Chronic kidney disease (CKD) is a major cause of morbidity and mortality in cats.¹ Nutritional management has been shown to improve both survival and quality of life in cats with CKD and is a cornerstone of long-term management in these patients.²,³ While nutritional management of CKD has been demonstrated to prolong survival and improve quality of life in cats with CKD, some cats may experience appetite loss and changes in lean body mass that can interfere with quality of life. Another common condition that affects aging cats and can reduce their quality of life is degenerative joint disease (DJD). Appetite loss, muscle loss, and DJD are all problems in which nutrition should be part of the solution.

**Appetite and Weight Loss**
Pets with CKD may suffer from a decreased appetite for a number of reasons including uremia-related stomatitis, gastritis, and nausea. It is important to address these underlying causes of inappetence or the feeding plan may not be successful. Cats not consuming an adequate amount of calories each day will lose weight and they may also lose more lean mass than healthy pets due to a lack of an adaptive response to inadequate caloric intake. Adequate caloric intake is important for maintaining both body weight and muscle mass.

When creating a nutritional plan, the first step is to ensure that adequate kilocalories are offered and consumed each day. Making a recommendation for a particular food and an amount to feed provides the pet owner with a target that needs to be met. Discussing how to transition the cat to a new renal food during the initial visit is also extremely important. For finicky cats, a prolonged transition period of 6 weeks may be necessary to achieve a successful transition. Also, discussing strategies to entice the pet to eat, such as warming canned food to body temperature and adding low sodium or no-salt added chicken broth to dry food, can be extremely helpful to the owner. The follow-up visit, approximately two weeks after the transition period, allows for adjustment of the feeding recommendations before significant weight loss occurs. In addition to these recommendations, other strategies have been developed to help pets with appetite loss.

An example of how renal foods can be made more palatable is the Enhanced Appetite Trigger (E.A.T.)™ Technology for cats in Hill’s® Prescription Diet® k/d® dry food. This technology was developed to stimulate the appetite.
of cats with CKD through enhanced sensory appeal. It was developed through a process in which researchers measured the unique food preferences of cats with CKD, identified key aromas and flavors that trigger food intake, and used the knowledge they acquired to help create a targeted taste solution with maximum appetite improvement. Studies demonstrate that this technology improves the appetite of cats with CKD, which results in more calories consumed (see Figure 1).

If these strategies and appetite-stimulant medication fail, a feeding tube may be necessary. Therapeutic renal foods can be mixed with water in a blender to achieve a smooth consistency that allows it to be fed through esophageal and gastric feeding tubes.

Muscle Loss
Muscle wasting is another common challenge in CKD patients. Some pets may be losing muscle mass because they are not consuming adequate kilocalories each day. However, when dealing with muscle loss in senior pets, especially those with CKD, it is important to recognize all of the causes and mechanisms for this change in body composition.

Adequate daily caloric intake will help to ensure that the cat is consuming an appropriate level of protein each day. However, feeding foods with lower levels of protein and its impact on lean muscle mass is frequently brought up as a concern. Based on results of published studies, muscle mass is maintained in cats while eating therapeutic renal foods. Additionally, protein quality needs to be considered. In reality, pets have an amino acid requirement, not a protein requirement, which makes the balance and amount of essential amino acids critical.
Proper formulation of therapeutic foods with lower levels of proteins can ensure that more than adequate levels of all the essential amino acids are present, avoiding deficiencies that would limit the body’s ability to rebuild muscle during normal daily turnover of muscle proteins. It is also important to ensure high digestibility so the protein can be well utilized by the body. An example of how this can be achieved is through Hill’s® Prescription Diet® k/d® feline, which provides more than 150% of the Association of American Feed Control Officials (AAFCO) requirement for each essential amino acid as seen in Figure 2.

When looking at other causes of muscle loss, cachexia and sarcopenia can both be seen in pets with CKD. Cachexia is the loss of lean body mass due to diseases such as CKD or cardiac disease and can occur due to multiple mechanisms including changes in cytokine, catecholamine, and insulin production as well as changes in muscle fiber synthesis and type. While few studies evaluating cachexia exist in the veterinary literature, loss of lean body mass in humans due to cachexia is directly associated with decreased survival.

![Figure 2](image-url)
Proper formulation of therapeutic foods with lower level of proteins can ensure that more than adequate levels of all the essential amino acids are present, avoiding deficiencies that would limit the body’s ability to rebuild muscle during normal daily turnover of muscle proteins.

time and quality of life.7 Because cachexia differs from starvation, solely providing nutritional support, including an increased protein intake, has failed to demonstrate efficacy in improving weight gain or lean body mass in humans. The impact of increased protein intake alone on cachexia has not been investigated in cats but is likely to result in similar results. Sarcopenia is the age-related loss of lean body mass in the absence of disease. It is related to cachexia but uniquely different. Like cachexia, its cause is multifactorial. For this reason, just increasing protein intake has not been shown to lessen this muscle loss. Cachexia and sarcopenia are managed by ensuring that any underlying diseases and associated inflammation are well managed and that adequate energy intake and high quality protein are provided daily. Other management strategies include providing L-carnitine and omega-3 fatty acids from fish oil.

Carnitine is important for fatty acid oxidation because it is involved in transporting fatty acids across the mitochondrial membrane. Enhancing fatty acid oxidation can help spare amino acids from being used for energy metabolism instead of protein synthesis. Mitochondrial efficiency has been shown to decrease with age and has been theorized to contribute to fatigue seen in older humans. Carnitine supplementation may help improve mitochondrial function in aging animals through improved efficiency of energy metabolism. Furthermore, carnitine is excreted primarily by the kidneys and is conserved by renal reabsorption. In many species, reabsorption of carnitine is as high as 90%, but efficiency of reabsorption has been found to be impacted by kidney disease, further highlighting the rationale for supplementation in a renal supportive food.5,9

Supplemental omega-3 fatty acids from fish oil have also shown promise in management of cachexia and sarcopenia. Omega-3 fatty acids from fish oil have been demonstrated to down regulate protein catabolism in cachexia through attenuation of proteasome expression decreasing inflammatory cytokines, and have benefits on muscle mass in dogs with cardiaccachexia.10,11 Studies investigating the beneficial effects of omega-3 fatty acids in management of sarcopenia suggest fish oil may further enhance protein synthesis in response to an anabolic substrate such as amino acids.12

Arthritis
Another common condition of aging cats is degenerative joint disease (DJD). A recent study found that 69% of cats with DJD also suffered from CKD.13 While it is not always obvious to pet owners, studies have shown that 90% of cats over the age of 12 years suffer from DJD.14 Nutritional management with omega-3 fatty acids has proven to be effective in managing DJD in cats.15 Omega-3 fatty acids provide clinical benefits by helping control inflammation and reducing the expression and activity of cartilage proteoglycan-degrading enzymes, which perpetuate the cycle of inflammation and damage within the joint. Nutritional management of feline DJD with a therapeutic diet has been proven to be effective at both decreasing stiffness and increasing daily activity in these patients.15

Summary
Renal therapeutic food is a vital aspect of managing CKD because it has been shown to increase quality of life and survival.2,3 In some cats, we need to look beyond the traditional attributes of a renal therapeutic food to address problems like appetite loss, decreased muscle mass, and arthritis. Providing a therapeutic food such as Hill’s® Prescription Diet® k/d® that contains a superior amino acid profile, L-carnitine, and omega-3 fatty acids from fish oil can be a huge benefit for these patients.
References