Nutritional Management of Chronic Kidney Disease

Overview: Diet is the cornerstone of medical treatment in dogs and cats with CKD. Commercial diets for CKD reduce the number or uremic crises and prolongs survival time in dogs and cats with naturally occurring disease (stages I-IV).

The primary goal of managing any disease (or healthy animal) is to meet energy needs and supply appropriate amounts of all essential nutrients

<u>Overall Focus Depending on Stage and Type of CKD</u>

- Calories
- Alleviate clinical signs
    - Protein
- Minimize electrolyte, acid-base, fluid abnormalities
    - Sodium, potassium, bicarb, B vitamins
- Slow progression of disease
    - Phosphorus, EPA + DHA, Antioxidants

Role of Malnutrition

- Inadequate caloric intake leads to catabolism of body protein and less efficient use of dietary protein
- Loss of body protein leading to cachexia has a poor prognosis
- Patients with CKD tend to have a waxing and waning appetites

Dietary Protein in CKD

- Amino acids are required in the diet, but too many lead to nitrogenous waste which contributes to uremic toxins. The goal is to minimize the waste (avoid excess protein)
- Protein goal: not too much, not too little
    - Protein malnutrition = morbidity
    - Reductions in protein are important for uremia (stages 3-4)
    - Control uremia improves QOL, food intake, etc.
- Unknown role in progression
    - No effect on progression of tubulointerstitial disease

What about PLN?

- Proteinuria is a negative prognostic factor
- Protein in kidney tubules cause damage
- Dietary protein restriction can reduce proteinuria which control progression of PLN and is advised even in early stages of the disease

    - Proposed mechanism: decreases glomerular hypertension and damage to glomeruli
    - Degree of restriction depends on current diet
    - Reduce by 25-50% and recheck UPC in 1 month

Other aspects of controlling protein in CKD

- Impact on palatability for some pets plus effect of disease
    - Must eat to meet energy requirements to avoid protein deficiency
- Commercial diets for CKD are often high in fat (fat is tasty and provides more kcal per gram compared to protein and carbohydrates)
    - Caution with pancreatitis
- Dietary protein is the source of most available phosphorus in diet
- No evidence that protein in excess of requirements is beneficial

What about cats, is protein too low in CKD diets??

- Despite the evidence of benefit of therapeutic diets, some practitioners recommend using any maintenance diets regardless of stage
- Clinical data shows better disease control, and maintain their weight for up to two years with CKD diets
    - High quality protein with good AA balance
    - Have to consume enough *must be eating the diet

Phosphorus

- An appropriate degree of restriction of dietary phosphorus is key
    - Helps control parathyroid hormone levels
    - Reduce the risk of soft tissue mineralization
- Goal: reduce intake as needed for the individual to normalize serum P with dietary reductions for as long as possible, then add binders if needed

Can I use a senior diet to manage CKD?

- Ideally, no. These diets are often not low enough in phosphorous and do not have any of the other beneficial aspects for supporting patients with CKD

Emerging Evidence

- Experimental increased intake of P can cause kidney injury in health cats (also seen in dogs, rodents, and people)
- Inorganic, soluble forms seem to be more harmful (higher bioavailability)
    - Especially with inverse Ca:P

    - Why are these included? Dental health (triple phosphates used to bind salivary calcium), pH stability, hydration agents, processing aids, and as a part of essential mineral mix
- Conservative recommendation based on published data in research cats
    - P intake > 3.5 g/1000 kcal should be avoided if source of P is unknown
- As of 2026, AAFCO sex max for cat foods of 5 g/1000 kcal, with a minimum Ca:P ratio of 1:1 AND a limit on inclusion of soluble (i.e. more bioavailable) sources of calcium
- Another important reason to not use maintenance diets for feline CKD
    - 82 diets analyzed *looking at phos
    - Median 3.0 g/1000 kcal
    - 33% of products > 3.6 g P/1000 kcal
    - 9% provided 4.8-4.8 g P/1000 kcal
    - More likely in high protein diets

Sodium

- Controlled Na in veterinary therapeutic CKD diets since these patients are prone to hypertension
- Possible drawbacks
    - Stimulation of RAAS
        - Wasting of K (in exchange for reabsorbing Na) and resulting clinical hypokalemia)
    - Palatability?
- Current consensus: avoid excessively low (<0.4 g/1000 kcal) and high (>1.5 g/1000 kcal) concentrations
    - CKD diets for dogs and cats should have 0.4-1.2 g Na/1000 kcal

Potassium

- Supplemented in diets
- Cats with CKD are at risk for hyponatremia
- For some dogs, potassium may need to be controlled due to hyperkalemia
    - Hyperkalemia can be addressed by the diet
    - In later stages of the disease, PLN, use of ACE*i* may be risk factors

CKD and n-3 Polyunsaturated Fatty Acids

- NO data for treatment efficacy in cats
- Two trials in dogs: same dietary treatments in dogs with induced CKD
- Basal diet supplemenated with 3 fat sources
    - Diet 1: menhaden fish oil (high in omega-3)
    - Diet 2: safflower oil (high in omega-6)
    - Diet 3: beef tallow (saturated fat/neutral)

- Dose was ~760 mg EPA + DHA/kg$^{0.75}$
- Dogs fed fish oil diet for 20 months showed
    - Improved renal function (creatinine clearance) and reduced proteinuria
- Dogs fed safflower oil diet showed
    - Reduced GFR, increased interstitial fibrosis
- No dose-response studies
- Theis very high dose appears efficacious at least for experimental CKD
- No adverse events reported during those 20 months
- Estimated amount in volume
    - 1 tbsp of "average potency" fish oil added per every ¾ cup of kibble
- Unpublished data
    - Supplement omega-3 PUFA at least 6-8x lower than prior reports with similar benefit
    - Cannot establish exact doses
    - Suggests that moderate doses are still useful
    - 140mg EPA + DHA/kg BW$^{0.75}$ and increase up to SUL (370mg EPA + DHA/kg BW$^{0.75}$)
- ALA come from vegetable sources
    - 18:3
- EPA+DHA come from Marine sources
    - 20:5 and 22:6
    - More double bonds

Sources of omega-3 PUFA

- No data for vegetable-sourced omega-3 fatty acids (linoleic acid)
    - Rate of metabolic conversion of linoleic acid to longer chain EPA and DHA <10%

Other Dietary Alterations

- Diets formulated for CKD are alkalinizing
    - Address the metabolic acidosis seen in later stages of CKD
- Supplemental B-vitamins (diuresis from polyuria)
- Fiber (prebiotic or fermentable fibers)
    - The theory is that nitrogen is trapped and excreted which impacts the overall N load in the body
        - "enteric dialysis" maybe too enthusiastic
- Antioxidants – may help alter effects of ROS on kidney and slow decline in GFR
    - Evidence CKD is an oxidative process
        - Vitamin E, carotenoids, lutein, etc.

Commercial diets for CKD

- Over a dozen options for both dogs and cats
    - Varied textures, flavors (kibble, stew, pate), some multi-function diets
- For cats, both early and late stage diets
- For dogs, both early and late stage diets
    - Hills u/d is the most aggressive (in particular protein and P)
        - The rest of the diets are moderate options which are appropriate for a wide range of patients
    - Diet rotation is often recommended if the patient can handle it

Homemade diets for CKD

- Beware of generic recipes from books or online
    - Outdated strategies for disease management and nutritional adequacy concerns

Summary: Nutrients of importance in CKD

Slow down progression	Improve clinical signs and complications
Phosphorus – restriction EPA + DHA – supplementation Antioxidants – supplementation Protein – reduction (only in PLN)	Protein – adequate reduction Sodium – avoid over-restriction and excess Potassium – supplementation (esp. cats) Bicarbonate – supplementation B vitamins - supplementation

Management of CKD: IRIS Staging

- No strong evidence that a diet change in Stage 1 is beneficial
    - Still a good idea to assess the diet
- Diet change is beneficial in stage 2+
    - As the stage increases, there should be an increase in protein and phosphorus reduction
- Substaging
    - Protein should be reduced when UPC is 0.2-0.5 (dogs) and 0.2-0.4 (cats) or higher

Transitioning to the new diet

- Avoid switching when the patient is ill, stressed, or hospitalized
- Diet changes should be gradual
    - 7-14 days or longer (especially in cats)
- Ensure adequate water intake
- May need to rotate or add variety
- Promote palatability (use treat allowance to add toppers, broth tuna juice, honey/syrup for dogs, applesauce/canned pumpkin, etc.)

*If voluntary intake is insufficient – medical workup

- Check for acidosis, anemia, uti, BP
- Increase palatability
    - Warm food
    - Small frequent feedings
    - Move feeding location
    - Change food dish
    - Additives, diet rotation
    - Have home-cooked diet formulated
- Gastroprotectants
- Appetite stimulants
- No force/syringe feeding
    - Can lead to food aversion!
- Assisted enteral feeding (tubes)
    - Provides appropriate diet in adequate amounts if needed, usually well tolerated with low complications
    - Can be used to administer meds and fluids with minimal stress
    - Helps maintain BW and muscle mass

Monitoring

- Clinical assessment
    - Appetite
    - Weight trends
    - Muscle mass trends
- Laboratory values
    - Azotemia
    - Phosphorus
    - Electrolyte imbalances
    - Serum albumin/UPC