

# Xylitol Toxicosis

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## WHAT IS XYLITOL?

Xylitol is a white, crystalline sugar alcohol that is used as a sugar substitute sweetener in many products. In the United States, xylitol's use as a sweetener has grown rapidly over the last few years. It is as sweet as sucrose, but contains only 2/3 the calories as sugar. Therefore it is increasingly found in sugar-free candy, baked goods, gums and other foods. It is also available in granulated form. It is popular among diabetics and those on low-carbohydrate diets as it causes little insulin release in humans. It also is increasingly being included in sugar-free gum, toothpaste, and other oral hygiene products due to its anti-cavity properties (it prevents oral bacteria from producing the acids that damage tooth surfaces).

## XYLITOL: HUMANS VS DOGS

In humans, xylitol is absorbed slowly and has little to no effect on plasma insulin or glucose levels. However, in dogs, xylitol is completely and rapidly absorbed, with peak blood concentrations occurring in about 30 minutes. It then acts as a strong promoter of insulin release with resultant hypoglycemia. In one study of dogs, the degree of insulin release from a xylitol dose was over 6 times that seen with an equivalent dose of glucose. In dogs, xylitol can also cause hepatic necrosis, coagulopathies, and death. Xylitol's effect on insulin and blood glucose in the cat is not clear at this time.

## HOW MUCH XYLITOL CAUSES TOXICITY?

Based on data from the ASPCA Animal Poison Control Center (APCC), dogs ingesting >0.1 g/kg of xylitol should be considered at risk for hypoglycemia. At doses exceeding 0.5 g/kg, there is risk of hepatotoxicity and other more serious effects.

Calculating the ingested xylitol dose can be challenging. Although the xylitol content is more commonly listed on food products, this is not the case with many chewing gums. In most gum products, it is likely that the total sugar alcohol content will be listed. Chewing gum which is sweetened primarily or exclusively with xylitol contains about 1-2 grams/piece. Thus, one or two pieces of gum could cause hypoglycemia in a 10 kg dog. For granulated xylitol, one cup weighs about 190g.

## CLINICAL SIGNS & DIAGNOSIS

Diagnosis is made on history, symptoms, and blood work. After ingestion, vomiting is often the first symptom. Hypoglycemia ensues rapidly; in most cases, it occurs within an hour of ingestion. Diarrhea, collapse and seizures may be seen. Initial blood work usually demonstrates severe hypoglycemia (<50 mg/dL) and, commonly, hypokalemia (insulin drives potassium into the cells).

Dogs may develop elevated liver enzymes and signs of hepatic disease 8-12 hours post-xylitol ingestion. Some recover fully. Others, however, may develop acute liver failure, hemorrhage, disseminated intravascular coagulation (DIC), stupor, and death. The lowest dose known to cause hepatic necrosis is estimated to be 0.5 g/kg; however, it is still not known if the hepatic necrosis is dose-related or if it is idiosyncratic.

*Dogs that develop acute hepatic failure may not show signs of hypoglycemia immediately after ingestion of xylitol. About 48 hours post xylitol ingestion, such patients usually have extremely elevated ALT and bilirubin values, moderate hypoglycemia, hyperphosphatemia, and prolonged coagulation times (PT/APTT). DIC and death may ensue. Hyperphosphatemia is thought to be a negative prognostic indicator.*

## DIFFERENTIAL DIAGNOSES

Other causes of hypoglycemia should be ruled out (parenteral insulin overdose, insulinoma, juvenile/toy breed hypoglycemia, etc). In dogs with liver disease, rule out other causes of acute hepatic necrosis (sago palm toxicity, hepatotoxic mushrooms, acetaminophen, aflatoxins, various drugs). Infectious hepatic diseases, shunts, and neoplastic disease must be considered as well.

## TREATMENT

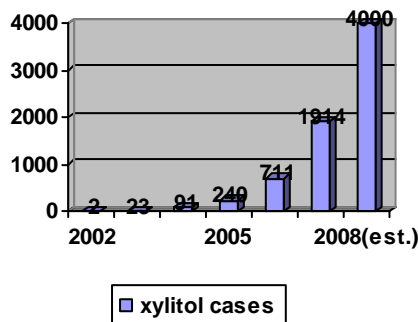
- There is no antidote for xylitol toxicity.
- *Remember that doses >0.1 g/kg should be considered at risk for hypoglycemia, and doses >0.5 g/kg are considered potentially hepatotoxic.*
- Because onset of clinical signs can be rapid, induce emesis only if asymptomatic and only if ingestion has occurred very recently (within 30-60 minutes). *Activated charcoal is not effective in binding xylitol.*
- Obtain baseline bloodwork (particularly glucose, electrolyte, phosphorus, and liver enzymes) and coagulation measurements. Monitor glucose every 1 to 2 hours for 12 to 24 hours. Monitor hepatic and coagulation parameters every 24 hours for at least 72 hours.
- Supportive care is paramount to survival. Intravenous fluid support is important to restore and maintain hydration. Because hypoglycemia can be prolonged (days in duration), it is important to administer dextrose bolus(es) followed by dextrose-based fluids. Correct hypokalemia by adding potassium to the fluids. Maintain body temperature; control pain.
- Medications: Prevent vomiting as needed with antiemetics. Antibiotics and gastrointestinal protectants may be indicated in acute liver failure; avoid drugs that are metabolized by liver. It is not known if liver protectants or antioxidants (S-adenosylmethionine, ursodiol, silymarin) are of benefit in this toxicosis.

## PROGNOSIS

The prognosis is good for uncomplicated hypoglycemia when treatment can be instituted promptly. Hepatic failure and coagulopathy generally carry a poor prognosis. Stupor, coma, and DIC have a grave prognosis.

## SUMMARY: XYLITOL- IS IT AN EPIDEMIC?

*"In the last few years, xylitol has grown from being a rare (or non-existent) problem to being a very common one. The dictionary defines epidemic as 'affecting or tending to affect a disproportionately large number of individuals within a population, community, or region at the same time'...so... technically you can call xylitol an epidemic."* (Eric Dunayer, MS, VMD, DABT, DABVT; ASPCA APCC; VIN, 8/16/2008)



The number of products containing xylitol has been steadily rising over the last few years, with a resultant surge in xylitol cases reported to the ASPCA APCC. Because of xylitol's rapid absorption in the dog, with risk of acute hypoglycemia, hepatic failure, and even death, treatment should be instituted in all cases in which a dog may have ingested >0.1 g/kg of xylitol. *All xylitol exposures should be evaluated by a veterinarian immediately.*