

Gastrointestinal

1 Changes in the gastrointestinal tract

There are several hypotheses to explain the changes that take place in the gastrointestinal tract of cats and dogs as a consequence of aging. These include:



2 Sense deterioration can reduce food intake

- ✓ With age, the number of taste buds and nerve endings in the nasal cavities is reduced, which may be why pets have a decreased interest for food.
- ✓ It is unclear whether this is due to a deterioration of the sense organs or to behavioral changes. The cognitive dysfunction syndrome is a combination of several of these changes.



Cognitive dysfunction syndrome

- ✓ It has been reported in cats and dogs. The prevalence of the disease varies with age, with values of 28 % and 50–68 % at 12 and 15 years of age, respectively, in both species. The causes are neurohistopathological and neurochemical; over time, the brain suffers oxidative stress due to its high lipid content.
- ✓ In addition, older animals have acquired routines and are very sensitive to situations of stress (owner's death, a new pet, moving house), which may cause them to display anorexia/hyporexia.
- ✓ In any case, the result of these processes is a progressive loss of weight and muscle mass.



Brain deterioration



New pets



Owner's death



Moving house

changes due to aging

3 Decreased levels of some hormones

✓ The levels of some hormones related to food consumption have been reported to decrease with age. This is the case of ghrelin, a hormone synthesized in the gastric mucosa with an orexigenic effect (appetite stimulant), which could contribute to reducing the appetite of senior dogs.

✓ Cats are the exception to this weight-loss rule. Healthy old cats increase their food intake to compensate for the deficiencies in their digestive processes.

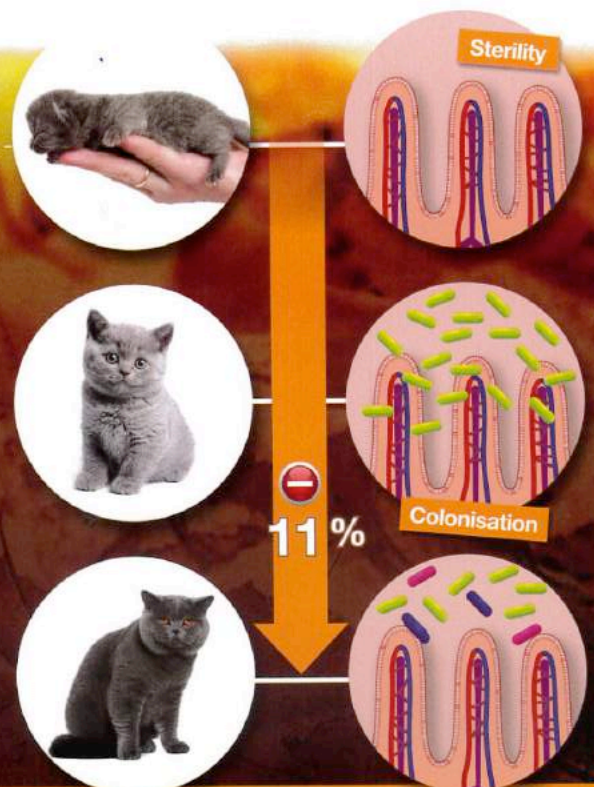
4 Changes in nutrient digestibility and efficiency

✓ There is some controversy on the changes in nutrient digestibility and efficiency of use. No significant results have been obtained, but, when compared with a group of young cats (<6 years), a tendency to a reduced energy and protein digestibility has been observed in older cats (>8 years), as well as significant differences in fat digestibility. The latter value is reduced by approximately **11 %**, although the authors do not consider whether this may be due to a reduction in pancreatic or biliary secretions.

✓ In human medicine, the efficiency of protein use has been shown to be reduced in senior patients. Similar studies conducted in dogs reveal similar results: old dogs need approximately **50 % more protein** to maintain and recover their nitrogen reserves.

5 Changes in the intestinal microbiota

- ✓ The digestive tract is sterile at birth, but it is rapidly colonized by the microbiota of the environment, which will suffer changes as a result of diet and age.
- ✓ In general, and although some genera increase their population, the total number of bacteria in the large intestine decreases by approximately 11 % compared with adult animals.
- ✓ In senior dogs, bacteria of the following genera are increased: *Clostridium* spp. (by up to 300 %), *Streptococcus* spp., *E.coli*, *Lactobacillus* spp. and *Bacteroides* spp. when compared with adult dogs. On the other hand, bacteria of the genera *Bifidobacterium* spp. and *Eubacteria* spp. are lower in number.
- ✓ This type of changes in the microbiota, particularly in the amount of clostridia, may affect the physiology of the digestive tract, e.g., protein and carbohydrate fermentation with modifications in the quality of the feces and formation of volatile fecal substances, or inhibition of the local IgA.



Other systemic

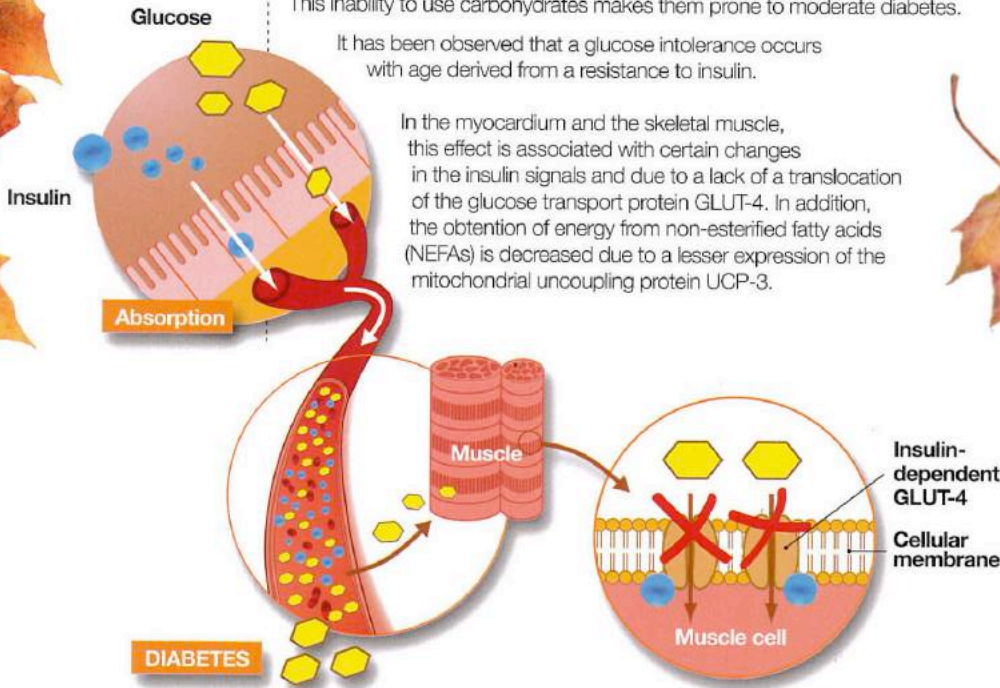
1

Difficulties regulating blood glucose

Older dogs require longer periods of time to regulate their postprandial glycemia. This inability to use carbohydrates makes them prone to moderate diabetes.

It has been observed that a glucose intolerance occurs with age derived from a resistance to insulin.

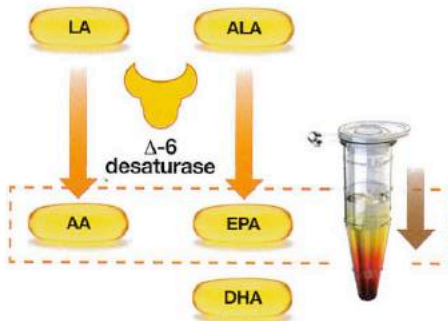
In the myocardium and the skeletal muscle, this effect is associated with certain changes in the insulin signals and due to a lack of a translocation of the glucose transport protein GLUT-4. In addition, the obtention of energy from non-esterified fatty acids (NEFAs) is decreased due to a lesser expression of the mitochondrial uncoupling protein UCP-3.



2

Loss of capacity to de-saturate essential fatty acids

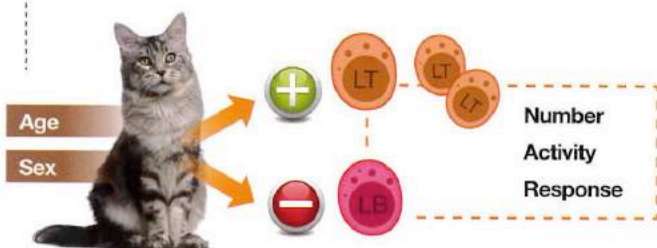
The activity of desaturases, especially the Δ -6 desaturase, in the synthesis of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) from α -linolenic acid (ALA), and of arachidonic acid (AA) from linoleic acid (LA), is reduced as a consequence of aging. Therefore, in old dogs, the concentrations of AA and EPA in serum are decreased.



3

Lower response of the immune system

The immune system is also affected by age and sex; especially B and T cells, whose numbers are affected along with their activity (phagocytic, chemotactic and mitogenic) and their lymphoproliferative response. Generally, B cells decrease while T cells, namely CD8 cells, increase.



changes of aging

4

Slower basal metabolism

- ✓ As a consequence of the changes that take place in the body composition, it has been demonstrated that the basal metabolism gets slower with age.
- ✓ On the other hand, with age, muscle mass, bone tissue, and water are lost, while, fatty tissue is deposited.



and greater deposit of fat



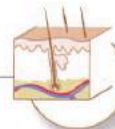
Fur

The fur loses density and color; grey hairs appear due to a lower number of melanocytes and a lack of activity of the tyrosinase (it synthesizes melanin and eumelanin from the amino acids tyrosine and phenylalanine).



Muscle mass

The decrease in muscle mass could be caused by the loss of motor nerves and lack of activity, leading to the process of cachexia mediated by the ubiquitin-proteasome pathway (system involved in the intracellular protein renewal).



Skin

The skin becomes drier and loses elasticity due to the atrophy of the epidermis and of the follicles.



5

Other physiological changes with specific nutritional treatment

Among the most obvious, and those that require the most attention from a nutrition perspective, we find **the loss of the functional capacity of the kidneys and the heart.**

- ✓ Chronic kidney disease (CKD) and cardiovascular diseases are within the first three causes of death in senior animals (the other cause is cancer). More than 50 % of dogs and cats that present CKD are older than 10 years of age. Heart failure (HF) affects 30 % of old dogs. The correct management of the patient's feeding slows down the progress of these diseases.



- ✓ The loss of elasticity of the joints and the appearance of osteoarthritis and arthritis are common changes associated with aging. Pain and limping will affect an animal's mobility, appetite, and capacity to chew. Certain nutrients are being used (for example, omega-3 fatty acids, antioxidants and chondroprotective agents) to modulate the process.



To be taken into account

Although in human medicine osteoporosis is associated with aging, this process is not observed in our pets.