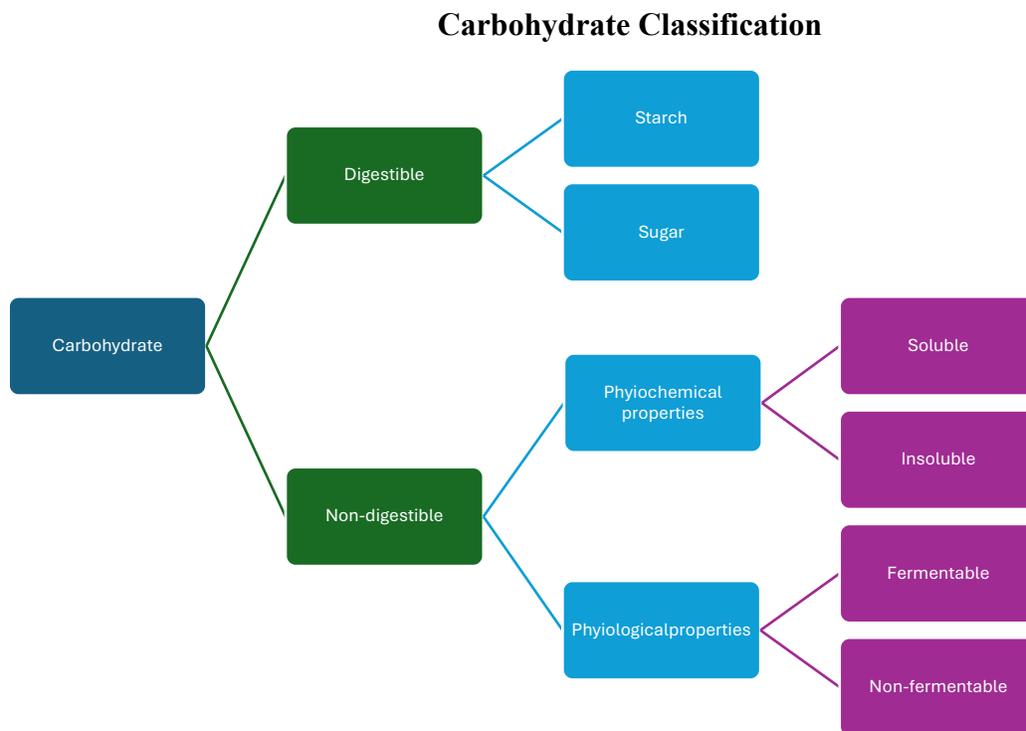


## Nutritional Management of Diabetes

**Overall goal of dietary management:** Improve glycemic control, not eliminate the need for insulin

### Glycemic index

- Measure of how fast food raises blood glucose
- Ranking compared to pure glucose
- Not typically used in pet food because they are a mixture of ingredients, fat may affect gastric emptying and BG absorption, and the processing may affect starch digestibility



### Canine Diabetes Mellitus

#### Goal of Diet:

- Maintain body weight and ideal BCS
- Improve diabetic control (steady BG over time, reduce effects of meals on BG concentration)
- Address any concurrent dietary responsive underlying disease (pancreatitis, obesity, etc.)

#### Key Nutritional Factors

#### Feeding Management

- Meal size, timing, treats
- Consistent intake
- Palatability, this is critical to ensure reliable intake, coordinated with insulin

### **Same amount of the same diet at the same times, every day**

Try to maintain the same insulin regimen, most dogs are dosed with insulin twice a day, therefore, there should be two corresponding meals per day

This principle also applies to treats, consistency in the amount, type, and frequency are critical. Choose options with low calories, do not overlook foods used to deliver medications, and avoid treats with simple sugars

### **Dietary Starch and DM in Dogs**

- In healthy dogs, studies have shown that when the source is identical, the amount of starch in the diet does not impact blood glucose, this is due to the action of insulin
- In healthy dogs, when the amount of starch is identical, the source of CHO affects postprandial blood glucose AUC (likely due to fiber)

### **What is Fiber?**

- Mostly complex carbohydrates (beta-linked chains of sugar molecules) not digestible by mammalian enzymes
  - o Also lignin, phytates, waxes
  - o B-linked need to be broken down by bacteria
- Not considered nutritionally essential in dogs and cats
  - o Important for health and disease
- Usually categorized by solubility and/or fermentability

### **Dietary Fiber management in DM and Dogs**

- Insoluble fiber
  - o Decreased transit time
  - o Impede substrate access to enzyme / decrease absorption of dietary carbohydrate
- Soluble fiber
  - o Delay gastric emptying
  - o Form gel in aqueous solution “bind” glucose
    - Slower glucose absorption leads to a decreased insulin need

### **Using Fiber to Manage DM**

- Obesity and DM are closely linked, especially in cats, the goals and strategies overlap
- Reduced caloric density and increased volume may help with satiety
- Modulation of gastric emptying and nutrition absorption
  - o Slowed gastric absorption and GI transit time

- >50g/1000 kcal (>15-20%DM) insoluble fiber (cellulose, peanut hulls) and/or soluble fiber (guar gum, pectin) can help to improve glycemic control in some dogs, with maintenance of insulin dosage. \*individual variation

### **Dietary Fat \*No studies**

- Pros
  - Palatability
  - Increased caloric density
  - Slows transit time
- Cons
  - Need to limit if there is fat intolerance
- As long as there is no fat intolerance, moderate fat content ensures adequate but not excessive energy density to minimize impact on patients with pancreatitis, hyperlipidemia, or obesity

### **Dietary Protein \*No studies**

- Higher protein is generally desired relative to calories for dogs with lower energy needs
- Maintain muscle mass
- Increase energy expenditure (not efficient to use for protein for energy)
- Allow for moderate carbohydrate and fat contents

### **Is a diet change always necessary in dogs with DM?**

- Only need a diet change if there is evidence of fat intolerance (pancreatitis) or a need for weight loss or another nutritionally responsive disease (CKD, chronic enteropathy, etc.)
- If regulation is poor, try a diet higher in fiber, or add a purified fiber supplement (psyllium, cellulose, etc.)
- Any diet change may alter glucose control, so monitoring is key!

### **Feline Diabetes Mellitus**

#### Current controversies

Can cats digest and metabolize carbohydrates adequately?

- Yes, even if high levels are in the diet (shown in several studies)

Do high carbohydrate diets cause DM in cats?

- No evidence
- Obesity leads to DM (strong evidence)

- High fat diets are a risk factor for obesity (energy dense), not high carbohydrate diets

### **Dietary Carbohydrate and DM in Cats**

- Low carbohydrate diets are often recommended
  - o These diets tend to be energy dense to the volume may be too low
- Limited research data available, subject numbers are small
- Carbohydrate source/intake are not the only factors influencing DM
- Few studies examining the effect of low CHO/high protein diets in diabetic cats
- Many nutrient differences between diet groups; some may impact DM management (protein and fiber)
- Inaccuracies of dietary fiber measurement, and therefore affects estimates of carbohydrate contents

### **Overview**

- Dietary starch levels
  - o Affects postprandial BG in healthy cats
    - But within normal limits
  - o Can alter glycemic control in diabetic cats
    - Levels <12%ME may increase remission rates and glycemic control
    - Solid evidence is still lacking
    - Other macronutrients may play a role
  - o Dietary fiber
    - May improve glycemic control in diabetic cats
      - Evidence for cellulose
  - o Current evidence suggests
    - Diabetic remission/control can be achieved with different dietary strategies
      - High protein, low carbohydrate diets
      - Moderate carbohydrate, high fiber diets
      - Fat mass loss is important to reduce insulin resistance and achieve remission (along with insulin therapy)
      - Higher remission rates appear more likely in obese cats which lose body fat, regardless of diet (priority)!
      - Obesity-related insulin resistance is reversible with weight loss

### **Practical Implementation Upon Diagnosis**

**\*Individualize your recommendation to each cat**

### **Consider**

- Cats don't appear to require strict control of meal timing

- Is weight loss needed? Is the cat weight stable?
- Concurrent disease?
- Low CHO diet? High fiber diet?
- Dry vs canned
- Any diet change may alter glucose control, so monitoring is key!

### **Dietary Management of Hyperlipidemia**

- Hypertriglyceridemia (chylomicrons very low-density lipoproteins)
- +/- hypercholesterolemia
- Postprandial (normal/expected) – 10-12 hr, limited
- Primary (familial/genetic) vs secondary
  - Hypothyroidism
  - DM
  - Hyperadrenocorticism
  - Pancreatitis

### **Management Strategies**

- Determine underlying cause and treat if it is treatable
- Institute dietary change even if the patient is asymptomatic
- Lifelong therapy
- Goal: fasted serum TG < 500 mg/dL

### **Dietary Fat**

#### **Dietary fat restriction is the cornerstone of treatment!**

- Ideally, determine current fat intake from diet history
  - Select a diet with much lower fat levels (at least half on ME basis)
- Typically, starting point is 15-20%ME in dogs, 20-25%ME in cats based on commercial diet options available
  - Do not assume that “light” diets are low fat
  - Patient may require further fat restriction and need a homemade diet
  - +/- lipid-lowering medication
- Treats should be low fat too
  - Use fruits and vegetables!

### **Comparing Fat Contents of Various Diets**

- Do NOT compare “% as is” on labels or “% dry matter”
- Compare on calorie basis (% of calories on ME basis or g fat/100kcal)

## Omega 3 PUFA (EPA + DHA from marine sources)

- Decrease serum triglyceride via a decrease in VLDL in humans
- Studies in healthy dogs show similar, higher, or lower serum TG after fish oil supplementation
- Some authors recommend 120 mg/kgBW/day in hyperlipidemic dogs

### \*In practice

- Start with overall dietary fat restriction and re-assess
- Consider fish oil supplementation after recheck
- Some commercial diet options already contain fish oil

### Low fat diet options

- Homemade diets can be very low in fat
- Must be formulated by a veterinary nutritionist
- Must meet linoleic acid requirement!
- Depending on ingredients, can get as low as 7-10% fat ME

### **Feline options**

- Purina OM dry (23% ME), Hill's feline r/d or w/d dry (23-24% ME)
- Some OTC options (~25-28% fat ME) or homemade

### **Medical Management**

- Consider fibrate medications
  - Chitosan and fiber are not typically rewarding

### **Hyperlipidemia Summary**

- Assess fasting serum triglycerides
- Institute fat reduction (aim for at least 50% lower in fat if possible)
- Reassess in 304 weeks and confirm compliance
- In extreme cases, balanced homemade diets may be needed
  - Can be very low in fat
  - Ensure fatty acid requirements are met
- Individualize your recommendations based on diet history and response to diet change