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Nourishing dogs and cats through their twilight years

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Abstract

Ageing dogs and cats represent a significant proportion of the canine and feline population (Day, 2010). Factors attributed to increasing longevity in these species include improved veterinary healthcare, nutrition and a healthier lifestyle, with lifespan also reportedly influenced by genetics and breeding, gender, size, breed and neuter status (Roudebush et al, 2005).

Appropriate nutrition and dietary management have contributed to improved quality of life, and life expectancy, of senior dogs and cats and should be considered a key component of the care of these companion animals.

This article will explore the terms used to describe an ageing dog or cat, consider the species-specific nutritional adaptations required during this latter life-stage and how these can be met through dietary provision.

Introduction

The companion animal population is ageing with approximately 40% of pet dogs and cats aged seven years or older (Laflamme, 2012). Continued improvements in veterinary care and disease prevention strategies, veterinary nutrition, breeding and husbandry are just a few of the factors contributing to pet longevity, resulting in a significant population of senior small companion animals (Day, 2010; Biourge and Elliott, 2014; O'Neill et al, 2015).

The average lifespan is documented to be around 13 years, with a maximal life span of 27 years for domestic dogs and around 14 years, with a maximal life span as high as 25 – 35 years, for domestic cats (Wortinger and Burns, 2015). A recent study by O'Neill et al (2013) investigated longevity and mortality of owned dogs in England. Of deceased dogs with information available, 3961 (77.9%) were purebred and had a median longevity of 11.9 years. Longevity in crossbred dogs exceeded purebred dogs by 1.2 years. The authors later revealed

similar findings in relation to cat longevity with the median life expectancy of crossbred cats (14 years) exceeding that of purebred cats by 1.5 years (O'Neill et al, 2015).

Bonnett and Egenvall (2010) compared age patterns of disease and death in insured Swedish dogs, cats and horses. Whilst an increased survival over recent years was seen in both dogs and cats, extreme differences between breeds were noted when considering the age patterns of death in both species. An investigation by Inoue et al (2015) into the longevity of insured dogs in Japan revealed similar findings with marked differences across species and breed. A maximum lifespan of 13.8 years was reported for animals weighing less than 5kg and 14.2 years for those weighing between 5 and 10kg. Increasing weight positively corresponded with decreasing longevity, with dogs over 40kg reportedly living an average of 10.6 years.

Longevity estimates vary depending on the population evaluated. Despite the inherent sampling biases associated with reference to pet insurance data, such results can contribute useful information about the risk factors affecting pet longevity. These include;

- Breed and size
- Bodyweight
- Genetics
- Lifestyle
- Environment
- Nutritional status
- Clinical health

(Day, 2010; O'Neill et al, 2013)

Nutrition is one of the most important considerations in the maintenance of health and plays a critical role in the management of diseases, patient recovery and hospital outcome; a reflection of its acknowledgment as the fifth vital assessment (after temperature, pulse, respiration and pain). When considering the care of the ageing companion animal population, the proven ability of nutrition and appropriate feeding choices to positively influence life expectancy, biologic effects of advancing age and the onset and progression of chronic disease, cannot be overlooked (Kealy et al, 2002, Cupp et al, 2007; Larsen and Farcas, 2014).

It is therefore essential for the veterinary healthcare team to closely monitor the body condition and nutritional intake of dogs and cats, and provide pet owners with appropriate nutritional advice and recommendations.

How old is 'old'?

Ageing encompasses a complex set of processes, gradually leading to increased vulnerability and damage at the cellular and organ level with eventual death of the organism (Cupp et al, 2007, p133). Whilst the concept of ageing is difficult to define, it is commonly acknowledged that chronological age is not a reliable indicator of functional age. In all mammals, ageing is associated with changes in body composition and composition, declining organ function and immune status, and alterations in physical performance and mental alertness. Yet there is great individual variability between individuals, with changes occurring at different rates (Moser, 1991).

Many terms are used in literature to describe ageing dogs and cats, with a corresponding variation in the number of years considered to be "senior", "geriatric", "old" and "mature". The spectrum of life stages is affected by species and breed of animal. Whilst recognised as being arbitrary in nature, life stage divisions (Table 1) provide a practical framework to help inform the individualised care required by each animal throughout its life (Bartges et al, 2012). Transition from adult to mature stage of life is commonly acknowledged as being earlier in large and giant breeds of dog than in small and medium sized dogs (Fascetti, 2010). However, the attribution of an exact age range is subjective and, due to significant variation in the rate of ageing in dogs, is better considered relative to genetic makeup and phenotype (Larsen and Farcas, 2014). Similarly, cats age at varying rates and, whilst age designations can help to identify the physical and behavioural changes associated with different life stages, these are influenced by many factors and are not absolutes.

Whilst old age is not a disease, the ageing process is associated with a decline in organ function and immune response, in addition to development of a number of physiological changes. The design of optimal nutritional programmes for aged animals must be underpinned by

knowledge of these changes (Day, 2010, pS60). A number of physical and environmental alterations can affect a dog or cat's ability and desire to obtain adequate nutrition in later life, some of which are non-obvious and maybe overlooked by owners. These include, but are not limited to;

- Presence of chronic pain.
- Involution of nervous tissue, contributing to dysgeusia and diminution of smell.
- Reduction in visual and auditory senses.
- Decreased sensitivity to thirst and subsequent risk of dehydration.
- Decreased gastrointestinal motility, leading to constipation.
- Altered mobility and activity level.
- Alterations in behaviour – this could be a true behavioural problem or the result of a variety of disorders including systemic illness, chronic pain and cognitive dysfunction syndrome (CDS).
- Reduced thermoregulatory capacity and subsequent increased sensitivity to heat or cold.
- Changes in home environment (introduction or loss of another animal or person).

(Larsen and Farcas, 2014; Fascetti and Delaney, 2012; Markham and Hodgkins, 1989)

In a study to compare the physiological changes and characteristics of ageing cats, dogs and their owners, Heuberger and Wakshlag (2011) found a positive correlation between age, bodyweight and duration of illness. Similarities were found in the diet and lifestyle of owners and pets, with increased weight and sedentary lifestyle associated with health issues and ageing. It is therefore essential to obtain a comprehensive history and conduct a thorough nutritional assessment, as part of a regular assessment of general health.

Nutritional assessment

As with any medical intervention, there are always risks of complications and this is no different with nutritional interventions. Minimising such risk depends on careful patient selection and assessment. In 2011, the WSAVA Global Nutrition Committee launched Nutritional Assessment Guidelines for Dogs and Cats to help the veterinary healthcare team and pet owners ensure that dogs and cats receive optimal nutrition, tailored to their needs

(Freeman et al, 2011). These guidelines provide a framework for the veterinary healthcare team to assist them in making a nutritional assessment, and specific nutritional recommendations, for every patient at every visit (Figure 1).

The first stage of this process involves making a systematic 'screening' evaluation of the animal as well as identification of the diet fed and any feeding management/environmental factors. The identification of nutrition-related risks may warrant a more in-depth 'extended' evaluation of each of these factors and will impact on how, and when, the nutritional plan can be implemented (Table 2).

A nutritional plan should prevent (or correct) overt nutritional deficiencies and imbalances. A detailed dietary history, including information about the pet's normal feeding habits and preferences at home, must be obtained from the owner. The rate of functional change in body systems and organ capacity in ageing dogs and cats is dependent on many factors and can vary significantly between individual animals; it is not uncommon for more than one chronic disease to be present (Wortinger and Burns, 2015). A properly administered geriatric nutritional program involves good risk factor management and the provision of dietary recommendations on an individual basis, with modifications secondary to re-evaluation at regular intervals (Gross et al, 2010; Moser, 1991).

Addressing nutritional requirements through diet

The rate and manifestations of ageing are determined by a number of intrinsic and extrinsic factors, of which one is nutrition. The quality and, potentially, length of life can be improved through nutritional management (Debraekeleer et al, 2010). A variety of diets are now available and, with the many appealing marketing strategies used and health claims made, selecting one can prove challenging for pet owners. In a survey of dog owners, the majority of respondents identified senior dogs as having different nutritional needs to adult dogs, with 63% reporting ingredients as the most important factor in selecting a senior dog food (Hutchinson et al, 2011). As with other diets marketed for different life stages, diets designed for elderly dogs and cats are subject to legal guidelines, yet there is no legal definition for "senior" diets or agreement on the nutritional requirements for this life-stage, therefore

nutrient profiles vary widely and according to the manufacturer's philosophy (Villaverde, 2017; Hutchinson and Freeman, 2011). Hutchinson et al (2011) revealed that, of respondents who owned a senior dog, 42.8% fed a senior diet, out of which, only 33.1% fed this diet based on a veterinarian's recommendation.

Advancing age, alone, is not a reason to change the diet (Wortinger and Burns, 2015; Laflamme, 2012; Fascetti, 2010) and should not be a routine recommendation for older animals who are healthy, in optimal body condition and already eating an appropriate diet. Similar to other life stages, dogs and cats should be fed to maintain a lean body condition throughout their senior years (Fascetti, 2010) with treats and snacks making up no more than 10% of the animal's daily calorie intake. Increased feeding frequency and water intake, combined with increased physical activity, contributed to maintenance of lean body mass (LBM) in adult cats (Deng et al, 2014). For senior cats, whilst increasing physical activity may be more challenging, consideration could be given to increasing the frequency of portion controlled feeding and methods to encourage increased intake of fresh water. Unless there is specific justification, there should be no need to supplement the diet of senior animals and this could have detrimental effects on health.

Before prescribing any dietary change, the outcome of a nutritional and general health assessment should be evaluated, with any changes in body weight or composition, presence of disease or medical condition or identification of other risk factors taken into account. Whilst poor health and old age are not synonymous, domestic cats develop a similar range of spontaneously arising age-related pathologies to those described in dogs, including cognitive dysfunction, renal inflammation and interstitial fibrosis and osteoarthritis (Day, 2010, pS65). 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. As with any aspect of patient care, animals should be re-evaluated at appropriate intervals to ensure achievement of desired results (Laflamme, 2012).

In addition to individual and species-specific nutritional and dietary requirements, the effects of ageing on feeding management and general care should also be considered:

- Regular health checks, incorporating a nutritional assessment, should be promoted
- Good dental health should be maintained by owners and supported by the veterinary healthcare team.
- Consider ad lib feeding if the animal is underweight and/or a picky eater but avoid this method if the animal is overweight, instead incorporating regular, portion controlled, meals.
- If required, make changes to feeding management and/or dietary provision gradually over a period of at least a week.
- Texture of the food may need to be altered, for example, a patient with dental disease may find a moist or semi-moist diet preferable to a dry diet. However, such changes may not be readily accepted by older animals.
- Regular and sustained periods of exercise can help maintain muscle tone, optimal body weight and condition, enhance circulation and provide stimulation.

Nutritional requirements of elderly dogs and cats

An optimal nutritional programme for aged animals will take into account the physiologic changes and should reflect the objectives of nutritional management of elderly cats and dogs which include to:

- Maintain health and optimal body condition
- Prevent or slow down disease progression
- Eliminate or alleviating clinical signs of disease
- Support physiological changes
- Enhance quality of life
- Delay the onset of ageing
- Extend life expectancy

Variation exists in the nutrient profiles of commercial diets formulated for older animals (Hutchinson et al, 2011). Despite a lack of specific regulatory guidelines for senior diets, key nutritional factors reflect some of the biologic effects associated with ageing and are tailored to optimise longevity, performance and health.

Water

Water is a key nutrient and essential for life. Elderly animals are less sensitive to thirst stimuli which, combined with osmoregulatory disturbances, effects of diuretic drug therapy and disease, pose greater risk of dehydration. Whilst no difference was detected in faecal water loss between adult cats and those over 12 years of age, Patil and Cupp (2010) cited in Fascetti and Delaney (2012) found urine volume was significantly higher. It was hypothesised that such results reflected the decreased ability for aged kidneys to concentrate urine, even in the absence of renal insufficiency. Some animals are less adept to adjusting water intake with changes in dietary composition (i.e. changes from moist to dry food) and dehydration can further affect ability to maintain thermoregulation. Fresh water should be supplied to cats and dogs on an ad-lib basis, with routine monitoring of intake.

Energy

LBM is the main driver of energy requirements in healthy dogs and cats, accounting for 96% of basal energy expenditure. In dogs and cats, LBM has a tendency to decline with age, with a pronounced loss being associated with morbidity and mortality (Laflamme, 2012). Kealy et al (2002) found a 25% restriction in food intake increased median life span and delayed the onset of signs of chronic disease in dogs. A later study by Lawler et al (2008) supported similar effects of dietary restriction in delaying adverse health events and contributing to longevity, yet acknowledged the underlying molecular mechanisms, most influential for longevity, as being insufficiently understood.

In comparison to adult dogs, energy requirements for dogs in later years of life are reduced due to loss of LBM and reduction in exercise. Without a reduction in caloric intake, obesity will develop (Fascetti and Delaney, 2012). The number of obese cats declines after seven years of age, yet a significant number of mature cats remain overweight. In contrast, senior and geriatric cats are prone to weight loss, justifying an increase, rather than decline, in energy requirements (Sparks, 2011; Gross et al, 2010). Energy requirements and food intake should be adjusted accordingly to maintain a healthy weight and lean body condition.

Protein

Protein is essential for maintenance of LBM, nitrogen balance, protein synthesis and immune function (Wortinger and Burns, 2015; Fascetti, 2010). In contrast to diets formulated for adult dogs and cats, preservation of declining organ function in healthy elderly animals has traditionally influenced the justification for protein restriction in senior diets (Laflamme, 2012; Hutchinson et al, 2011). Potential benefits of this restriction include a delay in age-related renal impairment and slowed progression of subclinical renal disease (Gross et al, 2010). Recent evidence challenges this outdated view with the protein requirements of older animals now thought to exceed that of adults (Wortinger and Burns, 2015; Laflamme, 2012; Fascetti, 2010). Whilst conclusive evidence is lacking, restricted protein diets should not be routinely recommended for older animals unless the presence of disease warrants such dietary modification (Villaverde, 2017). Unnecessary restriction of protein can further exacerbate loss of lean tissue and protein-calorie malnutrition. Quality of protein is also an important consideration; high biological value (BV) provides efficient utilisation of protein source and reduced bacterial metabolites (Fascetti, 2010; Hutchinson et al, 2011).

Fibre

The inclusion of fibre in diets formulated for ageing dogs and cats helps to dilute energy density and control and prevent weight gain. Increased levels of dietary fibre are recommended for inactive animals and those prone to obesity, whilst lower levels of dietary fibre are recommended for those of ideal weight and body condition (Debraekeleer, 2010; Gross et al, 2010). Fibre also has a role in facilitating gastrointestinal health, in particular fermentable fibre, including prebiotics, which produce short chain fatty acids; an important energy source for colonocytes (Biourge and Elliott, 2014).

Other nutrients

Diets intended for ageing dogs and cats frequently include a variety of other nutrients and nutritional supplements with accompanying claims to suggest these can have a positive effect. Vitamin and mineral requirements of an elderly dog and cat are not dissimilar to those during

the adult life-stage. The provision of a complete diet, suitable for the intended species, health status and age should be sufficient to meet this requirement. Patients with subclinical disease associated with a malabsorption syndrome or polyuria may have increased losses of water-soluble and fat-soluble vitamins. In addition, fat digestibility can be impaired in geriatric cats with subsequent impact on the digestibility of vitamins B, E, potassium and other minerals (Laflamme, 2012). Vitamin and mineral restriction without medical justification has no proven benefit (Villaverde, 2017).

Oxidative damage plays a significant pathophysiologic role in ageing and the pathogenesis of age-related diseases such as cognitive dysfunction (Roudebush et al, 2005). In contrast to cats fed exclusively a nutritionally complete diet, those fed a diet supplemented with a blend of antioxidants, prebiotic and particular ratio of n-3 and n-6 fatty acids led to a prolonged lifespan and improvement in a range of clinical measures of health (Cupp et al, 2007). Such findings suggest these nutrient interactions could measurably benefit health and longevity.

Summary

Senior pets represent approximately 40% of veterinary patients, a number predicted to rise with advances in technology and education. The “human-animal bond” contributes to increases in the life expectancy of pet dogs and cats with owners looking to the veterinary healthcare team to provide advice on optimal nutrition, appropriate to the species, life-stage and health status of pet. Life-stage nutrition tailors dietary requirements to optimise longevity, performance and health and to prevent disease. A 'one size fits all' approach to nutritional support of ageing cats and dogs is not appropriate and a nutritional assessment, with identification of any risk factors, is essential as part of a wider health screening.

Tables and illustrations

Table 1: Definition of life stages for dogs and cats (adapted from Bellows et al, 2016, p552; Bartges et al, 2012, p2; Hoyumpa Vogt et al, 2010, p43). Note that age designations are influenced by many factors and are not absolutes.

Stage	Dogs	Cats
Puppy / Kitten	Neonate until reproductive maturity.	0 – 6 months
Junior	Reproductively mature, still growing.	7 months – 2 years
Adult / Prime	Finished growing, structurally and socially mature.	3 – 6 years
Mature / middle aged	From adult up to approximately the last 25% of expected lifespan (a window of time around half life expectancy for breed). In small and medium breed dogs, this stage is generally considered to begin at 7-8 years of age but in large and giant breed dogs it is from 5+ years.	7 – 10 years
Senior	From maturity to life expectancy (approximately the last 25% of expected lifespan).	11 – 14 years
Geriatric	At life expectancy and beyond.	15+ years

Table 2: Examples of factors to consider when completing a nutritional assessment.

	Patient factors	Dietary factors	Feeding and environmental factors
Initial screening evaluation	<ul style="list-style-type: none"> • Age? • Physiological status? • Activity levels and daily exercise? • Body condition? • Body weight? • Existing medical conditions? 	<ul style="list-style-type: none"> • Conventional or unconventional? • Suitability for the species and life-stage? • Storage of the diet? • Complete versus complementary? • Composition (including ingredients)? • Feeding guidelines? 	<ul style="list-style-type: none"> • Frequency, timing, location and method of feeding? • Food container and material e.g. Metal bowl, food dispensing toy • Multi-pet household? • Quality of surroundings and husbandry? • Pet's access to space?
Extended evaluation	<ul style="list-style-type: none"> • Changes in food intake or behaviour? • Alterations in gastrointestinal function and faecal production? • Condition of the skin? • Effect of medical conditions and any medication? 	<ul style="list-style-type: none"> • Other sources of nutrients, e.g. access to treats, snacks and table food? • Type, formulation, energy density, texture and flavour of diet? 	<ul style="list-style-type: none"> • Primary feeder of pet? • Other providers and sources of food? • Extent of enrichment? • Environmental stressors? • Presence of conditions and/or circumstances causing fear and anxiety?

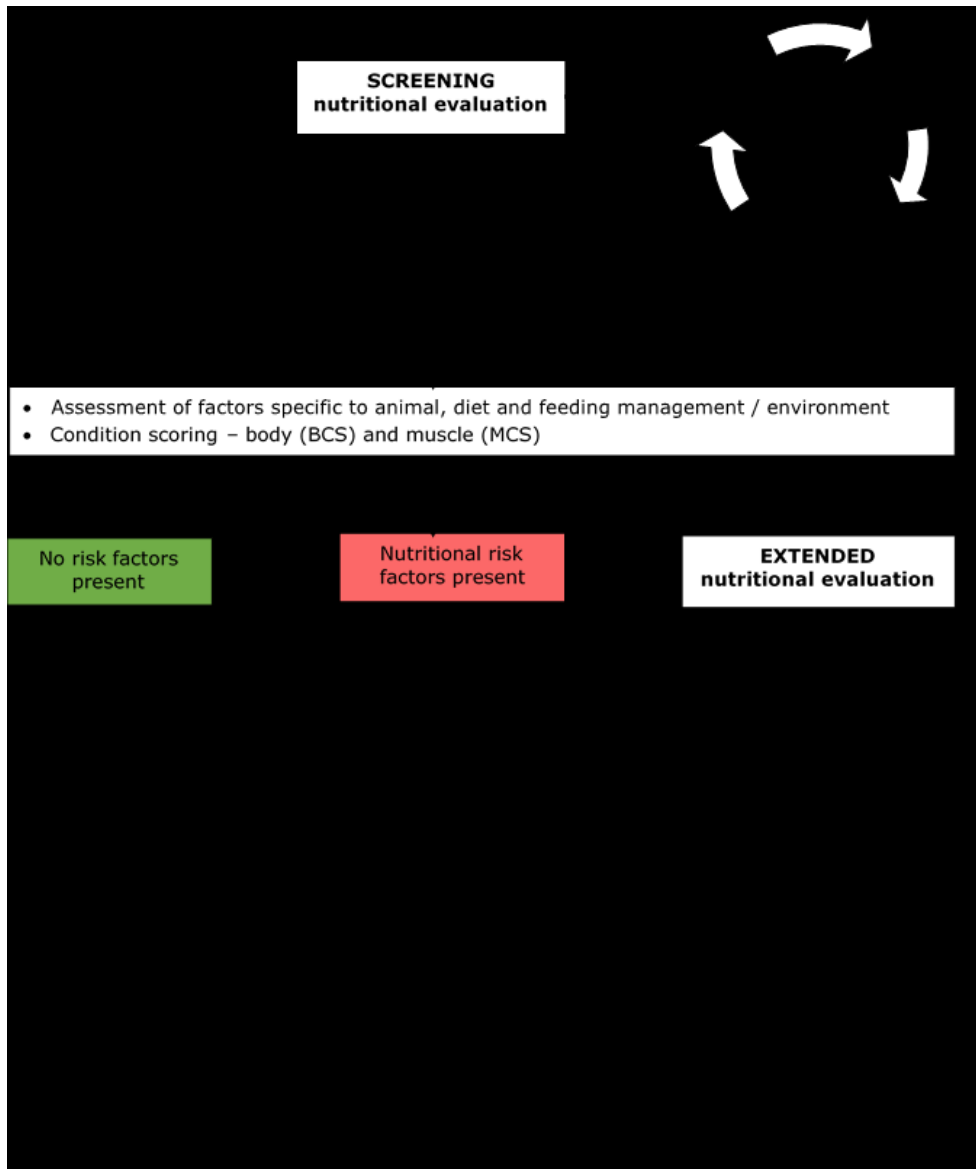


Figure 1: The nutritional assessment process using the WSAVA Nutritional Assessment Guidelines for Dogs and Cats (modified from Freeman et al, 2011).

Key points:

- Longevity is affected by a variety of intrinsic and extrinsic factors including nutritional status, breed, lifestyle, presence of disease, fear and anxiety.
- The design of optimum nutritional programmes for aged animals must be underpinned by knowledge of the physiological changes that occur in later life.
- Nutritional recommendations should be based on the completion of a nutritional assessment and tailored to individual needs of the animal.

Key words:

Ageing; cat; dog; veterinary life-stage; nutritional assessment

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