



Evidence-Based Medicine: Protein Requirements in Dogs and Cats with Chronic Kidney Disease

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The dietary management of CKD has been the mainstay of treatment for years, and remains the most commonly recommended therapy. Despite the evidence showing that diets modified for patients with kidney disease do improve outcomes, there remains controversy around the exact nutrient composition and timing of implementation of renal diets. At the forefront of the controversy is the protein content of the diets. In particular, the dietary protein requirements of cats with chronic kidney disease has been the source of much “discussion.”

There have been several methods used to determine the minimal protein requirements in healthy dogs and cats. The National Research Council (NRC) has published data that establishes minimum amounts of crude protein

required by healthy dogs and cats.¹ These data were based on several physiologic and metabolic variables (weight gain, nitrogen balance, etc.). Traditionally nitrogen balance studies have been used to determine the minimal crude protein intake required to compensate for urinary, fecal and other metabolic losses of nitrogen. However, this methodology can sometimes underestimate the true protein requirements, and newer techniques tend to utilize lean body mass determinations.²

In addition to the amount of protein in a specific diet, it is imperative that the quality of that protein be considered. When looking at the overall quality of the protein we consider both the amino acid composition of the protein and the bioavailability or digestibility of the protein. Regardless of the actual protein content of a diet, all

required amino acids must be present in adequate quantities. To define the minimum dietary requirements for certain amino acids, plasma amino acid profiles have been examined and compared to urinary excretion of specific amino acids.³ In order to compensate for the often unknown quality of the protein within diets, the daily recommended protein allowances for both dogs and cats are approximately 20% to 25% higher than the determined minimum protein requirements. Regulatory bodies in both North America and Europe have added an additional buffer, with their recommendations for minimum crude protein content being 36% to 55% higher than the published minimal requirements.^{4,5}

Although the commercially available kidney diets are often flogged for being “low-protein,” they do, in fact, meet the

Association of American Feed Control Officials (AAFCO) recommendations for minimum crude protein content. In one commercially available feline renal diet, the protein content exceeds the AAFCO recommendations for crude protein content by 4% dry matter (DM). Additionally, the composition of the protein supplies at least 150% of the daily recommended amounts of 11 essential amino acids.

One goal in the management of CKD has been to restrict dietary protein intake to a level allowing for normal metabolic function and nitrogen balance, while avoiding excess protein that could contribute to signs of uremia. Although the ideal quantity of protein to feed dogs and cats with CKD remains unresolved, a general consensus of opinion supports the fact that reducing protein intake improves clinical signs in animals with kidney disease, especially in stages 3 and 4. The rationale for limiting protein intake of patients with chronic kidney disease is based on the premise that controlled reduction of nonessential proteins will result in decreased production of nitrogenous waste with consequent amelioration of clinical signs of uremia.⁶ Although a direct cause-and-effect relationship has not been proven in many instances, it is generally believed that retained protein metabolites contribute significantly to many of the metabolic derangements found in patients with renal disease.⁷

In the past, the emphasis has been on reducing the protein content of the diets. Although protein content continues to play an important role in diet formulation, other diet modifications are also very important in managing patients with kidney

disease. There is grade 1 evidence from randomized, controlled clinical trials to support the recommendation to feed a kidney diet to dogs and cats with serum creatinine in excess of 2.0 mg/dl (176µmol/l); CKD stages 3 and 4 in dogs and mid-stage 2 through 4 in cats.^{8,9} In addition to limited protein, the diets used in these studies had other nutritional modification typical of commercial renal diets including reduced protein, phosphorus and sodium content; increased potassium, B-vitamin content and caloric density; a neutral effect on acid-base balance; and an increased omega-3/omega-6 polyunsaturated fatty acid (PUFA) ratio. These studies demonstrated a reduction in the number of uremic crises and renal related deaths in the group fed the kidney diets compared to those fed standard maintenance diets. Additionally, increased quality of life outcomes were observed in the dogs fed a kidney diet.⁸ Similar survival outcomes were observed in a non-randomized clinical trial performed in cats with naturally occurring CKD fed a renal diet. In this study, the median survival time for cats consuming the renal diet was 633 days compared to 264 days for cats that were not switched to a renal diet.¹⁰

There are limited data evaluating protein restriction as the sole dietary intervention for dogs and cats with CKD. Classic studies performed in rats with surgically induced CKD linked increased dietary protein to progressive glomerular sclerosis.¹¹ In one study of cats with surgically induced kidney disease, more severe renal morphologic lesions were found in the group fed a high protein (52% DM) diet.¹² However, a follow-up study determined that

it was the reduction in calories that afforded a reno-protective effect.¹³ High protein diets were not associated with progressive renal lesions in 3 studies of dogs with surgically induced CKD.¹⁴⁻¹⁶

Dietary protein restriction (35% vs 14% DM) has been shown to decrease proteinuria in dogs with glomerular disease.¹⁷ Consumption of a diet modified for kidney disease, including protein restriction, did delay development and reduce severity of glomerular lesions in a group of dogs with familial protein-losing nephropathy.¹⁸ A recent study showed similar findings with a kidney diet contributing to the control of proteinuria in dogs concurrently treated with benazepril.¹⁹ In all of these studies, the endpoint was a reduction in proteinuria, which is known to affect progression and survival in chronic disease.²⁰

Although there is little debate that cats with IRIS stage 4 CKD (serum creatinine >5.0 mg/dl) require a diet restricted in both protein and phosphorus, there has been recent discussion about the optimum protein content of diets for cats with earlier stages of kidney disease.

Much of the dietary protein debate has been focused on cats as they are considered to be obligate carnivores and thus have increased protein

requirements compared with dogs and humans.^{21,22} To maintain nitrogen balance, cats must consume sufficient amounts of a high-quality protein with an appropriate amino acid profile. Although there is little debate that cats with IRIS stage 4 CKD (serum creatinine >5.0 mg/dl) require a diet restricted in both protein and phosphorus, there has been recent discussion about the optimum protein content of diets for cats with earlier stages of kidney disease. Interest in age-related sarcopenia and maintenance energy requirements of older cats has called into question the practice of protein restriction in the earlier stages of CKD.^{23,24} In adult cats, the maintenance energy requirements appear to decrease until approximately 11 years of age and then begin to increase again.²⁵ In addition, the ability of the older cat to digest and utilize protein efficiently may be impaired, resulting in a tendency toward a reduction in lean body mass.^{26,27}

However, in the majority of cases, the iconic image of the “skinny chronic kidney disease pet” is not a result of decreased protein intake, but rather decreased caloric intake. In patients with advanced kidney disease, the metabolic causes of anorexia and vomiting lead to a decline in caloric intake and overall body condition. In desperation, many owners will offer high protein foods to their pets in an effort to increase their food intake. Although the commonly heard phrase “they have to eat something” is certainly true, the quality and quantity of a patient’s life will be prolonged if they eat adequate amounts of a diet formulated for kidney disease.^{8,9}

In one short-term study, the dietary protein requirement of cats with

spontaneous chronic kidney disease was found to be approximately 20% metabolizable energy (ME).²⁸ In other studies, diets containing 28% crude protein were shown to maintain lean body mass in cats with and without chronic kidney disease over a minimum of 4 months.^{29,30} In one randomized controlled clinical trial comparing cats eating a renal diet to those eating a maintenance diet, there was no difference in body weight, body condition score, or lean body mass after two years of study.⁹

We have recently examined a population of IRIS stage III/IV chronic kidney disease cats from our hospital that had esophagostomy feeding tubes placed as part of their medical management.³¹ Cats received 60% to 220% (median 101%) of their energy requirement, as a commercially available renal diet, through the tube. The significant variability in the amount fed is a result of the cats’ own oral intake of a commercial renal diet, and the adjustment of the tube feeding amount to ensure adequate daily calories. The median survival of this group of cats was 178 days. From the time of tube placement until death, the cats had increased/stable body weights and body condition scores, despite progressive renal disease. These findings support that commercial feline renal diets contain adequate levels of protein to maintain lean body mass if the patient is fed to caloric requirements.

The clinical studies available to date have shown that cats and dogs fed a commercially available renal diet have better outcomes than those fed a standard maintenance diet. These studies evaluated a composite “diet effect” and the observed benefit could

not be attributed to the modification of any single nutrient. There are no studies available in cats or dogs with naturally occurring renal disease that evaluate the effects of only dietary protein on progression of disease, and no studies showing that dogs and cats with CKD have different minimum protein requirements from healthy animals.

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It is also important to recognize that there is no evidence to suggest that increased levels of dietary protein are beneficial for cats or dogs with CKD. Until clinical data evaluating the effects of differing dietary protein intakes in cats and dogs with naturally occurring disease are available, the question of the optimum protein intake will remain unanswered. Until such time, the available evidence dictates the use of a renal diet in any patient with a serum creatinine concentration greater than 2.0 mg/dl or clinically significant proteinuria.

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