and energy restriction can help maintain healthy body weight.

### **Joint Health**

Large dogs are prone to joint problems including osteoarthritis, osteochondrosis, degenerative joint disease, hip dysplasia and elbow dysplasia. To reduce the likelihood of developing joint problems or to alleviate existing problems, it is recommended that products for the correct life stage and suitable for a large breed be fed to maintain optimum body condition.<sup>10</sup> Weight must be controlled to prevent extra stress on joints and exercise be given in moderation. Products containing chondroprotectives such as chondroitin, glucosamine and green-lipped mussel can help maintain healthy joints and mobility. Joint health can also be supported by the addition of antioxidants such as vitamin E, zinc and manganese, and omega-3 fatty acids.

## Heart Health

Large breeds are more susceptible to heart disease, in particular dilated cardiomyopathy and subaortic stenosis. Healthy heart function and alleviation of heart problems can be promoted through nutrition. Low-sodium diets prevent water retention and reduce workload on the heart. Dogs with heart failure may retain salt, leading to fluid retention in the lungs and abdomen expressed as coughing, difficulty breathing and abdominal distension. Taurine and L-carnitine provide essential elements for cardiac cell function and promote heart contractibility. Flavonols and antioxidants such as vitamin E, vitamin C, taurine and lutein help to maintain blood flow and support heart cell health.

## Digestive Health

Large dogs have a relatively short digestive system compared to small dogs. The digestive tract of large breeds is 2.8% of body weight, compared to 7% in small breeds. Food remains longer in the digestive tract of large dogs than in smaller breeds, due to its volume. Additionally, permeability of the small intestine and digestibility of fiber is greater in large breeds compared to small breeds. Increased permeability means electrolytes re-enter the lumen, increasing water absorption. This could lead to increased amounts of fluid entering the colon and in fecal water excretion. Large dogs often have poor feces quality due to high moisture content and a greater number of defecations.

Probiotics and prebiotics can be added to the diet to promote healthy microorganisms within the gut. Omega-3 fatty acids (EPA and DHA) also play a role in intestinal quality. Dietary fiber appears to normalize gut transit time in dogs and regulate normal bowel function. Added dietary fiber decreases transit time in dogs with normal or slow gut transit; transit time is increased in dogs with rapid gut transit. Rice is a highly digestible carbohydrate and improves digestibility. Beet pulp is a good source of both moderately fermentable and non-fermentable fiber, benefiting feces quality and improving the general functioning of the large intestine.

Gastric dilation-volvulus (GDV) is a life-threatening condition also known as bloat, stomach torsion or twisted stomach. Dogs fed once per day are twice as likely to develop GDV as those fed twice per day. Dogs that eat rapidly, exercise soon after eating or eat from raised bowls are at increased risk of GDV. One study found that dry food containing fat listed in the first four ingredients increased risk of GDV by 53%. Prevention of GDV includes awareness of signs (swollen stomach, non-productive vomiting and retching, restlessness, abdominal pain and rapid shallow breathing), feeding dogs two to three times per day, placing the food dish on the floor, making sure water is available at all times but limiting immediately after feeding, and avoiding excitement and exercise one hour before and two hours after feeding.

## References:

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- <sup>2</sup>WALTHAM® Centre for Pet Nutrition 2006 Dog Nutrient Guidelines
- <sup>3</sup>WALTHAM® Centre for Pet Nutrition 2006 Cat Nutrient Guidelines
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