

Nutrition of Canine and Feline Geriatrics

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Abstract

Greying of the muzzle, stiffness in movement, changes in posture, reduced responsiveness to outside stimuli are external signs of increasing age. The ageing process is complex and we have yet to discover its secret. The person who does - and can find a way to delay it - stands to make a fortune! In humans, the mean life-expectancy can be predicted based upon sex, race, socio-economic and other factors. For example, in western society women live longer than men and smokers have a reduced life expectancy. Factors affecting the life expectancy of cats and dogs have not been fully determined and within breed and across-breed comparisons have not been made though it is generally accepted that large and giant breeds of dog have a shorter life expectancy than small breeds.

Insufficient work has been done on the nutritional requirements of older cats and dogs or on the effects of nutrition on age-related changes, and so the first two premises are controversial. However, the role of certain nutrients in some common diseases of old animals is well documented and many of these diseases are often slow and insidious in their onset and progression, and so dietary manipulation may be beneficial. Old dogs and cats have nutritional requirements for energy, protein, fat, minerals and vitamins.

Keywords: Geriatric; Conception; Growth; Reproduction; Stiffness.

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There is no specific definition of a geriatric animal, though we all recognise external signs of increasing age such as greying of the muzzle, stiffness in movement, changes in posture, reduced responsiveness to outside stimuli, and so on. There are many problems about defining life-stages based on chronological age in cats and dogs because breeds have differing rates of ageing, lead different lifestyles and have different life expectancies. There is a simplified classification scheme (Table 1.1) based upon functionality rather than chronological age which can be applied at any time to any individual. There are many theories about the ageing process including the concept that all living creatures are genetically programmed to age - a 'biological clock' theory. Most higher living organisms have a relatively brief life consisting of the following basic life stages: conception, growth, reproduction and death. Only a few species (including humans and domesticated pets) pass through a post-reproductive senescent stage known as 'old age'. In the wild, most animals have predators that prevent the frail and infirm from surviving.

The ageing process is complex and we have yet to discover its secret. The person who does - and can find a way to delay it - stands to make a fortune! In humans, the mean life-expectancy can be predicted based upon sex, race, socio-economic and other factors. For example, in Western society women live longer than men and smokers have a reduced life expectancy. Factors affecting the life expectancy of cats and dogs have not been fully determined and within breed and across-breed comparisons have not been made though it is generally accepted that large and giant breeds of dog have a shorter life expectancy than small breeds.

Table 1.1 Proposed description for age stages of cats and dogs.

Age stage Description

1. (Fetal) Conception to birth - from fertilisation through embryological development to birth
2. (Growth) Growth - from birth until skeletal growth is completed

3. (Adulthood) Young adulthood - active reproductive phase. Until age-related changes
4. (Ageing) Advanced adulthood - obvious external signs of ageing and/or evidence of age-related changes affecting the function of at least one major organ system
5. (Senile) Age-related loss of central nervous system function leading to cognitive impairment and/or loss of control over at least one major organ system

Ageing changes

We can make several observations about ageing changes:

1. they are progressive
2. they are irreversible
3. multiple organ systems are involved
4. physiological mechanisms ultimately become impaired
5. variable expression is shown between individuals.

Ageing changes that may occur in tissues include:

- atrophy
- fatty infiltration
- fibrosis
- delayed ability to repair
- reduced number of active cells
- reduced rate of activity
- reduced organ function.

The pigment lipofuscin is deposited in body tissues in increasing amounts with increasing age, indeed it has been called 'the pigment of ageing'. In the dog lipofuscin is deposited at five times the rate that it is in humans.

Ageing changes proceed at varying rates in different organ systems of the body, and may be present in varying degrees of severity between individuals of the same age. Typically, older animals lose sensitivity of their major senses, e.g. vision, hearing, taste and smell, and all organ systems may be affected to some

degree by age-related changes. Geriatric screening is helpful in determining whether or not organ function is impaired, particularly before elective procedures such as minor surgery. Some organ systems are more likely to be affected than others, for example with increasing age teeth are likely to demonstrate: dental calculus accumulation ?gingival hyperplasia ?periodontitis ?gum atrophy and retraction ?enamel wear ?ulcerative lesions ?tooth loss. By the time they are 7-8 years of age 95% of dogs are said to be affected by periodontal disease.

The occurrence of obesity increases with age probably due to:

1. reduced lean body mass (hence reduced basal energy requirement)
2. reduced exercise
3. over nutrition.

Obesity can have serious effects on other body systems, e.g. cardiovascular and skeletal systems, and may have a role in the cause of some diseases, e.g. diabetes mellitus.

Manipulation of dietary intake in older animals is necessary when there is either:

- (1) frank clinical disease present
- (2) subclinical disease present
- (3) the nutritional requirements of the individual have changed.

Commercial pet foods have been formulated specifically for old dogs and in the future it is likely that foods will be developed for older cats as well. The justification for such products is based upon several premises:

- (1) That older animals have different nutritional requirements from younger adults.
- (2) That it is desirable to reduce the dietary intake of certain nutrients because they may be risk factors for the development, onset or progression of age-related changes.
- (3) That it is desirable to reduce the dietary intake of certain nutrients because they may be risk factors for the development, onset or progression of disease processes.

- (4) That it is desirable to increase the dietary intake of certain nutrients because of an increased requirement in older animals due to ageing changes in various organ systems.
- (5) That it is desirable to increase the dietary intake of certain nutrients because of increased requirements due to the likely presence of subclinical disease.
- (6) That many owners feed their animals a ration that greatly exceeds their nutritional needs.

Insufficient work has been done on the nutritional requirements of older cats and dogs or on the effects of nutrition on age-related changes, and so the first two premises are controversial. However, the role of certain nutrients in some common diseases of old animals is well documented and many of these diseases are often slow and insidious in their onset and progression, and so dietary manipulation may be beneficial. Good examples are endocardiosis in dogs and chronic renal failure in both cats and dogs .

It is true that many owners feed rations that grossly exceed the nutritional needs of their animal so reducing dietary intake to meet requirements may be beneficial, will help reduce the likelihood of obesity occurring and is unlikely to be harmful.

Age-related changes that may affect nutrition

Age-related changes that may occur and affect nutrition include:

- reduced appetite
- reduced sense of taste
- reduced sense of smell
- reduced secretions - saliva, gastrointestinal secretions (including enzymes)
- reduced absorption?
- reduced transportation?
- reduced utilisation - liver

- reduced ability to excrete waste products - liver disease, renal disease increased requirement for nutrients - zinc?
- shift in body weight distribution from lean body mass to fat.

Energy

For any individual, energy requirements may stay the same, increase or decrease with advancing age. There are few studies looking at the energy needs of large numbers of old cats and dogs.

With advancing age a fall in basal metabolic rate has been recorded in humans and experimental animals. This is thought to be due to a change in the ratio between lean body mass and fat, there being an increasing tendency to lay down body fat with advancing age.

There are several possible explanations for this trend:

- (1) reduced thyroid hormone activity (secretion or receptor response)
- (2) other hormonal effects, e.g. sex hormones, catecholamines.

Similar effects may also be seen in dogs and cats. Certainly there is an increased incidence of obesity in dogs with increasing age (Edney & Smith, 1986).

Energy requirements may also be reduced if an individual is doing less exercise due to changed behavioural patterns or secondary to other problems, e.g. an orthopaedic problem such as degenerative joint disease or osteoarthritis.

Older animals with reduced energy requirements should have their energy intake reduced otherwise obesity may result. Regular weighing of older animals should be recommended to detect any trend towards weight gain.

Obesity should be regarded as a serious problem in older cats and dogs. Obese animals have reduced glucose tolerance and hyperinsulinaemia (Mattheeuws *et al.* 1984a; Mattheeuws *et al.* 1984b) even in the absence of frank evidence of diabetes mellitus. Gross obesity can significantly reduce cardiovascular

and respiratory function and also exacerbates numerous other problems such as skin disorders, and orthopaedic problems. Obesity in cats is a risk factor for the development of hepatic lipidosis and in cats and dogs it is a risk factor for the development of diabetes mellitus.

Most major organ system diseases seen in older animals (e.g. cardiac disease, renal disease, hepatic disease and neoplasia) result in catabolism and weight loss.

This is particularly important in cats which, because of their high protein-calorie requirement rapidly break down their own body muscle and other available proteins in the presence of inadequate protein intake or excessive energy utilisation. Almost all chronic diseases in the cat result in significant weight loss or even cachexia.

When energy intake does not meet requirements additional energy should be provided and the selection of energy source (fat, protein or carbohydrates) will depend upon the underlying clinical status of the animal. In cats protein is a major provider of energy because of their obligate carnivorous nature, however fat provides 2.25 times more energy than either protein or carbohydrate and so this will often be the high energy source of choice for both cats and dogs. Carbohydrate will be used when high protein or fat intake is contraindicated in the individual because of the presence of impaired organ function or disease (e.g. renal failure, hyperlipidemia).

Protein

The protein requirements for geriatric cats and dogs have not been determined. In the absence of clinical or subclinical disease minimum protein requirements are probably the same as for adults. It must be remembered that cats are obligate carnivores with higher protein requirements than dogs.

Protein intake should be maintained near to the minimum requirement in situations in which excessive protein intake is considered to be a risk factor for disease progression (e.g. chronic renal failure); or when excessive protein

intake may have a direct clinical effect (e.g. hyperammonaemia in hepatic disease, and uremia). It is controversial whether or not early dietary restriction of protein may prevent the onset of age-related progression of renal failure, though there is good experimental evidence that avoidance of excessive protein intake delays progression once renal damage is present.

It should be noted that no authorities recommend reducing protein intake below the minimum requirement, and that in the presence of chronic renal failure protein requirements may actually increase to twice that recommended for normal adult animals. Avoidance of unnecessary excesses is recommended not restriction below actual requirements. The term 'low protein' and 'protein restriction' which are in common use are therefore somewhat misleading.

Geriatric patients benefit from the feeding of high quality protein sources which are:

- highly digestible
- contain high concentrations of essential amino acids.

Protein sources with a high biological value include egg, liver and other animal source ingredients. Cereals have a lower biological value, but feeding a ration containing a mixture of plant and animal source materials can increase the overall biological value of the protein in the food by providing a better balance of amino acids.

Fat (Oils)

The fat requirement for old cats and dogs has not been determined and, in the absence of subclinical or clinical disease, it is likely to be the same as that for younger adults.

Fat is a high energy nutrient and excessive intake is likely to lead to the development of obesity, hence total daily intake should be controlled to maintain a fit healthy body weight.

Essential fatty acids have many important roles to play in the body including cell membrane structure and skin and hair coat

condition. Some authorities consider supplementation of a ration with essential fatty acids of possible benefit for old animals, and it is unlikely to be detrimental unless excessive quantities are given in the absence of sufficient antiin the ration (e.g. vitamin E). Fat intake should be carefully controlled in the presence of liver disease, pancreatic disease, hypothyroidism and other causes of hyperlipidemia. Cats and dogs rarely develop coronary artery disease and in these species dietary fat intake does not appear to be a risk factor for the development of cardiovascular disease.

Carbohydrate

As long as the food contains sufficient quantities of gluconeogenic amino acids and fat, there is no dietary requirement for carbohydrate in cat or dog rations. However, in feeding trials carbohydrates in the form of starch are well utilised by both cats and dogs and it is a useful raw ingredient.

Carbohydrates in the form of dietary fibre may be beneficial in maintaining normal gastrointestinal function in geriatric patients because of their effects on motility and the water content of stools. They may decrease the occurrence of constipation in animals predisposed to develop it - though few clinical studies have been performed in the dog or cat. Fibre in the diet also reduces the bioavailability of all energy producing nutrients (i.e. fat, carbohydrate and protein) and so should probably be avoided in animals with compromised gastrointestinal function - particularly those with malabsorption.

Vitamins

Some authors consider that older animals should be provided with increased quantities of vitamins in the ration to overcome reduced ability to digest and/or absorb them from the ration though there is little evidence to support this viewpoint.

Water soluble vitamins are lost from the body in the urine and polyuria such as accompanies

chronic renal failure or diabetes are indications for increasing dietary intake to compensate for urinary losses.

Vitamin intake should probably also be encouraged in the presence of reduced liver function.

Minerals

There is concern about the amounts of some minerals in rations fed to older animals, particularly: Phosphorus, Sodium, Potassium, Zinc and Calcium.

Phosphorus

It is known that phosphorus retention occurs frequently in animals with chronic renal failure. This can result in calcification of various tissues including the kidneys themselves. For this reason high dietary intake of phosphorus should be avoided in older animals.

Controlling dietary phosphorus intake has been shown to delay the progression of renal failure in several studies .

Sodium

Many older dogs have endocardiosis which, even in compensated patients, results in sodium retention through activation of the renin-angiotensin-aldosterone pathway. Also, hypertension is a common proin chronic renal failure in dogs and excess sodium load may make this worse. In humans clinically normal people with high salt intakes have higher blood pressure, and there is an age-related increase in blood pressure as well. Although primary hypertension is rare in cats and dogs, some dogs are known to have salt-sensitive hypertension and recent studies at the Royal Veterinary College have demonstrated an increase in blood pressure with advancing age in cats and dogs (Bodey 1995 personal communication). In the presence of congestive heart failure sodium intake should be minimised to decrease its effects on preload. While conventional treatof dogs with endocardiosis states that treatment is

unnecessary until heart failure is decompensated the author considers early introduction of reduced sodium diets helpful, particularly as the hypothalamic-pituitary-adrenal axis is stimulated early in the disease and switching old dogs from a relatively high sodium content ration to a relatively low sodium content ration can be difficult in some individuals due to acquired taste preference for salt.

Potassium

Potassium is very important as the main intracellular electrolyte in the body and depleted concentrations lead to weakness and neuromuscular abnormalities.

Severe potassium loss can occur in renal disease leading to clinical hypokalaemia, therefore care is needed to avoid a ration with low potassium in such cases.

Zinc

Some authors suggest that older dogs require an increased dietary supply of zinc, presumably due to decreased ability to digest/absorb it. In cancer patients supplementation with zinc can lead to improved appetite and enhanced immune response.

Calcium

High concentrations of calcium in a ration can reduce the bioavailability of other minerals such as copper, zinc and phosphorus so excessive dietary intake should be avoided particularly in rations containing relatively small amounts of trace elements, and in individuals with impaired gastrointestinal function such as malabsorption.

High calcium intake can also stimulate hypercalcaionism and suppress

parathyroid hormone activity which may be significant and complicate the clinical picture in some cases. Excessive calcium intake should be avoided as this can encourage the

development of nephrocalcinosis and other soft tissue calcification in at-risk individuals.

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