

Diabetes Mellitus & Kidney Disease – Feline

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Definition

In feline *diabetes mellitus* blood glucose concentrations cannot be maintained in the normal range as a result of low insulin secretion from pancreatic beta cells. *Renal disease* is abnormal renal function with a decreased glomerular filtration rate (GFR) and possibly urine-concentrating ability without azotemia. *Renal insufficiency* is abnormal renal function with a decreased GFR, urine concentration, and mild azotemia. *Renal failure* is severe azotemia associated with some or all of the systemic manifestations of uremia. For more on diabetes in cats, see pages 30–31; for more on feline kidney disease, see pages 86–87.

Key Diagnostic Tools and Measures

Persistent hyperglycemia over 2 days is indicative of diabetes mellitus. Renal disease is assessed by urine specific gravity of 1.014 or less and increased serum creatinine. Both conditions have concurrent clinical signs of polyuria, polydipsia, and history of weight loss.

Pathophysiology

More than 80% of cats are thought to have Type II diabetes mellitus, which is a relative insulin deficiency because the amount of insulin actually secreted may be increased, decreased, or normal but is always inadequate relative to serum glucose levels. Diabetes mellitus is characterized by peripheral insulin resistance combined with dysfunctional beta cells. The incidence of renal disease increases with age and generally is associated with renal cell injury and death. Dysfunction occurs in one or more categories of renal function: glomerular filtration, membrane selectivity, urine concentration, tubular resorption, or endocrine function. Diabetic nephropathy as seen in people is not well recognized in cats.

Signalment

Diabetes mellitus affects cats of any age and gender but is diagnosed more commonly in neutered male cats older than 6 years of age (usually between 10 and 13 years) with no particular breed predilection. Renal disease occurs in all age groups but is seen more commonly in cats over 10 years of age (7.7% of cases), and more so over 15 years of age (15.3% of cases). In one report, renal disease was recognized more than twice as often in Maine coon, Abyssinian, Siamese, Russian Blue, and Burmese breeds.

Key Nutrient Modifications

Diets low in soluble carbohydrate^a (CHO) (<20% on a dry matter [DM] basis) are considered superior for the management of diabetes mellitus. Grains suggested to have a lower glycemic index in the cat include corn, sorghum, oats, and barley. By limiting dietary CHO, blood glucose is maintained primarily from dietary protein using hepatic gluconeogenesis which releases glucose into the circulation at a slow and steady rate. Diabetic cats require high-quality protein ($\geq 30\%$ DM and $>85\%$ digestible) of high biologic value.

The mainstay of dietary management of renal disease is to reduce the nitrogenous waste products, hence avoiding an excessive (30–35% DM) quantity of protein is recommended. Dietary protein intake should be adjusted to minimize azotemia. Increasing protein quality decreases deamination of nonessential amino acids, thereby decreasing production of nitrogenous waste. Dietary phosphorous restriction (0.3–0.5% DM) has been shown to slow the progression of renal disease. The CHO, fat, and

^a Soluble CHO (mostly starch) is measured and reported as Nitrogen Free Extract (NFE) whereas CHO as fiber is reported as Crude Fiber.

fiber fraction can be adjusted to allow for a lower protein as needed to control azotemia. Hence, low CHO and phosphate diets with moderate protein should be adequate in most cases.

Recommended Ranges of Key Nutrients

Nutrient	% DM	g/100 kcal	% DM	g/100 kcal
	Recommended dietary level		Minimum dietary requirement*	
Protein	30–35	6–8	26	6.5
Fat	15–30	4–9	9	2.3
Carbohydrate	15–35	3–6	n/a	n/a
Phosphorus	0.3–0.5	0.07–0.12	0.5	0.13

Modified intake of these nutrients may help address metabolic alterations induced by disease states. The recommended dietary composition is shown as percent of dietary DM and as g or mg per 100 kcal metabolizable energy. All other essential nutrients should meet normal requirements adjusted for life stage, lifestyle, and energy intake.

*Nutrient requirement for adult animals as determined by the Association of American Feed Control Officials

Therapeutic Feeding Principles

The management goals of feline diabetes are to avoid insulin-induced hypoglycemia and hyperglycemic episodes and to optimize the chance of achieving diabetic remission. It is generally recommended that diabetic cats be fed twice daily at the time of the insulin injections, although it is acceptable to provide smaller meals more frequently.

It is not yet clear which food profile (high-fiber vs. low-carbohydrate) provides optimal glycemic control. Feeding low-carbohydrate foods is associated with a reversion rate of clinical diabetes to a non-insulin-dependent state by threefold compared with feeding high-fiber foods. Reversion has occurred, however, when feeding the high-fiber option and glucose control is not significantly different in cats that remain insulin-dependent. Dietary management of the comorbidities must also be considered when selecting diets for the diabetic patient.

The goals of management for renal disease are to minimize the azotemia and electrolyte aberrations. Cats should be fed a canned diet to increase water intake fortified with B vitamins and antioxidants. Sodium and potassium intakes need be adjusted on an individual basis but a diet containing alkalinizing agents will help to manage the acidosis. Cats generally do better fed multiple small meals (four to six per day) to minimize the postprandial load to the kidney.

■ **Treats** – Maintaining a low carbohydrate, protein and phosphorous intake is important. Suitable examples include portions of the cat's recommended diet or kibble forms of comparable diets.

■ **Tips for Increasing Palatability** – Transition the diet change from the regular diet to the suitable diabetic diet over 5 to 14 days; longer times for cats that are more resistant to change. The palatability of food generally increases with increased temperature, water, and the nutrients fat, protein, and salt. Warm (microwave) food or lightly warm canned food. Add warm chicken or beef broth (low salt), water or oil from canned fishes (sardine, tuna, mackerel), if appropriate, to enhance taste.

■ **Diet Recommendations** – Nutrient ranges of diets recommended for diabetic cats with renal disease are <35% CHO, 30% protein, and 30% fat with <0.5% phosphorous DM basis. Cats should be fed to maintain or achieve an ideal body weight. Canned foods are generally more palatable; contain more water, fat, and less CHO than kibble. Consider a specifically designed home-made diet to meet multiple dietary needs if commercial products are unsuccessful.

Client Education Points

- Feed meals at the time of insulin injection at 12-hour intervals. It is recommended that only food products designed for a diabetic cat with low phosphorous be fed, and that the food is obtained from a reliable source for quality control and product consistency.
- Cats can become non-insulin-dependent, hence close monitoring is essential.
- Cats may be fed smaller meals between insulin if tolerated.
- Cats with mild to moderate signs of hypoglycemia such as weakness, trembling, and wobbliness that are still able to eat should be immediately fed a renal type diet. If signs are severe, such as seizure or coma, glucose syrup designed for human diabetic patients can be rubbed into the gums, and owners should seek veterinary attention immediately.

Common Comorbidities

Comorbidities are very common in diabetic cats with renal disease. For cats that are also overweight or obese, feed a high-fiber, low-CHO food. Insulin sensitivity may return as adiposity decreases. Cats that also have pancreatitis or cancer (adenocarcinoma) can still be fed low-CHO, high-protein

diabetic foods. Other common comorbidities include bacterial cystitis and urinary tract infections, hyperlipidemias (change to a lower-fat, low-CHO diabetic food), endocrinopathies (hyperadrenocorticism, acromegaly), and drug-induced conditions (glucocorticoids, progestins). For stress hyperglycemia associated with illness, manage as a diabetic until resolved.

Interacting Medical Management Strategies

Normalizing serum phosphorous should first be attempted through feeding a lower phosphorous diet for 2 to 4 weeks before adding intestinal phosphate binders. Acarbose is a useful adjunct for managing diabetic cats with advanced renal disease that are meal-fed a restricted-protein diet. It is less effective for cats eating multiple small meals daily.

Monitoring

Blood and urinary glucose and ketone concentrations need to be monitored to determine the level of glycemic control, along with regular blood and urine specific gravity tests to monitor progression of renal disease. Monitor body weight and adjust energy intake to achieve an ideal weight.

Algorithm – Nutritional Management of Feline Diabetes Mellitus with Creatinine >2.0

