

CRITICALLY APPRAISED TOPIC:

DIET AND KIDNEY DISEASE

Renal diets may improve quality of life in cats with acute or chronic kidney disease.

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CLINICAL QUESTION

For a cat newly diagnosed with acute or chronic renal disease, can dietary modification improve quality of life (*e.g.*, reduce episodes of renal secondary hyperparathyroidism and uremia)?

CLINICAL SCENARIO

Randy is a 12-year-old neutered male Domestic Shorthair cat that presented for his annual wellness exam.

Randy's owner has not noticed anything abnormal in his demeanor during the last few months. Physical examination and routine hematology are unremarkable, however a serum biochemistry panel reveals a slightly elevated urea (38 mg/dL, range 18-33 mg/dL) and creatinine (2.6 mg/dL, range 1.1-2.2 mg/dL), and urinalysis shows a urine specific gravity of 1.020 with no evidence of proteinuria. Systolic blood pressure and serum thyroxine concentration are within normal limits.

In the absence of clinical signs consistent with renal failure and given that the urine is moderately concentrated, Randy is diagnosed with renal insufficiency. The owner is aware that chronic kidney disease (CKD) is incurable but would like to know whether there is anything she can do to delay the onset of clinical disease as long as possible.

EVIDENCE SUMMARY

A targeted literature search was performed using the PubMed database and the MeSH terms "(diet OR nutrition) AND (kidney OR renal) AND (cat OR feline) NOT (rat OR rats)" – the search strategy was designed not to include *rattus* spp in the retrieved research.

CLINICAL BOTTOM LINE

- Specially formulated therapeutic diets with restricted phosphorus content can help to reduce complications due to renal disease (*e.g.*, renal secondary hyperparathyroidism and uremic episodes) and improve survival times for cats diagnosed with chronic kidney disease (CKD).

A total of 127 articles were returned, of which seven were published in English and relevant to the clinical question.

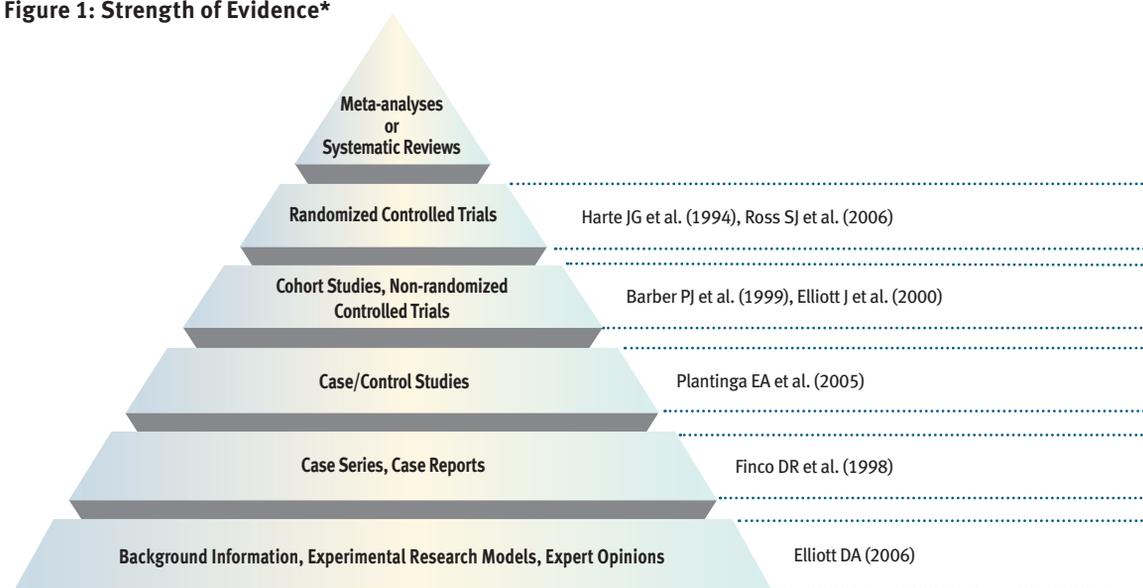
MAIN RESULTS

- Renal diets (restricted in phosphorus, with or without phosphate-binding agents) can lower serum concentrations of phosphate and parathyroid hormone (PTH), thereby reducing episodes of renal secondary hyperparathyroidism.^{1,2}
- There is evidence that renal diets improve survival time in cats diagnosed with CKD.^{2,3}
- Some evidence exists that renal diets may reduce serum urea concentrations and can reduce uremic episodes.^{2,4,5}

COMMENTS

Renal diets are typically high in fat (energy dense), have a reduced quantity of high-quality protein, are restricted in phosphorus, and have greater levels of omega-3 fatty acids (and sometimes decreased omega-6 fatty acids), fermentable fiber and antioxidants compared with adult feline maintenance

Figure 1: Strength of Evidence*



*See corresponding Evidence Summary, Table 1, page 5.

diets.⁶ While there are no data currently available on the minimal protein requirement for cats with kidney disease, it is believed that the requirement is similar to that of healthy cats.⁷

The quality of available evidence is highly variable, with few randomized controlled trials. Some studies were randomized but had no control group, or vice versa. The literature reviewed included one retrospective study.³ The heterogeneity of the population in that study, lack of client compliance with diet, and potential variability in the accuracy of practitioners' reports, may have led to

an underestimation of the effect of the diet on indicators of renal function. Nonetheless, the study revealed that the median survival time of cats fed renal diets was significantly longer than that of cats fed "normal" adult maintenance diets.³

Acceptance of renal diets by cats with CKD can be variable, however acceptance is reported to be improved when diets are introduced gradually.⁴

CAT Appraiser: Patrick Shearer, BVMS, PhD

Date CAT was "born"/expiration date: 05/31/2011

References

1. Barber PJ, Rawlings JM, Markwell PJ, et al. Effect of dietary phosphate restriction on renal secondary hyperparathyroidism in the cat. *J Small Anim Pract.* 1999;40(2):62-70.
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3. Plantinga EA, Everts H, Kastelein AM, et al. Retrospective study of the survival of cats with acquired chronic renal insufficiency offered different commercial diets. *Vet Rec.* 2005;157(7):185-187.
4. Ross SJ, Osborne CA, Kirk CA, et al. Clinical evaluation of dietary modification for treatment of spontaneous chronic kidney disease in cats. *JAVMA.* 2006;229(6):949-957.
5. Harte JG, Markwell PJ, Morailon RM, et al. Dietary management of naturally occurring chronic renal failure in cats. *J Nutr.* 1994;124 (12 Suppl):2660S-2662S.
6. Elliott DA. Nutritional management of chronic renal disease in dogs and cats. *Vet Clin North Am Small Anim Pract.* 2006;36(6):1377-1384, viii.
7. Finco DR, Brown SA, Brown CA, et al. Protein and calorie effects on progression of induced chronic renal failure in cats. *AJVR.* 1998;59(5):575-582.

Table 1: Evidence Summary

Study	N	Design	Intervention	Results	Limitations
Barber PJ et al. 1999	23 client-owned cats with stable CKD; 15 in the restricted-phosphate diet group and 8 in the normal-phosphate diet group.	Non-randomized controlled trial. All owners were offered dietary management; cats of owners that refused dietary management and cats that did not accept the diet formed the control group.	Feeding of a phosphate-restricted diet in either wet or dry form. Cats were monitored monthly, then at two-month intervals if stable, or more frequently if a change in management was necessary. Blood and urine samples were collected at examinations for assessment of plasma biochemistry, ionized calcium, parathyroid hormone concentration and 1,25 dihydroxycholecalciferol.	Consumption of the therapeutic diet resulted in a statistically significant reduction in plasma phosphate and PTH concentrations within 5 months of beginning the study; aluminium hydroxide therapy was necessary in only two cats. The greatest decrease in plasma PTH concentration was not related to a similar reduction in plasma concentration of 1,25 dihydroxycholecalciferol. Eight cats fed the therapeutic diet became euparathyroid, whereas there was no statistically significant difference in mean plasma PTH concentrations of cats fed proprietary diets; in seven of these eight cats, PTH concentrations increased.	Study not randomized, control group selected on the basis of cats' dietary preference.
Elliott J et al. 2000	50 client-owned cats with stable CKD; 29 in the test diet group and 21 in the control diet group.	Non-randomized controlled trial. All owners were offered dietary management for their cats; cats of owners that refused dietary management and cats that did not accept the diet formed the control group.	Feeding of a diet restricted in phosphorus and protein; some cats within the group fed the test diet were also given intestinal phosphate-binding agents to maintain plasma PTH concentrations within the normal range. The diets were fed in either wet or dry form. Cats were monitored monthly, then at two-month intervals if stable, or more frequently if a change in management was necessary. Visit frequency was at least every three months. Blood and urine samples were collected at examinations for assessment of plasma biochemistry, ionized calcium, parathyroid hormone concentration and 1,25 dihydroxycholecalciferol. Survival time from diagnosis to euthanasia was also documented.	Feeding the test diet was associated with reduced plasma phosphate and urea concentrations. Cats not fed the test diet had increased plasma PTH concentrations. Cats fed the test diet survived longer than control cats (median survival times of 633 versus 264 days).	Study not randomized, control group selected on the basis of the cats' dietary preference. The use of intestinal phosphate binding agents means that the effect on survival of the diet alone cannot be estimated.

Table 1: Evidence Summary (cont'd)

Study	N	Design	Intervention	Results	Limitations
Elliott DA 2006	N/A	Review article	Review of studies assessing energy, protein, mineral and electrolyte, fatty acid, fiber and antioxidant requirements of patients with chronic renal disease. Recommendations for feeding and monitoring strategies.	Renal diets are typically high in fat (energy dense), a reduced quantity of high-quality protein, restricted phosphorous, increased omega-3 fatty acids (and sometimes decreased omega-6 fatty acids), fermentable fiber and antioxidants. Patients should be reevaluated within 2 weeks after initiating nutritional therapy and then three to four times per year. A complete dietary history, physical examination, bodyweight, body condition score, and laboratory evaluation are indicated.	
Finco DR et al. 1998	28 commercially bred young adult female cats	Case series. Renal mass was reduced surgically in all cats to induce renal failure.	Cats were grouped to ensure mean GFR values were similar between groups. One of four diets was then randomly allocated to one of each cat group – low protein, low calorie (A); low protein, high calorie (B); high protein, low calorie (C); high protein, high calorie (D). Cats were observed daily and plasma bicarbonate measured regularly. Serum biochemistry (anion gap, albumin, alkaline phosphatase, alanine transaminase, bicarbonate, BUN, total calcium, chloride, creatinine, glucose, potassium, sodium, inorganic phosphorus, total protein) was repeated bimonthly. GFR, urinalysis and UPC measurements were repeated monthly. Cats were euthanized at the end of the study.	Protein-replete diets were not associated with increased severity of glomerular or nonglomerular lesions, increased proteinuria, or decreased GFR. Calorie-replete diets were not associated with increased severity of glomerular lesions, but were associated with mild increase of nonglomerular lesions.	No control group, surgical model of renal failure and controlled conditions may not reflect the clinical scenario of renal disease encountered in practice.

Table 1: Evidence Summary (cont'd)

Study	N	Design	Intervention	Results	Limitations
Harte JG et al. 1994	35 client-owned cats diagnosed with CKD	Randomized controlled trial	Cats were fed either a test diet restricted in protein and phosphorous or a control diet. Cats were assessed weekly for 8 weeks, then again at 12 and 24 weeks after commencement of the feeding trial. Assessments included body-weight, routine hematology, serum biochemistry and urinalysis.	Halitosis, gingivitis, appetite and body condition worsened in both groups of cats, however this worsening was less pronounced in cats consuming the test diet, as judged by owners and veterinarians. Mean serum urea and creatinine were not notably different at day 0; values decreased in the test group and increased in the control group. For urea and creatinine the weeks 0 to 24 differences were considerably different between control and treatment groups. There was a statistically significant interaction between study group and time, which indicates that response patterns varied over time for each group.	Follow-up time was fairly short, <i>i.e.</i> no survival information generated.
Plantinga EA et al. 2005	321 client-owned cats diagnosed with chronic renal disease	Retrospective survival analysis. Cats were included in the study if they had been diagnosed with chronic renal disease, were over 8 years old, had survived more than two months after diagnosis, plasma urea was recorded as greater than 14 mmol/L, plasma creatinine was recorded as greater than 175 µmol/L, diet was either a “normal” diet or a commercially available renal diet for at least 75 percent of survival time, no diseases other than chronic renal disease were diagnosed and the cause of death was related to chronic renal disease.	Survival analysis; time between diagnosis of CKD and death was compared between cats fed a renal diet or a “normal” maintenance diet	Median survival time of cats that were given conventional diets (n = 175) was seven months; median survival time of cats that received one of the seven renal diets (n = 146) was 16 months. Median survival time of cats on the most effective of the diets was 23 months and median survival time of those on the least effective diet was 12 months	Validity depends on the accuracy of the reports received from the practitioners, and assumption that the kidney diet bought by the cat’s owner was indeed offered to the cat.

Table 1: Evidence Summary (cont'd)

Study	N	Design	Intervention	Results	Limitations
Ross SJ et al. 2006	45 client-owned cats with stage 2 or 3 chronic renal disease	Double blind, randomized controlled clinical trial	Cats were randomly assigned to an adult maintenance diet group (n = 23 cats) or a renal diet group (n = 22 cats) and assessed every 3 months for up to 24 months. Double-blinding was achieved by providing coded diets in identical packaged material. Efficacy of the renal diet in reducing uremia, renal-related deaths, and all causes of death were evaluated as compared with the maintenance diet.	The percentage of cats that had uremic episodes was significantly lower in cats fed the renal diet (no episodes reported) than cats fed the maintenance diet (26%). Cats fed the renal diet had a statistically greater reduction in renal-related deaths than cats fed the maintenance diet, there was no statistically significant difference in the overall mortality rates between groups up to 24 months after the study.	

ABOUT THE AUTHOR

Patrick Shearer, BVMS, PhD, graduated from Murdoch University School of Veterinary and Biomedical Sciences in Perth, Western Australia, in 2003. Dr. Shearer was part of the Banfield Applied Research & Knowledge (BARK) team as an associate medical advisor between 2009 and 2011. Now located in Davis, Calif., Dr. Shearer continues to provide medical advising, review and writing services to Banfield as a contractor. 