



Part 2 Life-stage nutrition for dogs and cats

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ABSTRACT Dogs and cats have unique nutritional requirements that vary throughout their lives, so it is important to feed a diet suited to their age and physiological state. The plethora of pet foods makes it hard for owners to decide what, and how much, to feed their animals, so the veterinary team must be able to provide accurate advice on optimal life-stage nutrition. Part 2 (of a two-part series) reviews the nutritional adaptations required during the growth and senior stages of life and considers the vital role veterinary nurses play in educating pet owners about optimal nutrition and dietary choices.

Keywords companion animal nutrition, life stage, dietary requirements, canine, feline

Introduction

As outlined in Part 1 of this article (VNJ, July 2022), nutrition is a key consideration in the maintenance of a pet's health, longevity and wellbeing. Three main components influence the life of an animal: genetics, environment and nutrition. Of these, nutrition is the primary factor the veterinary profession can influence to maximise health, enhance performance, improve longevity and manage disease (Burns, 2014).

The Covid-19 pandemic has seen an increased demand for domestic pets, which has had a significant impact on pet welfare, especially among pets with new and inexperienced owners. Diet has been notably affected, with over 1.4 million pets gaining weight since the start of the pandemic, contributing to a growing pet obesity crisis (PDSA, 2021). Owner knowledge about

the welfare needs of their pet is deficient and virtual veterinary appointments are on the rise, so fewer pet owners visit veterinary practices and fewer nutritional assessments are performed in person. It is therefore more important than ever to strengthen the relationship between veterinary professionals and pet owners to foster mutual trust and rapport.

Approximately 90% of pet owners consider their companion animals to be family members (Cohen, 2002; Carlisle-Frank & Frank, 2006), with over half reported as giving equal or higher priority to buying healthy food for their pets than themselves (Schleicher et al., 2019). Yet confusion and misinformation exists around nutritional facts and dietary choices, which have direct consequences on the health and wellbeing of pets and their owners. It is therefore essential that the veterinary healthcare team can provide sound and fundamental nutritional advice throughout each stage of a pet's life.

Feeding during growth

Multiple factors can affect an animal's growth but diet is the one factor that can be controlled by owners and influenced by the veterinary healthcare team. Whether hand-reared or fed by the dam, all puppies and kittens

should begin weaning at 3–4 weeks old. A species-specific complete diet, designed for growth, should be fed until full reproductive and skeletal maturity. Providing additional supplementation is unnecessary and could prove detrimental. As with any life stage, consumption of excess energy is also undesirable and can predispose animals to abnormal skeletal development, obesity and other chronic conditions. Treats should constitute a maximum of 10% of a pet's total daily calorific intake. Establishing an optimal feeding schedule and good dietary habits is fundamental at this stage. During the initial 4 months, daily food intake should be split over multiple meals to accommodate the pet's limited stomach capacity. Introducing food-foraging toys and puzzles can help provide exercise and environmental enrichment.

Owners should be educated about key nutritional factors (Table 1) and energy requirements (Table 2, overleaf). No equation will guarantee an optimal growth rate, so appropriate modification is required to maintain a lean body condition. Regular monitoring is important during the growth period to assess growth rate, body condition, weight and dietary management. Growth charts appropriate to the species, breed and life stage of the pet should be completed at least monthly until 6 months of age, then every 3 months until adulthood, then every 3–6 months during adulthood.

Table 1. Key nutritional factors of healthy cats and dogs during growth (FEDIAF, 2021). Unless otherwise stated, minimum recommended nutrient levels are provided, with units expressed per 100 g dry matter.

Key nutritional factor	Cats	Dogs	
		Early growth (<14 weeks)	Late growth (≥14 weeks)
Water	Daily fluid requirement can be calculated using one of these formulas: 50–60 ml/kg/day or 1–2 ml/kg/hour. Fresh water should be supplied on an ad-libitum basis, with routine monitoring of intake.		
Protein	28 g	25 g	20 g
Fat	9 g	8.5 g	8.5 g
Calcium (Ca)	1.0 g (min)–1.5 g (max)	1.0 g (min)–1.6 g (max)	Puppies of breeds with adult weight <15 kg during the whole late growth phase: 0.8 g (min)–1.8 g (max) Puppies of breeds with adult weight >15 kg during the whole late growth phase: 1.0 g (min)–1.6 g (max) After 6 months: 0.8 g (min)
Phosphorus (P)	0.84 g	0.9 g	0.7 g
Ca:P ratio	1:1 (min)–1.5:1 (max)	1:1 (min)–1.6:1 (max)	Puppies of breeds with adult weight <15 kg during the whole late growth phase: 1:1 (min)–1.8:1 (max) Puppies of breeds with adult weight >15 kg during the whole late growth phase: 1:1 (min)–1.6:1 (max) After 6 months: 1.8:1 (max)
Potassium	0.6 g	0.44 g	0.44 g
Sodium	0.16 g	0.22 g	0.22 g
Chloride	0.24 g	0.33 g	0.33 g
Magnesium	0.05 g	0.04 g	0.04 g

Table 2. Average daily energy requirements (DER) during growth of healthy cats and dogs (FEDIAF, 2021). The alternative method for calculating the DER of large- and giant-breed dogs, using 15–100% of anticipated adult body weight (BW), is proposed by Richardson et al. (2010). MER, Maintenance energy requirement.

	Age and percentage of anticipated adult BW	DER using MER factor $MER (kcal/day) = 75-100 (BW \text{ kg})^{0.67}$
Cats	Kittens up to 4 months (<50% of adult BW)	2.0–2.5 × MER
	4–9 months (50–70% of adult BW)	1.75–2.0 × MER
	9–12 months (70–100% of adult BW)	1.5 × MER
	Age and percentage of anticipated adult BW	DER
Dogs	Newborn	25 kcal/100 g BW
	Up to 50% of adult BW	210 kcal/kg $BW^{0.75}$
	50–80% of adult BW	175 kcal/kg $BW^{0.75}$
	80–100% of adult BW	140 kcal/kg $BW^{0.75}$
	Percentage of anticipated adult BW	DER using MER factor $MER (kcal/day) = 130 (BW \text{ kg})^{0.75}$
Large and giant dog breeds	15	2.5
	30	2.1
	43	1.9
	60	1.6
	71	1.4
	80	1.3
	100	1.0

Large and giant-breed puppies

Puppies predicted to have an adult bodyweight of over 23 kg (50 lb) and 45 kg (100 lb) are considered large and giant breeds, respectively (Kerby, 2018). Their rate of growth is prolonged and they are sensitive to nutrient deficiencies and excesses, and overfeeding. Excessive caloric intake contributes to an accelerated growth rate and excessive weight gain, predisposing puppies to developmental orthopaedic disease (Lauten, 2006). A diet formulated for large-breed growth, fed on a meal-restricted/portion-controlled basis (not ad-libitum) and without any supplementation, is fundamental to reducing this risk. Puppies should be assessed regularly throughout the growth period and dietary adjustments made as necessary to encourage gradual growth, managed weight gain and maintenance of a lean body condition.

Feeding during senior years

The rate and manifestations of ageing are determined by several intrinsic and extrinsic factors, of which one is nutrition. The Association of American Feed Control Officials (AAFCO) and the Fédération Européenne De l'Industrie des Aliments pour Animaux Familiers (FEDIAF) – the European pet-food industry federation – only distinguish growth, reproduction,

and adult maintenance as life stages in dogs and cats. Consequently, there is no clear definition or agreement on the nutritional requirements for the senior life stage, and nutrient profiles vary widely and according to the manufacturers' philosophies (Corbee, 2018; Villaverde, 2017). It is therefore essential that the nutritional evaluation of senior pets involves an individual assessment with a recommended nutrient profile (rather than product name) matched to the needs of the individual. This makes it even more critical for the veterinary healthcare team to be able to provide a source of credible nutritional advice and support for owners of ageing pets.

Frequent nutritional assessment is of particular importance during this life stage and owners should play an active role. Teaching owners how to accurately and objectively assess their pet's body condition score (BCS) and muscle condition score (MCS) is crucial to the early detection of secondary health conditions. Each unit increase above ideal (a score of 5) on a 9-point BCS equates to 10–15% excess bodyweight. Unhealthy weight gain increases the risk to health and exacerbates age-related conditions such as diabetes and arthritis (Churchill, 2018; Laflamme, 2005). Obesity further decreases quality of life and life expectancy and should, therefore, be prevented. Unless life expectancy is poor for reasons other than

excess weight, a weight-reduction programme should be instigated (Corbee, 2018). Although many middle-aged and older pets are overweight, a large percentage of senior dogs, and cats in particular, have a low body condition (Laflamme, 2005). Any unintentional weight loss after the age of 7 years old, particularly of 10% or more, could be significant and should be investigated and addressed as a priority issue. BCS and MCS are not directly related – animals, especially those that are sick, may be losing lean muscle mass despite an abundance of body fat (Laflamme, 2012), so body and muscle condition must be independently assessed in all animals, regardless of life stage.

Muscle mass results from the balance between anabolic and catabolic pathways involved in protein synthesis or breakdown. A suboptimal MCS with any degree of muscle wastage, however mild, requires prompt identification. A primary driver of basal metabolic rate, accounting for approximately 96% of basal energy expenditure, is lean body mass (LBM), which includes skeletal muscle, skin and organs. Sarcopenia and cachexia are two important multifactorial syndromes associated with skeletal muscle wasting and loss of LBM that occur with ageing (independent of illness) and in the presence of disease, respectively (Freeman, 2017;

Peterson & Little, 2018; Ray et al., 2021). The underlying mechanisms involved in each syndrome overlap considerably and can occur concurrently (Freeman, 2017), with important clinical implications. Deleterious effects include physical disability and poor quality of life, with a pronounced loss of LBM being associated with increased morbidity and mortality. Addressing sarcopenia and any potential cachectic conditions early is therefore crucial to the rapid instigation of nutritional support and an appropriate treatment plan.

While old age is not a disease, the ageing process is associated with a decline in organ function and immune response, in addition to the development of physiological changes and an increased likelihood of comorbidities (Chandler et al., 2018). The design of optimal nutritional programmes for aged animals must be underpinned by knowledge of these alterations (Day, 2010) together with consideration for the potential presence of pain. Despite a lack of specific regulatory guidelines for senior diets, most focus on the general characteristics of ageing cats and dogs (Corbee, 2018), so dietary recommendations reflect some of the biological effects associated with ageing and are tailored to optimise longevity, performance and health (Table 3, below and continues overleaf).

Table 3. Dietary factors requiring consideration in healthy senior cats and all breeds of senior dogs. (This table spreads across pages 29 and 30.)

Dietary factor	Cats	Dogs
Water	Water is a key nutrient and essential for life. Ageing impairs thirst sensitivity, which, combined with osmoregulatory disturbances, effects of medications (such as diuretic drug therapy), and disease, pose a greater risk of dehydration. Inadequately hydrated animals may be at risk of certain medical conditions including urolithiasis, constipation, diabetes mellitus and obesity. Fresh water should be supplied to cats and dogs on an ad-libitum basis, with routine monitoring of intake. If food intake is good but water intake is questionable, providing a moist diet can help to ensure adequate intake and hydration.	
Energy	Lean body mass (LBM) is the main driver of energy requirements in healthy dogs and cats, accounting for 96% of basal energy expenditure. In both species, LBM tends to decline with age, with a pronounced loss being associated with morbidity and mortality. Not all older animals are overweight or less active, and disease can also influence energy requirements. Not all animals will benefit from restriction, so energy requirements and food intake should be adjusted accordingly to maintain a healthy weight and lean body condition.	
	The energy requirements of cats often decrease from 7–10 years old, and then increase from 11 years, with the greatest increase occurring after 13 years of age (Cupp et al., 2004). This rise is thought to be due, in part, to a reduced digestive function (Laflamme, 2018). Diminished gastrointestinal tract function in senior cats may also lead to consumption of smaller volumes of food at each feeding, requiring calorie-dense diets offered in smaller, more frequent meals (Ray et al., 2021).	The energy requirements and LBM of dogs tend to decrease with age and a reduction in activity, with the greatest decline occurring in dogs over 7 years of age (Churchill, 2018).

Table 3. Dietary factors requiring consideration in healthy senior cats and all breeds of senior dogs. (This table spreads across pages 29 and 30.)

Dietary factor	Cats	Dogs
Protein	Unnecessary protein restriction in senior cats and dogs is potentially more detrimental than a deficiency in younger animals (Churchill, 2018) and may exacerbate loss of lean tissue and protein-calorie malnutrition (Hutchinson et al., 2011). Optimal intake can help to prevent sarcopenia (Corbee, 2018). Quality of protein source is also a key consideration and should be of high biological value (BV), providing efficient utilisation and reduced bacterial metabolites (Fascetti, 2010; Hutchinson & Freeman, 2011).	
	Approximately 1 in 5 cats over the age of 14 years have a reduced ability to digest protein, which can contribute to weight loss (Perez-Camargo, 2004). This has implications for the amount, quality and digestibility of dietary protein given to senior cats.	Protein requirements increase in senior dogs due to increased protein turnover and reduced protein synthesis. Diets with a higher protein:calorie ratio, with 25% of calorific intake from quality protein, can help to minimise loss of LBM (Churchill, 2018).
Fat	In comparison to carbohydrate and protein, fat has a higher energy density. An increased dietary source may be advocated in situations requiring maximisation of energy intake in senior cats and dogs.	
	Fat digestibility is impaired in approximately one third of senior cats (Perez-Camargo, 2004), with a subsequent impact on the digestibility of vitamins B and E, potassium and other minerals (Laflamme, 2012).	An energy-dense diet may be especially useful for senior dogs in situations where food consumption is either insufficient to maintain an optimal weight or reduced for reasons such as cognitive dysfunction.
Micronutrients	Vitamin and mineral requirements of ageing dogs and cats are similar to adult maintenance requirements. Restriction without medical justification has no proven benefit but appropriate nutrient modulation may be required in the presence of specific diseases and when poor digestibility, lower absorption and/or increased losses are expected (FEDIAF, 2017; Villaverde, 2017).	
Fatty acids	Omega-3 (also known as n-3) and omega-6 (also known as n-6) fatty acids are associated with a number of health benefits and improved longevity in cats (Cupp et al., 2007). Omega-3 long-chain fatty acids (LC-PUFA), including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), are particularly valuable in modulating inflammation. Optimal intake may therefore benefit senior animals with inflammatory conditions, including osteoarthritis, and those with diseases that predispose them to cachexia. Omega-3 fatty acids have a role in reducing inflammatory mediators that may be present in sarcopenic dogs and cats.	
Medium-chain triglycerides (MCTs)	Unlike in dogs, MCTs have no demonstrable effects in improving cognitive function in elderly cats.	Ageing is associated with a reduction in the ability to metabolise and utilise glucose as the primary energy source for neurons, affecting memory, learning and awareness. The provision of MCTs as an alternate cerebral energy source can help to offset cognitive decline and preserve brain structure, thus maximising brain function in senior dogs (Pan et al., 2010).
Antioxidants	Antioxidants play a role in preventing cell damage caused by oxidative metabolites and in supporting the immune system.	
	Highly digestible diets rich in antioxidants and omega-3 fatty acids, as well as interactive toys and puzzles and environmental enrichment, may all help to slow the development of sarcopenia in cats (Ray et al., 2021).	Oxidative damage plays a significant pathophysiological role in ageing and the pathogenesis of age-related diseases such as canine cognitive dysfunction.

In certain disease conditions, the prescription of a therapeutic veterinary diet may be considered more appropriate than a senior life-stage diet and can have a profound effect on the clinical course and prognosis of the disease. Animals who present with multiple seemingly competing or conflicting comorbidities can prove challenging. A thorough nutritional assessment should ensure that minimum nutrient requirements are being met. Rapid instigation of nutritional support is indicated if dietary intake is insufficient to maintain weight.

For those animals that successfully maintaining weight, prioritisation should be given to dietary management of the condition that is most progressive, responsible for impairing quality of life and/or imparting the poorest prognosis. Where possible, nutrients of concern for the other condition(s) should also be addressed (Churchill, 2018).

Advancing age, alone, is not a reason to change the diet, and this should not be a routine recommendation for older animals that are healthy, in optimal body condition and already eating an appropriate diet (Fascetti, 2010; Laflamme, 2012; Wortinger & Burns, 2015). Once a nutritional plan has been determined and implemented, frequent patient monitoring and nutritional assessment is required, with appropriate modification to achieve the desired effect. It is also important to consider potential adjustments to feeding management, such as raising the height of food and water bowls (**Figure 1**) and making appropriate changes to account for alterations in the sense of taste and/or smell.



Figure 1. It is important to consider any potential adjustments to the feeding management of senior pets, such as raising the height of food and water bowls.

Optimising the role of the veterinary nurse in nutrition-related education and support

Veterinary surgeons and veterinary nurses (VNs) are leading authorities on pet nutrition and health care (Laflamme et al., 2008; Michel et al., 2008; Freeman et al., 2013; Connolly et al., 2014; Schleicher et al., 2019) and should be considered the most important source of information for pet owners.

However, factors such as limited consultation time often impact on our ability to provide this and we are rapidly losing ground to other media (Schleicher et al., 2019). It is therefore essential to build rapport and establish and maintain good relations with clients in order to become the primary and trusted source of animal-related nutritional advice and education.

It is also important to consider whether the practice is nutrition-friendly. For example:

- Does it have defined standards of nutritional care?
- Are there established processes and protocols in place to create, reinforce, remind/support and follow up on nutritional recommendations?
- Does the veterinary healthcare team collectively and effectively convey the importance of optimal pet nutrition to clients?
- If client footfall in the practice is low, are other communication methods, such as the practice website or social media sites, being sufficiently utilised?

Understanding owners' reasons for the diet selection and feeding practices they choose for their pets, as well as behaviours and attitudes influencing their decision making, is essential to facilitate better communication on appropriate dietary choices for pets.

Combining verbal provision of nutrition-related advice with other formats, such as handwritten or electronic instructions, can help reiterate a dietary recommendation and enhance compliance (Wayner, 2012; Wilson, 2013).

It is important for VNs to be involved in the nutrition-evaluation process when they have knowledge and skills in both nutritional concepts and communication (Freeman et al., 2011). There are many intrinsic and economic benefits to be gained through appropriate delegation and the provision of VN-led consultations and client education, not only in relation to diet and nutrition but also for other aspects of pet health and welfare.

Benefits include but are not limited to:

- An increased likelihood of owners disclosing a detailed and accurate (dietary) history to VNs rather than to veterinary surgeons.
- The ability to offer more time and cost-effective care
- The generation of additional revenue
- A potential increase in owner compliance
- An increase in job satisfaction, respect, appreciation and recognition, leading to happier colleagues
- The enhancement of the profile of the VN role among the general public.

VNs can play a key role in nutritional assessment, nutritional recommendation and follow-up (Corbee et al., 2019) and are critical in providing information exchange with clients (Johnson & Linder, 2013). As such, those with a special interest in nutrition are well placed to act as nutrition champions – promoting the inclusion of nutritional assessment as a standard component of patient care and helping reinforce good nutritional practice throughout the veterinary clinic.

Conclusion

Veterinary healthcare teams are expert sources of the information needed by owners for optimal pet nutrition. Direct nutritional education – using a team approach, multiple client contact points and available nutrition tools – can help to better educate clients about pet nutrition. Offering food and seeing it eaten is a primary means of human expression of care, so educating owners about appropriate feeding protocols and diet choices helps preserve the bond between pets and their owners. Clients who understand that preventive care preserves and lengthens their relationship with their pets are more likely to use veterinary services regularly, so team members should focus on proper nutrition for every patient that presents to their practice.

Life-stage nutrition tailors dietary requirements to optimise longevity, performance and health and to prevent disease. A 'one size fits all' approach to the nutritional support of cats and dogs is not appropriate. A nutritional assessment, with identification of any risk factors, is essential as part of wider, regular health screening. Good nutrition is not a fad – it is good medicine and good business. As Hippocrates is famously quoted as having said: *'let food be thy medicine and medicine be thy food'*.

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