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Diabetes Mellitus: Introduction

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Here Are the Take-Homes for Pet Diabetes

- *Diabetes mellitus is caused by a deficiency of insulin. You are probably going to have to give injections of insulin as a replacement. (Don't worry. It's easier than you think).*
- *The main symptoms of diabetes mellitus are excessive urination, excessive thirst, excessive appetite, and weight loss. Treatment should control these symptoms. Watching for these symptoms is the best way to know how your pet is doing.*
- *The starting insulin dose is going to be based on averages and will be tweaked based on trial and error, depending on both test results and control of the symptoms.*
- *You can save a lot of money if you get your own glucose meter and learn to do blood sampling at home (it's easier than you think).*
- *Using too little insulin is a problem in the long term but too much insulin is potentially an emergency in the short term. Be sure you know how to recognize hypoglycemia and what to do about it.*

Additional Resources

- Cataracts in Diabetic Dogs
- Diabetic Ketoacidosis in Dogs and Cats
- Diabetic Cat Diet
- Diabetic Dog Diet
- Glargine (Lantus) and Detemir (Levemir) Insulin
- Insulin Administration in Cats
- Insulin Administration in Dogs
- Insulin Alternatives
- Monitoring Glucose Regulation in Dogs and Cats
- Hard to Regulate Diabetic Cats
- Hard to Regulate Diabetic Dogs
- Home Testing of Blood Glucose for Diabetic Cats

What is Diabetes Mellitus?

In order to understand the problems involved in diabetes mellitus it is necessary to understand something of the normal body's sugar metabolism.

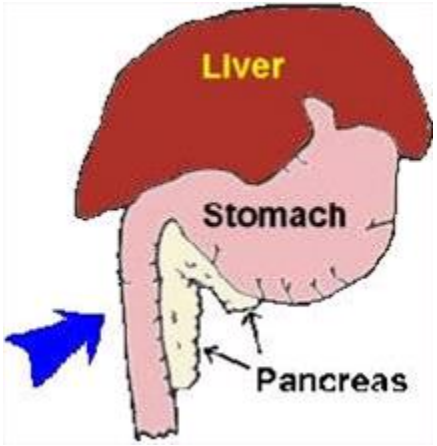
The cells of the body require fuel in the form of fat or sugar to conduct their daily activities. Some tissues can use either sugar or fat depending on circumstances and some tissues (such as the brain and nervous system) depend almost exclusively on sugar as fuel. Diabetes mellitus mostly involves the metabolism of sugar (in particular, a sugar known as **glucose**) so we will focus on the sugar part of the situation. Glucose comes from the diet in the form of starches and sugars that we eat.

Tissues cannot absorb glucose without a hormone known as **insulin**. Insulin is produced by the pancreas as part of the body's natural blood sugar regulation. Insulin can be considered to be a key that unlocks the door, allowing sugar in the bloodstream to enter the body's cells. Once inside the tissues, glucose can be burned for fuel or stored, but without insulin the sugar stays in the bloodstream and cannot be used by the body.

Ketones in urine for three days or more in a row warrants a visit to the veterinarian.

In a Diabetic Animal there isn't Enough Insulin

In fact, there may be no insulin at all. Remember that insulin was the key to unlock the cell so that glucose could be brought inside. With no insulin, glucose cannot get in. Not only is glucose not being taken in and stored, but it is left floating around in the bloodstream in extremely high amounts. The body's tissues are starving and the bloodstream has plenty of glucose to feed them but without insulin, the glucose is unavailable.



The pancreas is nestled along the stomach and small intestine. It secretes digestive enzymes into the small intestine but it also secretes hormones into the bloodstream to regulate blood sugar. Graphic by MarVista Vet.

So What Symptoms Result from this?

Because there is no way to remove the glucose from the bloodstream, blood sugar levels are astronomically high. Normally, the kidney is able to conserve the bloodstream's glucose but its mechanisms are overwhelmed and glucose spills into the urine in high amounts. Glucose is an "osmotically active" substance, which means it is able to draw water with it. All this glucose urine pulling lots of water with it translates into excessive thirst and excessive urination.

The tissues of the body are unable to access any of the glucose they need for fuel and are basically starving. Fat is mobilized and muscle is broken down to help feed the tissues but it does not do much good without insulin to bring fuel inside the cells. The patient shows excessive appetite because his body is in a state of starvation. Because the body is rapidly breaking itself down, weight loss is also a classic sign.

All the sugar in the urine provides a desirable growth medium for bacteria and urinary tract infection is a common finding in diabetes mellitus.

In diabetic dogs (but not cats), a specific type of cataract rapidly develops in the eye when high amounts of glucose enter the lens. Glucose normally feeds the lens but the amounts of glucose coming into a lens in the diabetic state are much higher. Excess glucose is converted to another sugar called sorbitol, which in turn attracts water. The excess water disrupts the clarity of the lens creating a diabetic cataract, which leads to blindness in almost all diabetic dogs.

The main symptoms of diabetes mellitus are:

- **Excessive Thirst**
- **Excessive Urination**
- **Excessive Appetite**

- **Weight Loss**

Is it like the Human Disease? Will we Need to Give Insulin Shots?

Dogs: Diabetes is permanent and yes on the insulin shots.

Cats: Diabetes might not be permanent. Yes on the insulin shots if you want a chance at remission.

Diabetes mellitus is a classical disease in humans and most of us have heard some of the terms used to describe it. In humans, diabetes is broken down into two forms: Type I and Type II. These are also referred to as juvenile onset and adult onset diabetes or insulin dependent and non-insulin dependent diabetes. In short, Type I is the type where the pancreas produces no insulin at all, and Type II is the type where the pancreas produces some but not enough. Many pet owners wonder if dogs and cats have similar categories for their disease.

Virtually all dogs have insulin dependent diabetes and must be treated with insulin. There is no way around it. Their condition is similar to the Type I diabetic human in many ways.

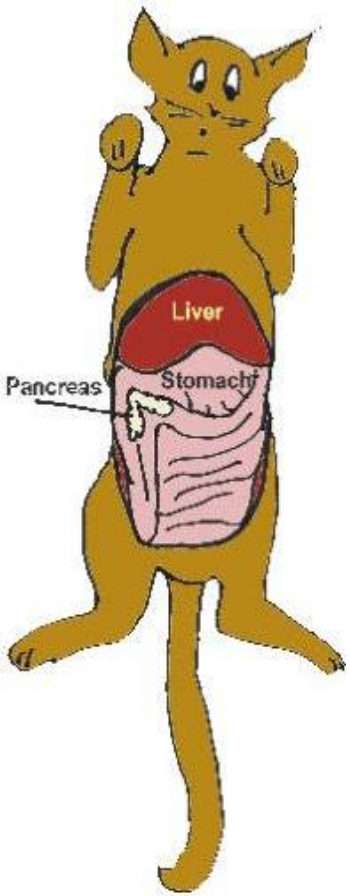


Illustration by Wendy Brooks, DVM

Most cats have non-insulin dependent diabetes, which has some similarities to Type II human diabetes. The term "non-insulin dependent" might suggest that these cats can get away without insulin injections, but that is not the case. Instead, what this means is that for these cats, the diabetes can resolve if the pancreas improves its insulin-secreting ability. In order to have a chance at changing a diabetic cat back into a normal cat, insulin injections are definitely needed. Alternatively, about 25 percent of diabetic cats are in a mildly diabetic state where it is possible for them to be managed with oral medication.

Not all diabetic cats are similar to humans with Type II diabetes. Some diabetic cats, perhaps as many as 25 percent, have more severe hormone issues, such as acromegaly or Cushing's disease, that make them not only insulin dependent but difficult to regulate.

Treatment: Giving Insulin by Injection

Since deficiency of insulin is the problem, it’s not surprising that giving insulin is the solution. You will need to learn to give injections, which is daunting to some owners at first, but almost everyone quickly becomes an expert.

First, an insulin type and dose need to be selected. There are several types of insulins and it is not possible to know exactly how much insulin your individual pet will require; trial and error is needed. Your veterinarian will make a guess based on what works for other cats and dogs and what has been reported in the literature. Most pets require injections twice a day, approximately 12 hours apart, following a meal. Because overdose of insulin is potentially an emergency, it may be prudent to start with once a day insulin, just in case.

Insulin has traditionally been given by syringe in a shot, but insulin pens are proving more and more popular. The syringe method involves buying a box of syringes and a bottle of insulin, drawing up a measured amount of insulin, and giving a shot. The pen involves applying a needle tip to the pen, dialing a dose on the pen, sticking the tip into the pet's skin and pressing a button on the pen. Most people feel the pen method is much easier to perform but it may be difficult to find needle tips that are long enough for pet use as pet skin is much thicker than human skin. In some situations, the pen is used as a dispenser for the

syringe as the pen cartridges may be more cost effective than bottles of insulin. Without video or first-hand experience with insulin pens or syringes, it may be hard to visualize the difference. See our section on insulin administration for details and video. Not all pet insulins are available in a pen format. Your veterinarian will instruct you regarding options.

Some insulins are available from the neighborhood pharmacy and some are available only through veterinary offices and veterinary pharmacies. Your veterinarian will either provide you with supplies or will give you the necessary prescriptions. If you are using syringes (instead of a pen) be sure the syringes and insulin concentration match. Insulin syringes are marked in insulin units (either U-100 syringes for 100 unit/cc insulins or U-40 syringes for 40 unit/cc insulins). Whenever you receive more supplies, always double check these numbers.

Never alter the insulin dose recommended by your doctor. To determine whether dose adjustments are needed (or if a different type of insulin is more appropriate), your pet will need a glucose curve where blood sugar levels are monitored every 2 to 4 hours or so for 12 to 24 hours. This kind of testing tells the doctor how long the insulin injection is lasting as well as what the lowest and highest glucose levels of the day are. It is important to find out when your pet's curve is due. Often in the beginning, it takes several dose selections and several curves before the right dose is determined.

A bottle of insulin, when stored properly, should last 6-8 weeks, after that time it should be replaced.

Diet and Feeding

Regulation can generally be worked out on whatever diet the pet is eating but there are some diets and feeding strategies that are helpful. For dogs, high-fiber diets are preferred as they slow absorption of sugars and help maintain a more regulated blood sugar level. Fiber also seems to make the body's tissues more sensitive to insulin, which also helps with regulation. Diabetic dogs are best fed in two meals, approximately 12 hours apart. After they have been seen to eat their food, their insulin dose can be given.

For cats the strategy is different. First, cats seem to do best fed in multiple small meals daily so they should be allowed access to food at all times. Second, the high protein/low carbohydrate diets seem to be the most conducive to regulation. There are specific prescription diets, both canned and dry, for diabetic cats.

Learn more details on handling diet and feeding for cats and for dogs.

What about Home Glucose Testing?

Your pet is going to periodically need 12-hour glucose curves in order to assess the current insulin dose. This means checking the glucose every 2 hours or so to determine how long it takes for the insulin to peak and how long it takes to wear off. Whenever the insulin dose is changed, some kind of glucose checking is needed. It is also a good idea to periodically check glucoses at certain times of day to get an idea of how the pet is doing.

If you can learn how to check your pet's blood sugar levels at home, you can save a great deal of money and probably achieve better glucose regulation. This is not as difficult as it sounds.

To do home monitoring, you will need a glucose meter. Human meters can be obtained at any drugstore but we recommend getting a veterinary meter as the calibration is different. There are several brands available. The meter kit will contain measuring strips, solutions for calibration, and a spring-loaded lancet device for taking blood samples (usually from the ear margin).

Not every pet is amenable to getting pricked with a lancet so that a drop of blood can be harvested for testing. We do not want your pet to fear interaction with you and do not want you to get bitten or scratched; still, some pets are comfortable with periodic glucose monitoring at home. Home testing may work best for pets that become so agitated by going to the vet that their blood sugar levels are altered at the vet's office and cannot be interpreted. Furthermore, pet owners can save a great of deal of money if they can produce their own glucose curve at home.

If you choose to use a glucometer at home, keep a log of when your pet was fed, when insulin was given, and what the glucose levels were that you found. (There are many phone apps to assist with this.) Bring this log to your veterinarian when you come for check ups. Glucose levels obtained prior to the first insulin shot of the day are particularly useful. Your veterinarian will also be particularly interested in signs associated with poor regulation: excessive thirst, excessive urine production, excessive appetite, and weight loss.

If your pet is too sensitive for a valid glucose curve at the vet's office and you do not think you are up to blood sugar testing at home, the fructosamine blood test may be useful. Again, this test looks at average glucose levels so wide fluctuations will not be discovered but at least there is a monitoring option for this situation.

See the insulin administration guide for cats.

Hypoglycemia and other Things to Watch for

The most serious problem to watch for is hypoglycemia (low blood sugar). This results from a mismatch in food consumption and insulin dose. If the dose is too high you can get hypoglycemia. If the pet doesn't eat, you can get hypoglycemia. Your pet may look simply tired, weak, or sleepy. If she is roused, she will seem drunken or may not be able to fully come to alertness. This can be an emergency and can progress to seizures so it is good to know what to do at home to prevent disaster.

First try to get your pet to eat. If the pet will not eat, give light Karo syrup, honey, or even sugar-water at a dose of one tablespoon per 5 pounds of body weight. The sugar will absorb directly from the mouth; swallowing is not necessary. If no improvement occurs, immediately see a veterinarian for emergency treatment. When your pet is more stable, a glucose curve will be needed to determine why this happened and what a more appropriate insulin dose might be.

It is best to make sure that your pet has recently eaten before giving the scheduled insulin dose.

Bring your pet in for a re-check exam and testing if you note any of the following:

- the pet seems to feel ill.
- the pet is losing weight.
- the pet has a ravenous appetite or loses its appetite.
- the pet seems to be drinking or urinating excessively.
- the pet becomes disoriented or groggy.

It is important for diabetic pets to have their teeth cleaned annually. Dental tartar seeds the body with bacteria and when blood sugar levels run high, infections in important organs can take root. The kidneys and heart are particularly vulnerable.

If your pet appears wobbly or drunken, the blood sugar level may have dropped too low. This occurs after an insulin overdose. First try to get your pet to eat. If the pet will not eat, administer light Karo syrup, honey, or even sugar-water at a dose of one tablespoon per 5 pounds. If no improvement occurs, immediately see your veterinarian for emergency treatment. When your pet is more stable, a glucose curve will be needed to determine why this happened and what a more appropriate insulin dose might be.

Some Pets are Difficult to Regulate

Your pet will probably require re-regulation at some point. There may be an underlying reason to sort out. If your pet seems to fit in this category, some reasons could be:

- *Improper administration of insulin*. If possible, have your doctor observe you giving the insulin to your pet. Another possibility is that your insulin may be out of date.
- *Rapid insulin metabolism*. Insulin wears off quickly in some animals. Your pet may require a different type of insulin or a second injection during the day or even additional injections during the day.
- *Insulin overdose* may actually lead to elevated glucose levels (and clinical signs of diabetes mellitus). In this situation, too much insulin brings the blood glucose too low and other hormones respond to bring it back up (and generally over-do it).
- *Steroid administration* (such as prednisone, prednisolone, etc.) will interfere with insulin.
- *Progesterone*, a female hormone, also interferes with insulin. Unspayed female diabetics should be spayed once they are sufficiently regulated.

For more details on trouble with regulation, read about hard to regulate cats.

Feeding a Diabetic Pet

Regulation is achieved via a balance of diet, exercise, and insulin. Realizing that therapeutic diets are not always attractive to pets, there are some ideal foods which should at least be offered.

The most up-to-date choice for cats is a low carbohydrate high protein diet. These diets promote weight loss in obese diabetics and are available in both canned and dry formulations. For dogs, high fiber diets are still in favor as fiber seems to help sensitize the pet to insulin. Talk to your veterinarian to select an appropriate choice for your pet.

Avoid soft-moist diets as sugars are used as preservatives. Avoid breads and sweet treats. If it is not possible to change the pet's diet, then regulation will just have to be worked out around whatever the pet will eat.

More Information

A listserv for owners of diabetic pets is also available. To subscribe, send a message to majordomo@listserver.net and write the words "subscribe petdiabetes" in the body of the message.

Related resources

- Monitoring Glucose Regulation in Dogs and Cats - *March 31, 2020*
- Insulin Administration in Cats - *October 30, 2019*
- Insulin Alternatives - *October 15, 2019*
- Cataracts in Diabetic Dogs - *August 25, 2019*

- Glargine (Lantus) and Detemir (Levemir) Insulin - *August 6, 2019*
- Insulin Administration in Dogs - *March 27, 2019*
- Diabetic Ketoacidosis in Dogs and Cats - *September 18, 2018*
- Hard to Regulate Diabetic Cats - *August 20, 2018*
- Hard to Regulate Diabetic Dogs - *July 20, 2018*
- Diabetic Cat Diet - *July 17, 2018*
- Diabetic Dog Diet - *May 3, 2018*
- Home Testing of Blood Glucose for Diabetic Cats - *November 24, 2014*

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