# Protein Requirements in Dogs and Cats in Stage 1 Chronic Kidney Disease: Is There An Answer?

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**Protein requirements of dogs and cats with CKD**

Protein requirements of healthy adult animals are most often equated with the minimum amount that will maintain nitrogen balance, which is defined as nitrogen intake equal to nitrogen losses through urine, feces, skin, hair or sweat. Nitrogen balance in traditional protein requirement studies was measured by feeding purified diets or diets supplemented with crystalline amino acids of high bioavailability. Thus, the minimum protein requirements determined by these methods do not reflect feeding typical commercial foods and the use of National Research Council (NRC) 2006[1] Minimum Requirements (MR) values is not practical when typical cat and dog foods are fed. This is why the NRC, Association of American Feed Control Officials (AAFCO)[2] and The European Pet Food Industry Federation (FEDIAF)[3] recommend using Recommended Allowance (RA) of protein, which is based on the MR value and a safety factor above the minimum to account for uncertain protein availability influenced by amino acid losses during cooking, heating, and digestion. Another indicator of dietary protein adequacy that is used increasingly often is a measurement of lean body mass (LBM) over time, using a body composition study (DEXA Scan).

The established RA for protein is often used as a benchmark for adequate protein concentration in dog and cat foods. However, it is important to realize that information on protein requirements of pets with CKD is limited to only one well designed feline controlled study, showing that cats

## Definition of early chronic kidney disease (CKD) and commonly asked questions

The definition of International Renal Interest Society (IRIS)-Stage 1 nonazotemic CKD is that some renal abnormality is present, such as inadequate urinary concentrating ability without identifiable nonrenal cause, elevated SDMA (symmetric dimethylarginine; IDEXX), abnormal renal palpation or renal imaging findings, proteinuria of renal origin, abnormal renal biopsy results, or increasing blood creatinine concentrations in samples collected serially.

Since the onset of the search for biomarkers of early disease and the more frequent use of SDMA test, the clinical question that is often asked by veterinarians is: "Now that I have identified early CKD, what intervention is indicated at this early stage and what amount of dietary protein is adequate?"

with spontaneous CKD have protein requirements similar to those of healthy adult cats.[4] Additional studies investigating the protein requirements of CKD patients in both early and late IRIS stages and in dogs are needed.

The published clinical studies in dogs and cats with naturally occurring CKD provide strong support for the use of renal foods for CKD management, but they were not specifically designed to evaluate protein requirements.[5-8] The foods in those studies were tested as a whole, which does not allow separating the effect of individual nutrients. Furthermore, they did not consistently report body composition (DEXA) or Muscle Condition Score (MCS), and the patient's nutritional assessment was usually limited to Body Condition Score (BCS) or body weight changes, which are not reliable measures of lean body mass.

The limited information on protein requirements in veterinary patients with CKD raises questions about whether renal foods contain enough protein to maintain lean body mass in the long term. The most commonly used dietetic renal foods meet and exceed protein RA of a healthy adult dog and cat established by NRC 2006, and most dietetic feline renal foods also meet and exceed the protein allowance established by AAFCO and FEDIAF (Table 1). These established levels provide a sufficient amount of protein daily as long as the animal eats sufficient amount of calories from that food to remain in energy equilibrium or in a positive energy balance. None of the commonly available feline and canine renal foods contains less than the NRC recommended daily allowance of protein; thus they are not deficient in protein.[9] In one controlled 4-month-long study, the dietary protein requirement of cats with spontaneous CKD was determined using DEXA and nitrogen balance and was found to be approximately 20% (ME).[4] This value was similar to protein requirements of adult healthy cats; however, the IRIS Stage of the CKD cats in the study was not defined. Foods containing 28% crude protein (6.5 g protein/100 kcal ME) were shown to maintain lean body mass measured by DEXA in cats with and without CKD over a minimum of 4 months.[10,11] This protein level of 6.5 g/100 kcal ME meets and exceeds recommended allowances by NRC 2006, AAFCO 2016 and FEDIAF 2016; thus, it is in agreement with current feeding standards for healthy adult cats. In another study, healthy senior dogs (average age 13 years) were fed a renal food (Hill's® Prescription Diet® k/d®) with 14.8% dry matter highly digestible protein for 4 months, which resulted in significantly increased LBM, a decrease in serum creatinine and BUN and no change in albumin.[12] Based on those studies, the commercially available renal foods contain enough protein to support and maintain muscle mass in dogs and cats that are eating to meet their caloric requirements. In one randomized, controlled clinical trial comparing CKD cats eating a renal food to those eating a maintenance food, there was no difference in body weight and BCS after two years of study.[5] In summary, there is no evidence to support the premise that feeding a renal food results in protein malnutrition, as long as the animal is eating to meet its caloric requirement.

There is a lot of focus on the amount of dietary protein for pets; however, it is very important to consider protein quality as well. This includes the balance of amino acids and whether the food provides amino acids the pet needs. Foods with highly digestible and high biologic value proteins can have less quantity of protein and meet the amino acid needs of pets. Therefore, feeding a renal food with highly digestible and bioavailable protein and an ideal amino acid profile will minimize nitrogenous waste production while still providing amino acids in adequate amounts.

Another challenge is that renal foods are considered only as "controlled-protein" foods; however, they have other important benefits in addition to containing a controlled amount of high-quality/biologic value, highly digestible protein. These other benefits include:

I Controlled amounts of dietary phosphorus – the recommended initial approach for decreasing renal secondary hyperparathyroidism and controlling serum phosphorus in CKD patients.

II Increased amounts of omega-3 fatty acids from fish oil – help to manage inflammation and may be beneficial for sarcopenia/muscle wasting.

III Buffers – to help control acidemia that occurs with CKD and may contribute to muscle wasting.

IV Potassium – to help prevent/manage hypokalemia, which can contribute to renal dysfunction (more common in cats).

V Antioxidants (vitamin C & E and beta-carotene) - shown to have beneficial effects in CKD.

In summary, renal foods are more than simply controlled amounts of protein – they are a "package deal" as they contain a package of nutritional benefits for CKD patients.

**Nutritional recommendation for dogs and cats in IRIS-Stage 1 CKD**

There is ongoing discussion in the profession regarding whether feeding a renal food should bin in IRIS-stage 1 CKD patients. At this time, IRIS doesn't make any treatment recommendations based on an elevated SDMA with normal creatinine. However, the IRIS recommendation on dietetic renal food in earlier stages of the disease is for cats and dogs with confirmed persistent proteinuria (cats: UPC >0.4; dogs UPC>0.5) and for those where plasma phosphorus concentration would not remain <4.6 mg/dL (Figure 1). The question often discussed is the best time for the introduction of renal foods in earlier stages, such as elevated SDMA (>14 µg/dL), non-azotemic, non-proteinuric IRIS-stage 1 and 2.

**FIGURE 1**

**IRIS RECOMMENDS A DIETETIC RENAL FOOD AS A STANDARD OF CARE FOR CKD PATIENTS**

| Stage 1 | Stage 2 | Stages 3&4 |
|---|---|---|
| **Renal food** | **Renal food** | **Renal food** |
| UPC > 0.4 (cats)<br>UPC > 0.5 (dogs) | | |

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One issue to consider is the progressive nature of CKD. Jepson et al. assessed the prevalence of development of azotemia within 12 months of presentation in a population of geriatric healthy cats and reported that 30% of cats recruited had developed azotemia by 12 months.[13] The authors concluded that incidence of azotemia in this population is high and monitoring of geriatric cats is therefore very important. Since the progression of CKD is unpredictable in each individual patient, one could argue that as long as the renal food is nutritionally adequate, feeding it in early stages is safe as long as there is no contraindication to its nutrient profile (e.g., history of pancreatitis in dogs since renal foods are typically high in fat) and it adequately maintains LBM.

Additional supporting arguments for feeding renal foods in Stage 1 non-proteinuric CKD are: 1) It may be easier to transition a pet (especially a cat) to a new food in the early stage of CKD, while pets are still feeling well; 2) Intervening early will have the maximal beneficial effect on delaying progression and further increasing lifespan; 3) Monitoring and recommending treatment earlier also increases the opportunity for the veterinary healthcare team to have more contact and interaction with clients over time.

The major argument against feeding renal food in IRIS-Stage 1 CKD revolves around the maintenance of lean body mass. The prevalence of these patients failing to maintain lean body mass when eating their caloric requirement has not been established. Elderly pets are prone to both sarcopenia associated with aging and cachexia associated with disease. There is a misconception that sarcopenia or cachexia can simply be fixed with the additional of more protein to the diet. Evaluation of this factor is also greatly compromised by the failure of many patients to meet their caloric requirements due to hyporexia. Additionally a major missing aspect in many clinical practices is adequate nutritional assessment that includes evaluation of caloric intake, body weight, muscle mass and response of these parameters to a diet change. Therefore the ability to determine diet adequacy in these patients is compromised and typically driven by the owner as opposed to the veterinary care team.

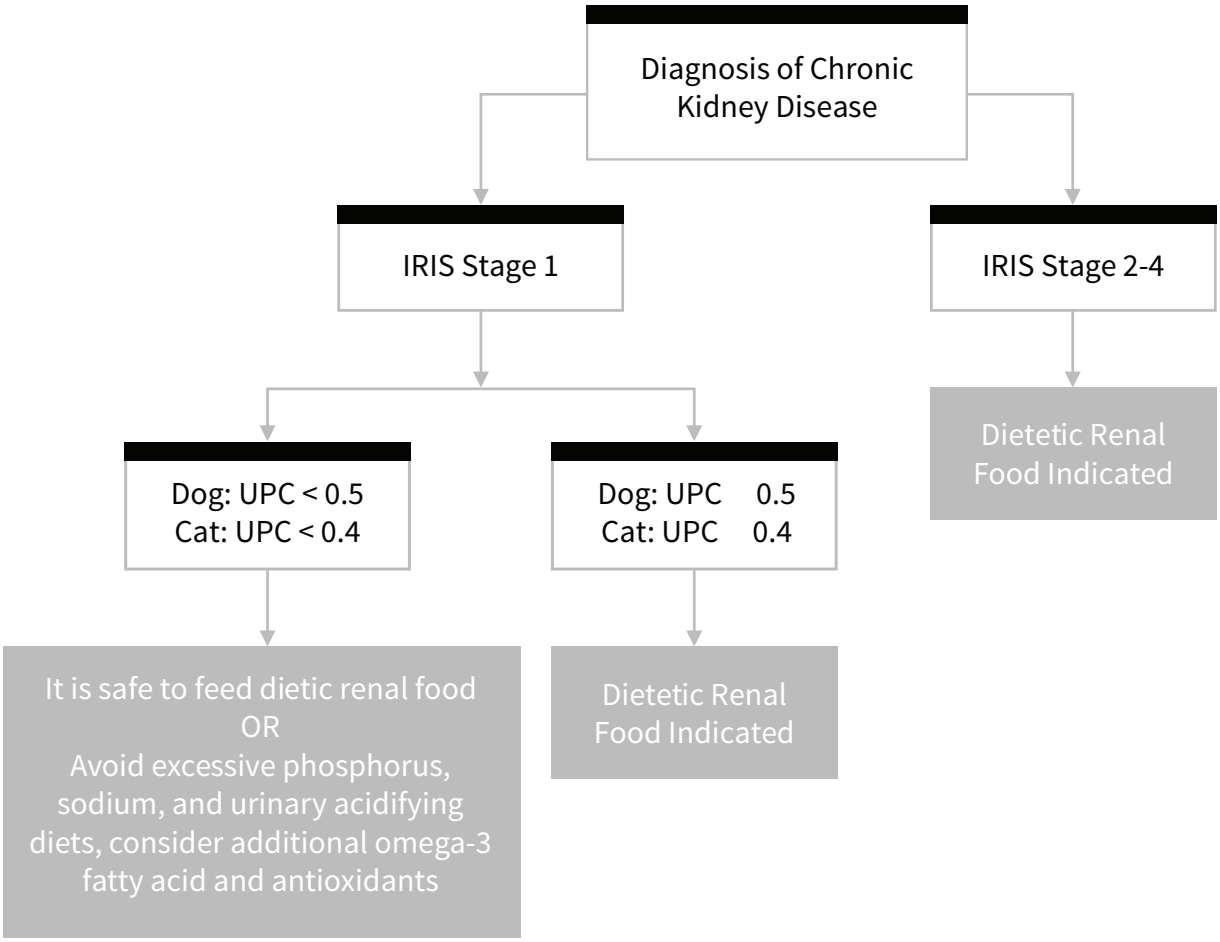
**What do we currently recommend?**

As more studies and information become available, it is likely that we'll see guidelines for IRIS-Stage 1 CKD patients. New research is emerging that indicates that feeding dietetic renal food offers benefits to dogs in IRIS-Stage 1 CKD. This prospective 12-month-long study evaluated the effects of a therapeutic renal food (Hill's® Prescription Diet® k/d®) in pet dogs with IRIS-stage 1 CKD.[14] All renal biomarkers (creatinine, BUN, SDMA) were decreased significantly from baseline at 3-months, and remained decreased from baseline at 12 months, suggesting stabilized kidney function. While the evidence for recommending nutritional management is not as strong for IRIS-stage 1 CKD, it is reasonable to implement treatments that have been shown to improve outcome for cats and dogs with IRIS-stages 2-4 CKD (e.g., renal food) as long as there is no contraindication (e.g., dogs or cats at risk of diseases that may be worsened due to relatively increased dietary fat) and lean muscle mass is maintained. Therefore a key recommendation is increasing the vigilance of repeated nutritional assessment in this patient population.

For professionals who are not comfortable recommending dietetic renal foods in non-proteinuric IRIS-Stage 1 CKD, the safest recommendation is to feed a "renal friendly" food that avoids excessive phosphorus and sodium and is not acidifying. Foods containing n-3 fatty acids from fish oil and antioxidants should be prioritized (Figure 2). The evaluation of the current food is advisable, as some over-the-counter pet foods can be excessively high in nutrients relative to

**FIGURE 2**

**DIETETIC RECOMMENDATION FOR IRIS STAGE 1-4 CKD IN DOGS AND CATS**




animal requirements. For example, there are no AAFCO or FEDIAF maximums on protein, sodium, or potassium in dog foods, and the FEDIAF 2016 allowed maximum on phosphorus is 5 times the NRC 2006 recommended allowance. Therefore, it would be prudent to transition to a food closer to the FEDIAF or AAFCO recommended minimum level of phosphorus to avoid any potential harm to the animal and still meet the nutrient requirements. If one does not intervene (recommend treatment) in IRIS-Stage 1 CKD, it is important to monitor for subtle signs of progression (e.g., increasing values for SDMA, serum creatinine, or urine protein : creatinine ratio (UPC) and decreasing urine specific gravity). If there are signs of progression, intervening (treating) is appropriate in order to delay further progression.

Regardless of the food fed, the importance of maintaining hydration and water balance in CKD patients should also be stressed. In general, feeding a wet food (~75% moisture) will provide water intake at the level of 1-time daily maintenance fluid if the animal eats an average amount of calories to maintain body weight.

**What studies are needed to determine the optimal diet for cats/ dogs with IRIS-stage 1 CKD?**

In spite of current existing knowledge, there is room for new research opportunities in nutritional management of CKD. Examples of such studies include:

1 Feeding a controlled, moderate- or high-protein food to IRIS-stage 1 CKD cats and -tage 1 CKD dogs to determine

which level of protein adequately maintains body weight and LBM or influences biomarkers associated with progression of CKD such as SDMA and fibroblast growth factor (FGF)-23.[15]

2 Feeding a dietetic renal food and renal friendly food to IRIS-stage 1 CKD dogs and cats and measuring the effect of these foods on body weight and LBM and on biomarkers associated with progression of disease, such as SDMA and FGF-23.

**Conclusions**

IDEXX SDMA is a kidney function test that enables veterinarians to detect CKD earlier in clinically healthy pets during routine preventive care or pre-anesthetic testing. It also provides practitioners a better tool to diagnose CKD in cats and dogs with non-specific clinical signs such as decreased appetite and weight loss. Early diagnosis provides the opportunity to identify an underlying cause and provide for earlier management of CKD by implementing nutritional management and medications at the earliest appropriate time, to improve quality of life and slow disease progression. Based on published evidence, feeding a dietetic renal food is the single most effective management option for improving survival and quality of life in dogs and cats with CKD. While new emerging evidence increases on the benefits of dietetic renal food in dogs with IRIS-Stage 1 CKD, more research is needed to confirm the most optimal nutritional management in early stages of the disease.

**TABLE 1**

**RECOMMENDED ALLOWANCES FOR PROTEIN IN FOODS FOR ADULT DOGS AND CATS**

| | NRC 2006 Recommended Allowance (g protein/100 kcal ME) | AAFCO 2016 Recommended Minimum (g protein/100 kcal ME) | FEDIAF 2016 Recommended Level (g protein/100 kcal ME) | Hill's® Prescription Diet® k/d® (g protein/100 kcal ME) |
|---|---|---|---|---|
| **Cats** | 5 | 6.5 | 6.5 | Feline 6.7-6.8 |
| **Dogs** | 2.5 | 4.5 | 4.5 | Canine 3.4-3.6 |

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