

Diabetes Mellitus in Cats

**What is diabetes mellitus?**

Diabetes mellitus is a disease caused by failure of the pancreas to produce adequate amounts of insulin or of the body to respond to the insulin that is produced.

**Why is insulin so important?**

The role of insulin is much like that of a gatekeeper: It stands at the surface of body cells and opens the door, allowing glucose to leave the blood stream and pass inside the cells. Glucose, or blood sugar, is a vital substance that provides much of the energy needed for life and it must work inside the cells.

Without an adequate amount of insulin, glucose is unable to get into the cells. It accumulates in the blood, setting in motion a series of events which can ultimately prove fatal.

When insulin is deficient, the cells become starved for a source of energy. In response to this, the body starts breaking down stores of fat and protein to use as alternative energy sources. This causes the cat to eat more, but ultimately results in weight loss.

The body tries to eliminate the excess glucose by excreting it in the urine. However, glucose attracts water, so the urine glucose that is excreted also contains large quantities of the body's fluids. This causes the cat to produce a large amount of urine. To avoid dehydration, the cat drinks more and more water.

Thus, we have the four classical signs of diabetes:

* Weight loss
* Increased water consumption
* Ravenous appetite
* Increased urination

Not all of these signs are readily seen in every diabetic cat, but we expect that you will have seen at least two of them.

**How is diabetes mellitus diagnosed?**

Because the four classical signs of diabetes are also present in other feline diseases, clinical signs alone are not sufficient to make a diagnosis. We also look for a high level of glucose in the blood stream and the presence of glucose in the urine using laboratory tests. The normal blood glucose level for cats is 80 to 120 mg/dL, while diabetic cats often have levels over 400. Diabetic cats also have glucose present in the urine. The combination of these findings in a cat with at least two of the clinical signs of diabetes is sufficient evidence to make a diagnosis of diabetes.

A cat’s blood glucose level can be influenced by excitement. “Stress hyperglycemia” can result from a ride in the car and a visit to the veterinary hospital, which may compromise the testing process for diabetes. When this is suspected, a serum fructosamine test can be used. This test gives an average blood glucose reading for the last two weeks. It will be clearly elevated in a diabetic cat.

**What does a diagnosis of diabetes mean for my cat ?**

There are two forms of diabetes in cats: uncomplicated diabetes (the most common form) and ketoacidosis (the life-threatening form). If ketoacidosis is present, the cat is in crisis and must be treated quickly. Intravenous fluids are given and quick-acting insulin is administered. Generally, one to three days of hospitalization are required to stabilize the cat and convert the diabetes to the uncomplicated form.

Uncomplicated diabetes needs treatment, but it is not necessary to achieve regulation of the blood glucose level immediately. As long as the cat is eating and drinking and is not dehydrated, insulin can be gradually worked up to the proper level over days or even weeks.

The first phase of treatment for uncomplicated diabetes is called regulation. This means that insulin is given until the proper dose is found to keep the blood glucose in the range of 100 to 300 mg/dL throughout the day and night. When this occurs, the signs of diabetes are relieved. The cat begins to gain weight and his/her appetite returns to normal. The cat’s urination and water consumption also return to normal levels.

The second phase of treatment is called maintenance. This means that the cat has been regulated and has the appearance and behavior of a normal cat. Hopefully, the cat stays in this phase the rest of his/her life. However, some cats require insulin changes with time and new circumstances, so occasional reregulation may be needed.

Diabetic cats are best regulated when as many factors as possible are consistent from one day to the next. For this reason, keeping your cat indoors is preferred. There is no doubt that not all cats will adapt to this lifestyle, but the benefits are substantial in keeping your cat regulated.

When starting insulin, your cat will need to be monitored at the hospital for one to three days for glucose curve testing. You may also perform the blood glucose measurements at home on a glucometer, if you prefer. This would require the purchase of a glucometer and training with one of our technicians on the proper technique for blood sampling. Home glucose testing may sound complicated, but it is actually very quick and easy with practice and will give more accurate results. Once the body has adjusted to the insulin, a glucose curve should be performed again in 10 to 14 days to assess the adequacy of the insulin dose. The curve will be repeated weekly until adequate regulation is achieved.

**What does a diagnosis of diabetes mean for me?**

There are some serious financial obligations involved in treating a diabetic cat; however, the majority of expenditure occurs during the regulation phase. It is difficult to predict how expensive individual treatment will be because it is entirely dependent on how quickly the cat is regulated. The cost is especially great if the cat is ketoacidotic, but this occurs in less than 10 percent of diabetic cats. Once the cat is stable, the costs for insulin, syringes and rechecks are less expensive and spread out over a longer period of time. The cost can also be reduced if home glucose testing is performed.

Financial commitment is not the only factor to consider, however. This disease also requires a substantial amount of involvement on your part to keep the cat regulated. You will be giving insulin injections twice daily and will need to monitor the cat’s progress for any signs that he/she is not well-regulated. If you are not dedicated to keeping your diabetic cat regulated, you will be disappointed with the results and the expenses associated with poor regulation.

**How is diabetes treated?**

There are four steps to treating your diabetic cat. Each is of equal importance, but all contribute to a common goal—consistency. The best way to keep a cat regulated is to keep as many factors the same as possible. The more things vary from day to day, the more likely the cat is to have regulation problems.

**Understanding Diabetes**

The more you know about the diabetic cat, the better you will be at keeping your cat regulated. There are many important points presented in this document. Read and reread it several times so you are intimately familiar with the information. If there are sections that you do not understand, please call for clarification. Every concept is important.

**About Insulin**

Insulin is given by injection with a tiny needle, so most cats do not find them unpleasant. They are given just under the skin in areas in which there is no chance of injuring vital organs. This technique is much better tolerated by cats than most owners expect. Most cats require that injections be given twice daily, as close to a 12-hour interval as is feasible for you to do on a consistent basis.

There are several types of insulin available. The specific type, dose and injection interval will be determined with a glucose curve. This is a test in which insulin is injected early in the morning and blood glucose levels are determined every two to four hours throughout the day. The purpose of this test is to determine how long it takes for the blood glucose to reach its lowest level or "peak time." The test is also used to determine how high and low the blood glucose levels are throughout the day.

Glucose curves can be performed by hospitalizing your cat for the day or by testing at home using a glucometer.

**Clinical Signs of Diabetes**

A well-regulated diabetic cat should no longer have the four clinical signs of diabetes, though you should be actively looking for these signs at all times.

* **Weight Loss**: The ideal way to determine weight loss is with a good quality scale at your home. Using the same scale every time is the most accurate way to do this. A baby scale is best, but you can also weigh yourself and yourself plus your cat and take the difference using a regular bathroom scale. It is recommended that you obtain your cat’s weight at least twice each month and record them in a log for easy reference. If you prefer, you can bring your cat to the hospital for us to weigh him/her.
* **Food Consumption**: Ideally, you should measure your cat’s food each time it is added to the bowl, noting the amount of uneaten food from the previous filling. This is feasible in some situations, but the presence of several cats in the household can make this difficult. It is important to feed a diet low in carbohydrates and in fact, there are now prescription diets made specifically for diabetic cats. Feeding a canned version of this diet is ideal; we recommend Hill’s Prescription Diet m/d. Feeding this type of diet increases the possibility of remission (no longer needing insulin) and also reduces the insulin requirement in cats that do need to stay on it.
* **Water Consumption**: Measuring the amount of water added to your cat’s bowl is another desirable exercise, though monitoring this in a multi-cat household can be difficult. Of all the methods listed, monitoring weight is the most accurate in multi-cat households.

Regardless of the method used, be sure to schedule an exam if any of the signs of diabetes return.

**Blood Testing as a Means of Monitoring**

There are two tests that are used to monitor the level of regulation of diabetic cats: blood glucose level and serum fructosamine. Ideally, blood glucose level determinations should be made at the lowest level of the day, which should be four to six hours after the insulin is administered. The serum fructosamine test gives an average blood glucose level reading for the last two weeks. It is used routinely to monitor how well diabetic cats are regulated at home.

Blood testing should be performed any time the home monitoring methods reveal abnormalities. Complete blood panels and a urinalysis should be performed at least every six months, while a blood glucose level test should be performed at least every three months. Your cat's blood glucose level should also be checked any time you are worried that something is not quite right. The serum fructosamine test should be performed annually.

**What causes hypoglycemia, how do I recognize it and what should I do about it?**

Hypoglycemia is another word for low blood glucose level. If your cat's blood glucose level is below 80 mg/dL, it is considered too low. If it is below 40 mg/d, it is life-threatening. A well-regulated cat’s blood glucose level should not be below 80 mg/dL at any time. Because hypoglycemia can be life-threatening, it is always better for the blood glucose level to be too high than too low.

Causes of hypoglycemia include:

* A dose of insulin that is too high
* A double dose of insulin (usually given by two different family members)
* Too little food intake or vomiting of food
* Too much exercise or activity
* Spontaneous remission of diabetes

A cat experiencing mild hypoglycemia is typically very weak. The cat may be completely unresponsive to your attempts to arouse him/her or he/she may try to walk but appear very uncoordinated. When severe hypoglycemia is present, the cat may even become comatose or have a seizure.

A mildly hypoglycemic cat should be given syrup or honey (one tablespoon by mouth). If a dramatic response does not occur within 20 minutes, a second dose should be given. If that does not cause a response, intravenous glucose will need to be given. Cats showing signs of severe hypoglycemia should be rushed to a veterinary hospital for intravenous glucose. If the cat does respond to oral supplementation, he/she should not be given insulin again until the cause of the problem is determined.

The list of causes above should be considered carefully. If the cause is not immediately apparent, your veterinarian should be consulted.

**Tell me more about spontaneous remission of diabetes.**

Spontaneous remission occurs when a diabetic cat experiences an unexpected improvement or cure of the disease. When this happens, the pancreas resumes normal function so that insulin injections are no longer needed. This phenomenon is peculiar to the cat and is not uncommon. It is thought to occur in about 50 to 80 percent of diabetic cats on glargine insulin. There are several other types of insulin available for cats and spontaneous remission can occur with these as well.

The first sign of spontaneous remission is hypoglycemia. At the peak time (determined by the glucose curve), the cat will be very unresponsive; however, a few minutes to a few hours later he/she will appear normal. The cat has the ability to respond to hypoglycemia by converting glycogen (stored in the liver) to glucose, but after a few days of this response, glycogen stores are depleted. The cat will become critically hypoglycemic and may die without immediate intravenous glucose.

The key to detecting spontaneous remission is to observe your cat at the peak time. Since this time may occur during the night or when you are at work, you should observe for it closely on weekends or other days when you are at home. If your cat is showing suspicious signs, you can quickly check the blood glucose at home with a glucometer.

**What do I need to know about handling insulin?**

Insulin comes in an airtight bottle that is labeled with the insulin type and the concentration.

Before using, mix the contents. It says on the label to roll it gently, not shake it. The reason for this is to prevent foam formation which will make accurate measuring difficult.

Some types of insulin have a strong tendency to settle out of suspension. If the insulin is not mixed properly, dosing will not be accurate. Therefore, the trick is to roll it enough to mix it without creating foam.

When you have finished rolling it, turn the bottle upside down to see if any white powder adheres to the bottle. If so, more rolling is needed.

Insulin is a hormone that will lose its effectiveness if exposed to direct sunlight or high temperatures. It should be kept in the refrigerator, but it should not be frozen. It is typically not ruined if left out of the refrigerator for a day or two and not exposed to direct sunlight, although this is not advisable. Insulin is safe as long as it is used as directed, but it should be kept out of the reach of children.

Before injecting your cat with the insulin, check that there are no air bubbles in the syringe. If you get an air bubble, draw twice as much insulin into the syringe as you need. Then withdraw the needle from the insulin bottle and tap the barrel of the syringe with your fingernail to make the air bubble rise to the nozzle of the syringe. Gently and slowly expel the air bubble by moving the plunger upward.

When this has been done, check that you have the correct amount of insulin in the syringe. The correct dose of insulin can be assured if you measure from the needle end, or "0" on the syringe barrel, to the end of the plunger nearest the needle.

**How do I make a proper injection?**

* Place the cat so that he/she can be restrained easily.
* Using your left hand (if you are right-handed), lift a roll of skin from a loose area along the cat's back.
* Part the hair and place the tip of the needle on the skin so the syringe is horizontal to the cat’s spine and pointing toward the cat’s head.
* Quickly pull the skin over the needle. You may need to slightly thrust the needle forward at the same time.
* Make the injection and remove the needle.
* Rub your hand over your cat’s hair at the injection site to be sure it is dry. If it is wet, the needle probably went through the opposite side and the injection was made on top of the skin. Since it is not possible to know how much of the insulin was injected incorrectly, it is best not to repeat the injection. However, learn from your mistake so this does not happen again.
* Give your cat a reward that can be associated with the injection. Stroking and holding is best, but a small treat is also acceptable.

**How should my cat be cared for when I am out of town?**

The ideal way to care for your diabetic cat when you are out of town is to have a friend or neighbor stay at your house to give your cat his/her insulin. This approach keeps almost all things consistent. If you cannot find in-home care, a kennel or veterinary hospital can be used for boarding. However, be sure to choose a facility that has a doctor or technician available to give your cat proper medical care.