# Nutrition for Geriatrics

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It has been said that the only thing certain about life, is death. However, just as certain is that as animals age, physical and physiological changes occur. Loss of hair pigmentation, loss of skin elasticity, and visual and auditory decline are well recognized. Impaired immunity (immune senescence), skeletal muscle loss, and cognitive impairment are just some of the many more subtle changes that can occur with old age.

Chronological age does not accurately predict the presence of age-related physiological changes in dogs or cats (biological age). Individuals vary substantially in the age at which they demonstrate obvious signs of old age. On the basis of recent studies of human twins and families, biological age has been estimated to have a heritability of 27% to 57%. This indicates that environmental influences are the greatest determinants of the aging process, and it is likely that nutrition is a significant component.

However it also indicates that chronological definitions of "senior", "geriatric", or "old aged" are inappropriate and misleading, and border on arbitrary. Thus defining any given animal as "old" in order to prescribe altered requirements is dependant on individual assessment and not on a rigid adherence to chronological categories. For the purpose of this presentation, "geriatric" is defined as demonstrable features attributable to the aging process.

## Changes in body composition

Obesity is perhaps only second to dental disease as the most common condition affecting domestic cats and dogs world-wide. Age has been identified as a risk factor for obesity in several studies. In response, several pet-food companies have produced diets for "senior" animals that have lower energy contents than adult maintenance diets. However, geriatric animals often lose weight, and the incidence of obesity declines with age within a population as a consequence of physiological changes within individuals, and the shortened life-span of obese individuals.

The cause of the weight loss appears to be a combination of a decreased appetite and decreased food digestibility, and results in a loss of lean body mass (sarcopenia) and, to a lesser extent, fat mass. The causes of the decreased appetite are not well defined in cats and dogs but could include changes in taste and smell, and changes in gastric motility that could lead to early satiation. In aged humans basal and stimulated concentrations of the satiating hormone, cholecystokinin, are increased, which is thought to contribute to early meal cessation.

Meal-induced thermogenesis shows a delay to peak, possibly due to a delay in gastric emptying. Inadequate data are available on the effect of aging in dogs and cats on other energy-producing mechanisms such as adaptive thermogenesis. These physiological changes place older cats and dogs at major risk of developing pathological weight loss when they develop disease states,

especially those associated with inflammatory cytokine responses that compound lean body mass loss.

In both dogs and cats, geriatric weight loss is significantly associated with mortality due to numerous diseases. Weight loss may be very gradual, beginning as early as 2 years prior to death. In a study of cats in the year before death from neoplastic, renal, or thyroid disease, an average bodyweight loss of 10% was seen.

## Nutrient requirements of geriatric dogs and cats

The energy requirements of animals as they age vary between animals just as the ages at which animals become geriatric. The resting energy requirement (RER) of an animal is the energy required to maintain cellular process at rest in a thermoneutral environment. Although the RER may decline with aging, this is mainly due to the decline in lean body mass. The RER is also decreased due to a decline in Na+-K+-ATPase activity, decreased muscle protein turnover, and possibly due to changes in mitochondrial membrane permeability (mitochondrial leak).

The maintenance energy requirement (MER) of a reproductively inactive, adult animal is the sum of the RER plus the energy required for physical activity; food digestion, absorption, and assimilation; and thermoregulation. For a typically active adult animal, the MER is between 1.2 to 1.5 x the RER, and physical activity accounts for most the energy required beyond the RER.

Geriatric animals are almost universally less active than younger adults leading to a decreased MER. This has been measured to be between 10% and 25% less than that of a young adult dog. However, despite reduced activity, the MER may not decrease by the amount predicted by the decrease in activity. Indeed, as age progresses, the MER tends to increase in cats (See figure).

There is no evidence to support the practice of indiscriminate dietary protein restriction in geriatric dogs and cats. In fact protein requirements appear to increase with age such that old Beagles require almost 50% more protein to maintain nitrogen balance than young Beagles. The consequences of protein malnutrition in geriatric animals is well established, and immune impairment, delayed wound healing and tissue repair, and increased susceptibility to oxidative stress are known sequelae. The decrease in appetite, loss of lean body mass, and decreased protein digestibility that occurs in some animals (see below) makes geriatric animals very susceptible to protein malnutrition.

The requirements of essential nutrients for optimal nutrition in older cats and dogs have not been well established but they may not be significantly different from young adults. Decreases in fat and protein digestibility (see below) may result in decreased absorption of fat soluble vitamins, or increased requirements for non-protein nitrogenous compounds such as choline or taurine, the synthesis of which may be limited. Although accumulative oxidative damage from mitochondria-derived free radicals is a central hypothesis in the theory of aging, the efficacy of increased dietary antioxidants remains largely unproven. The one exception would be in slowing the development of age-associated cognitive dysfunction in dogs, where high dietary concentrations of vitamin E, ascorbate, and lipoic acid improve learning and recognition in aged Beagles.

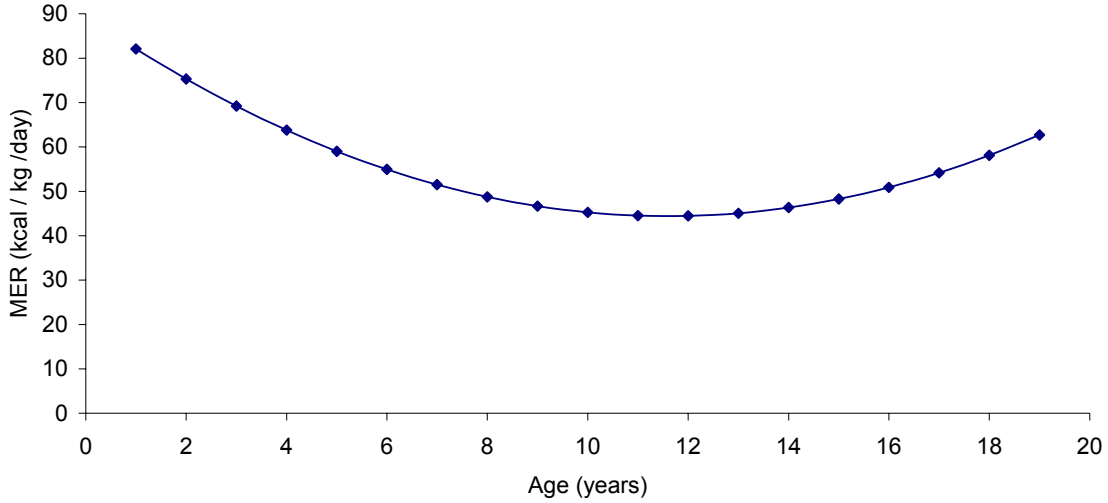
## Nutrient Digestibility

Both protein and fat digestibility decreases with age in many cats. This is especially true for fat digestibility, where more than 30% of cats older than 12 years have demonstrable compromises in fat digestibility. Although declines in protein and fat digestibility with age may be seen with some dogs leading to greater variability in digestibility with age, it appears reasonable to conclude that the majority of dogs maintain digestive efficiency as they age.

It is unclear why the ability of cats to digest fat and protein should decline with age. Alterations in intestinal transit time, pancreatic enzyme activity, intestinal absorptive area, and brush border enzyme activity remain possibilities, although studies have yet to provide support for any of these. It is now commonly recommended to increase dietary fat in underweight cats that have evidence of fat malabsorption. This recommendation may be appropriate, but care should be taken not to induce steatorrhoea, or diarrhoea as the result of hydroxylation and oxidation of unabsorbed fatty acids.

## Recommendations

The key to optimum nutrition in geriatric patients is individualization, rather than generalization. Close adherence to ideal body conformation and careful attention to weight changes in older animals is important. Patients that are overweight should be induced to lose weight at slow rates (1-2% bodyweight per week) while feeding to preserve lean body mass. Underweight patients should be fed highly digestible energy dense diets but with care not to simply increase fat mass. Active dog or working dog formulae may be ideal for underweight dogs. Indiscriminate protein or calorie restriction is not recommended and many premium maintenance adult diets may be perfectly adequate to maintain optimum health throughout an animal's adult life. Although the consequences of loss of lean body mass and body weight are known, it is not known if intervention will affect morbidity or delay mortality, but it seems prudent to intervene in the absence of evidence.




**Effect of age on MER in cats**: Formula MER = 89.576 – [(7.771 x age) + (0.334 x age$^2$)] taken from Laflamme DP, Ballam JM. Effect of age on maintenance energy requirements of adult cats. Compend Contin Edu Pract Vet 2002;24(Supp):82.

## Reference

Laflamme DP. Nutrition for aging cats and dogs and the importance of body condition. *Veterinary Clinics of North America. Small Animal Practice* 35, 713-42, 2005