

## CRITICALLY APPRAISED TOPIC:

# DIABETES MELLITUS

## What effect does diet have on newly diagnosed diabetic cats receiving insulin therapy?

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### CLINICAL QUESTION

For newly diagnosed diabetic cats receiving insulin therapy, what type of diet is best for supporting consistent glycemic control?

### CLINICAL SCENARIO

A 3-year-old castrated male Domestic Shorthair cat weighing 4.7 kg presented for polyuria/polydipsia of unknown duration and gradual weight loss. Over a one-year period, the patient had lost 1.8 kg and body condition score had decreased from 4/5 to 3/5. Current diet at time of presentation was not noted in the medical record. A physical examination was performed and the patient was found to be 5 percent dehydrated. The remainder of the physical examination was normal.

Blood samples were collected for a complete blood count and biochemical analysis. Urine was obtained by ultrasound-guided cystocentesis. The serum glucose concentration was 512 mg/dL (reference range 76-145 mg/dL); the remaining results were within normal limits. Urinalysis revealed a specific gravity of 1.046 and absence of ketones; 2+ cocci bacteria and glucose of 1,000 mg/dL were noted. Ketones were not present. Urine culture and serum fructosamine concentrations were not performed at the time, due to financial limitations. A presumptive diagnosis of diabetes mellitus was made. The cat was prescribed two units of glargine insulin subcutaneously BID (0.43U/kg). In addition, the cat was empirically prescribed 62.5 mg of amoxicillin/clavulanic acid orally BID (13.3 mg/kg) for seven days.

### CLINICAL BOTTOM LINE

- Dietary control of protein, carbohydrates and fiber may all play a role in the management of diabetes mellitus.
- Diets containing high fiber or high protein may lower insulin requirements in diabetic cats.
- Additional research is needed to identify the optimal nutrient balance for supporting glycemic control.

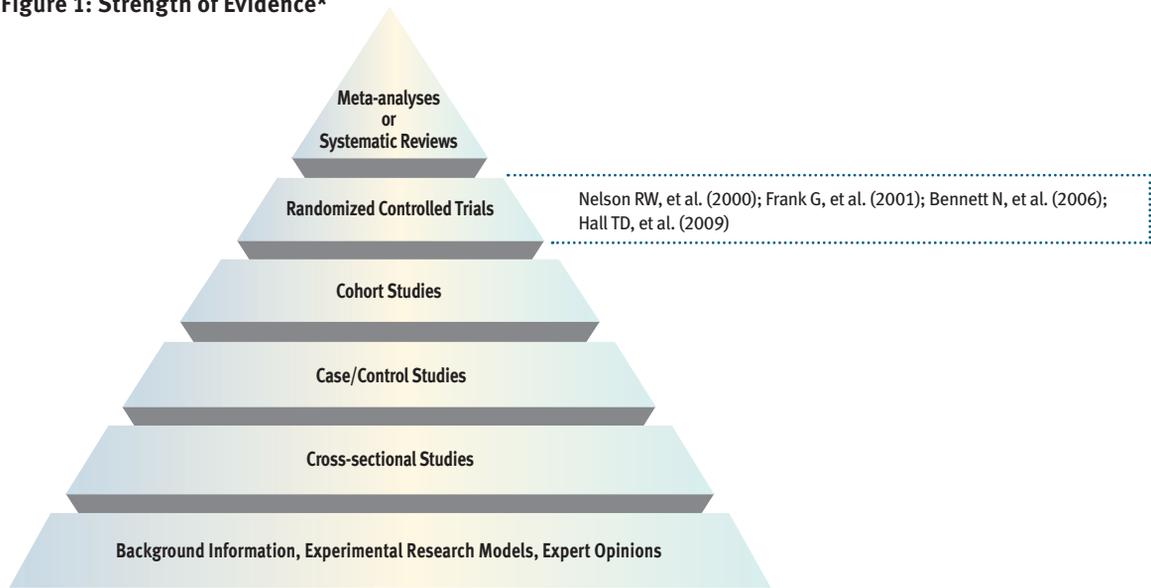
### EVIDENCE SUMMARY

A targeted literature search was performed using the CAB Abstracts and PubMed medical literature databases with the MeSH terms “diabetes mellitus AND feline AND diet.” There were 56 articles returned for those search criteria. The search was refined to those relevant to the clinical question, those that were primary studies, and those where full text articles were available (n=8). To further align with the clinical case in question, studies that used healthy cats were excluded, leaving four studies for review. Additional searches using the string “feline AND glycemic control AND diet” and “feline AND diabetes AND diet” were also performed. No additional articles were returned.

### MAIN RESULTS

- Dietary inclusion of 12 percent insoluble fiber significantly decreased both pre- and postprandial serum glucose concentrations as well as the 12-hour mean serum glucose concentration in diabetic cats.<sup>1</sup>

**Figure 1: Strength of Evidence\***



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

- After transitioning from a control diet containing high fiber/moderate fat to a treatment diet with high protein/low carbohydrate, eight of nine cats required lower doses of insulin, and three of the cats no longer required exogenous insulin.<sup>2</sup>
- When a low-carbohydrate/low-fiber food was compared with a moderate-carbohydrate/high-fiber food, a significantly higher number of cats no longer required administration of exogenous insulin.<sup>3</sup>

## COMMENTS

In all of the studies, body weight remained stable throughout the study period.<sup>1-4</sup> Given that overweight and obesity are known risk factors for diabetes, weight loss may influence the course of clinical disease. Therefore, if a treatment diet was formulated to promote weight loss, greater improvement might have been observed than if it was not. Other factors may also influence the effect of insulin and insulin resistance on cats. Because the studies examined were all clinical trials involving client-owned cats, factors such as amount of daily exercise, outdoor exposure and insulin dosage could not be controlled. Randomization to treatment groups, however, does minimize potential differences in regard to these factors and effect on the outcome.

Directly comparing the studies was challenging due to inconsistency of the units used to describe the diets, and different measures used, such as: percent as-fed;<sup>2</sup> percent dry matter;<sup>1,2</sup> percentage of metabolizable energy;<sup>3</sup> and g/100 kcal.<sup>4</sup> Authors also categorized the

nutrient content of diets as high, moderate or low, but with no specific definition of these categories, making diet comparisons difficult.

The source of nutrients and interactions between nutrients may also play a significant role in inter- and intra-subject variability of the effect of a given diet on glycemic control. When the proportion of one nutrient is decreased, the proportion of other nutrients also changes. Thus, it is challenging to determine the true effect of the diet on these cats. Further studies are needed.

In addition to prescribing glargine insulin (0.43U/kg) and 62.5 mg of amoxicillin/clavulanic acid, the veterinarian shared evidence with the owner regarding the potential benefits of a high-fiber or high-protein diet formulated for diabetic cats. Together they decided to add the diet to the treatment plan. At the one-month follow-up visit, physical examination showed the cat had maintained a stable body condition of 3/5. Glycemic control appeared to be well-maintained as evidenced by serum glucose and fructosamine concentrations at re-evaluation. The owner reported moderate improvement in energy and polyuria/polydipsia as well as no apparent adverse events to the insulin or the prescription diet. The veterinarian and owner mutually agreed to continue with insulin and dietary therapy, rechecking as appropriate for this patient.

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**Date CAT was “born”/expiration date:** 04/08/2011

**Table 1: Evidence Summary**

Study	Study Type	Subjects	Diets Evaluated	Design	Outcome	Limitations
Nelson RW, Scott-Moncrieff JC, Feldman EC, et al. (2000)	Randomized, partially blinded, crossover design	16 client-owned cats with naturally acquired diabetes	High-fiber and low-fiber diets were evaluated	Cats were fed one of the two diets for 24 weeks, then fed the other for 24 weeks	Mean preprandial serum glucose concentration, postprandial serum glucose concentration, and mean 12-hour serum glucose concentration were significantly lower	Lack of uniformity due to non-laboratory setting
Frank G, Anderson W, Pazak H, et al. (2001)	Clinical trial consisting of a standardization period and treatment period for all cats	9 client-owned diabetic cats with naturally acquired disease managed on exogenous insulin	Standardization diet: high-fiber/moderate-fat canned diet  Treatment diet: high-protein/low-carbohydrate canned diet	All cats were fed the standardization diet for one to two months, then transitioned to the treatment diet for three months	Total dose and dosage rate of insulin were decreased significantly during the treatment period	High dropout rate (9/18), lack of a concurrent control group, no blinding
Bennett N, Greco DS, Peterson ME, et al. (2006)	Randomized clinical trial	63 client-owned cats with naturally occurring diabetes mellitus	Control diet: moderate-carbohydrate/high-fiber diet  Study diet: low-carbohydrate/low-fiber diet	Cats were assigned one of the two diets and fed that diet for four months	Cats fed the low-carbohydrate/low-fiber diet were significantly more likely to revert to a non-insulin dependent state than cats fed the control diet	The majority of cats were not well-regulated, based on clinical signs and fructosamine, upon entry to the study (90 percent)
Hall TD, Mahony O, Rozanski EA, et al. (2009)	Randomized, double-blinded clinical trial	12 client-owned cats with naturally occurring diabetes mellitus	Control diet: commercially available adult maintenance diet  Study diet: low-carbohydrate/high-protein diet	Cats were assigned one of the two diets, and fed that diet for a period of 10 weeks	All cats achieved good glycemic control; monitoring rather than diet may be the key to treating these cats	Fed a dry, canned, or combination diet based on preference, not standardized

**References**

1. Nelson RW, Scott-Moncrieff JC, Feldman EC, et al. Effect of dietary insoluble fiber on control of glycemia in cats with naturally acquired diabetes mellitus. *JAVMA*. 2000;216(7):1082-1088.
2. Frank G, Anderson W, Pazak H, et al. Use of a high-protein diet in the management of feline diabetes mellitus. *Vet Ther*. 2001;2(3):238-246.
3. Bennett N, Greco DS, Peterson ME, et al. Comparison of a low carbohydrate-low fiber diet and a moderate carbohydrate-high fiber diet in the management of feline diabetes mellitus. *J Feline Med Surg*. 2006;(2)8:73-84.
4. Hall TD, Mahony O, Rozanski EA, et al. Effects of diet on glucose control in cats with diabetes mellitus treated with twice daily insulin glargine. *J Feline Med Surg*. 2009;11(2):125-130.

Amy Hille, DVM, MPH, DACVPM, graduated from Kansas State University with a Bachelor of Science in Animal Science in 1997 and a DVM in 2001. She completed her Master of Public Health from Oregon Health & Science University in 2006 with an emphasis in biostatistics and epidemiology. Amy joined the Banfield Applied Research & Knowledge (BARK) team in 2010 as an Associate Medical Advisor. 