



# WINN FELINE FOUNDATION

For the Health and Well-being of All Cats

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## Diabetes Mellitus in the Cat

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Diabetes mellitus is a common disease in animals and people and was first recognized in cats over 75 years ago.<sup>3</sup> Most commonly found in middle-aged to older cats, it is estimated to occur in 1 in 400 cats and may be increasing in frequency.<sup>2,14</sup> Although it is a potentially serious disease, veterinarians have learned a great deal in recent years about how to treat diabetic cats effectively so they may enjoy good health and quality of life.

### Effects of diabetes

Glucose is a type of sugar found in the bloodstream of all animals, as well as certain foods. It is the end product of carbohydrate metabolism in the body and is the chief source of energy for living organisms. Insulin is the primary hormone that controls this metabolism and the storage of fuel sources found in food. In diabetes, secretion of insulin from the pancreas may be impaired or the body's cells may be resistant to the actions of insulin. As a result the body's ability to regulate blood glucose levels is compromised.

Diabetes mellitus alters the body's functions and ultimately causes the normal metabolism of carbohydrates, proteins and fats to be profoundly disturbed. The cells in the body need glucose for energy to sustain life. In the normal animal, insulin helps glucose enter most body cells. In diabetic animals, on the other hand, glucose cannot adequately enter cells, causing it to accumulate in high levels in the bloodstream (this is called hyperglycemia) and in the urine. As a result, the body's cells do not receive the nourishment they need, forcing the cat's body to break down fat tissue and the protein of muscle tissue in a futile attempt to supply the needed energy.

### Typical patient and clinical signs

Diabetes is usually seen in cats over six years old, it can develop in cats of any breed, age or gender. However, the most typical patients are older, overweight and neutered male cats.<sup>9</sup>

Owners of diabetic cats will notice a change in their cat's behavior, specifically it will become increasingly thirsty and hungry. There are a small number of cats that will have a reduced appetite. In addition, the owner may observe an increase in the frequency and amount of urine produced by the cat. A diabetic cat may also seem lethargic, will frequently nap and their hair coat may be dull and oily with flakes of dandruff. It is not uncommon for cats to also have muscle loss that is most noticeable over the cat's back and in the rear legs.

While diabetic dogs and humans often develop cataracts, cats generally do not.<sup>10</sup> However, affected cats may walk flat-footed on their hind feet instead of up on their paws (a condition called tibial neuropathy or diabetic neuropathy) and is the result of the effect of prolonged high blood glucose on the nerves.

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Most diabetic cats remain bright and alert. If however, an owner has not recognized the signs of diabetes early, a condition called ketoacidosis may develop and the cat may become very ill if medical care is not sought. These cats may become depressed, weak and dehydrated, and in extreme cases may fall into a coma. Cats may also experience vomiting and diarrhea, loss of appetite and severe weight loss. Therefore it is important to be aware of the signs of diabetes so that the condition can be recognized and treated early.

## Diagnosis

Veterinarians, in addition to physical examinations, will use laboratory analyses of blood and urine samples to diagnose diabetes mellitus. Cats with diabetes will have very high blood glucose levels and glucose in their urine. Occasionally, frightened or stressed cats may also have a fairly high blood glucose level, which can be confused with diabetes. However, a blood test, called a fructosamine test, can help distinguish between true diabetics from those cats with stress-induced high blood glucose.

## Treatment

Treatment of diabetic cats depends on the patient's status. Severely ill cats will need to be treated intensively in the hospital for several days to stabilize them. These patients may require intravenous fluid therapy to rehydrate them, special short-acting insulin therapy to stabilize their blood glucose levels and other therapies to correct electrolyte imbalances. Any other illnesses present must be identified and treated, particularly infection or those that involve inflammation. Cats that are treated in the hospital usually stay until their insulin requirements are determined and their electrolytes and hydration are stabilized. Cats may have an IV catheter placed in a vein so that fluids and electrolytes can be given and dehydration can be corrected, as well as allowing blood glucose levels to be controlled even if cats aren't eating. Maintenance insulin requirements cannot be determined until cats are eating regularly and other disease states such as infection are controlled. Once any infection or other disease has been controlled and the initial insulin requirement has been established, the cat can be discharged from the hospital and home care can begin. Diabetic cats that are stable at the time of diagnosis may not need to be hospitalized and may be treated at home.

Commonly, diabetes mellitus in cats can be controlled with insulin therapy at home. Owners will provide their cat with a small amount of insulin usually twice a day.<sup>15</sup> Using special insulin syringes—used to measure the very small amounts of insulin needed and with needles that are very fine to make injections comfortable—owners will inject the allotted insulin under the cat's skin. It is very important that insulin injections are only given in areas of the body that have good circulation. This means avoiding areas of skin over the back and in the scruff where absorption can be unpredictable. Injections are generally given on the cat's sides, under the skin.<sup>8</sup> Before taking a diabetic cat home, owners will be instructed by their veterinarian on the techniques used to properly handle and administer insulin injections.

Insulin preparations vary in their action—some are short-acting while others are long-acting. Short-acting insulins reach peak activity in the body quite quickly and need to be re-dosed several times a day. Long-acting insulins may not reach peak activity for 12 to 24 hours, and so need to be given less frequently.<sup>7</sup>

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In general, cats metabolize insulin more quickly than other animals, so the longest-acting insulins are usually chosen to treat diabetic cats. Veterinarians may choose long-acting recombinant human ultralente insulins, insulin-glargine, detemir insulin, or a veterinary insulin such as PZI. Recently researchers have found that the type of insulin that a cat is started on when first diagnosed might play a role in whether or not the cat will need insulin for the rest of its life. Insulin-glargine appears to have an advantage over older types of insulins in achieving this type of remission (no longer needing insulin), but insulin-glargine is not the best insulin for all cats.<sup>6</sup> Because of this, veterinarians may choose to use different insulins for different individuals. It is important to note that individual cats have different responses to insulin and therefore the insulin treatment regime will need to be custom-tailored to the individual cat's needs. Variations in diet, weight, stress, infection, exercise, plus other disease conditions will all markedly affect the need for insulin.

For home treatment, owners will give their diabetic cat a small starting dose of insulin once or twice daily and the cat's progress is monitored. To do so, owners will observe their cat's appetite, water consumption and urination and will report any changes to the veterinarian. If the therapy needs to be modified, a series of blood glucose readings (called a blood glucose curve) is performed in the hospital over a 12-hour period. The blood glucose measurements over this period of time helps a veterinarian understand how the individual cat is absorbing and metabolizing insulin and whether the cat is getting the right amount of insulin. It is important to know that the clinical signs such as increased appetite and increased urination can be caused by either too much or too little insulin, so your veterinarian needs the information over this period of time in order to determine if insulin should be increased or decreased. Owners of diabetic cats can be taught to take blood glucose readings at home as well, using a lancet and portable blood glucose meter such as those used by human diabetics. Results can then be relayed to the veterinarian, who will determine if changes in the insulin dose are required. Blood glucose curves at home have been shown to be fairly reliable in cats that have good control of their blood glucose levels, but poorly controlled cats had too much variation in home curves to be accurately assessed. Because of this problem, glucose curves of cats that are not well controlled should be done in the hospital.<sup>1</sup> However, owners should never make changes in the treatment regime of a diabetic cat without consulting a veterinarian first.

Although pills are used to control diabetes for some human diabetics, oral therapy is generally less effective in controlling diabetes in cats and may take up to 10 weeks to start showing any benefits and is more costly than insulin. There have also been reports of adverse events in cats associated with oral anti-diabetic drugs.<sup>4</sup>

## Dietary therapy

Previously, studies have shown that high fiber diets can lower insulin requirements and blood glucose levels.<sup>8</sup> However, recent research points to diets high in protein and low in carbohydrates as effective in controlling diabetes in cats. For some diabetic cats, this type of diet alone may control the disease.<sup>5</sup> Insulin resistance (less response to insulin) can be associated with obesity, so weight loss can help lower the insulin requirements for some overweight or obese cats.<sup>2</sup> A high protein, low carbohydrate diet may be recommended for weight loss in overweight cats. Some canned cat foods are more likely to be available in this nutritional category than dry foods. Whatever food is chosen for a diabetic cat, it is important to control the amount of caloric food intake and times of feeding as directed by the veterinarian.

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## Potential complications

The most serious complication of insulin therapy is hypoglycemia or low blood glucose that can occur at the peak time of insulin activity or if a cat is not eating regularly. When using ultralente or PZI insulin the low blood glucose usually occurs six to eight hours after insulin is given. This is less common with insulin-glargine, but can occur. Insulin glargine tends to cause prolonged asymptomatic hypoglycemia in some cats. With PZI or ultralente insulin if hypoglycemia occurs, signs of hypoglycemia can be seen, usually in late afternoon at the time of peak insulin activity, and the cat will become weak, lethargic, disoriented and may stagger on its feet. Left untreated, this situation may progress to seizures and (in rare cases) death. If mild signs are observed, the cat should be fed immediately and the veterinarian consulted. If severe symptoms occur, a teaspoon of corn syrup smeared on the cat's gums will increase blood glucose levels sufficiently, providing enough time to get emergency veterinary help. Food or fluids should never be put down the throat of an unconscious or seizing cat as it may enter the airways accidentally. It is also not wise to put one's fingers in the mouth of a seizing cat as serious bite wounds can occur.

## Long-term monitoring

Once a suitable insulin dose has been determined for the affected cat, the required dosage should be maintained until instructed otherwise by a veterinarian. While it may seem tempting to vary the insulin dosage by observing clinical signs in diabetic cats, it will lead to poor control of the disease. Periodic blood glucose curves, done either in the hospital or at home, will help determine if the insulin dose needs to be adjusted over time. The fructosamine test can also be used to monitor diabetic cats. This simple blood test can be performed in conjunction with a check up. As of early 2018, a new test, similar to the A1C test for people, is available for use in cats and dogs. The test's use in diabetic patient monitoring will be evaluated over time. It is important for owners of diabetic cats to monitor several things on a daily basis, including appetite, attitude, water consumption, physical activity and urination. On a weekly basis, it is helpful to weigh the cat at home to monitor for fluctuations in weight. Any persistent changes should be reported to the veterinarian. It is also important to monitor diabetic cats for urinary tract infection because they are at higher risk for infections due to periodic glucose in the urine. Urine culture should be done at least once a year.<sup>3</sup>

## Commitment

Beyond the monetary cost of diagnosing, stabilizing, treating and maintaining a diabetic pet, there is a time commitment required of owners. Such a commitment may seem daunting at first, but it can be very rewarding for both owner and cat. This commitment will add to the quality of the cat's life and is paid back in years of healthy companionship. Veterinarians and their staff offer a tremendous resource for education and support during this process. As well, there have been occasions where diabetes in cats proves to be a temporary illness and after insulin treatment for a period of time, the animal may be slowly weaned off medication and controlled by diet alone.<sup>9</sup> While some cats may return to insulin-dependence in the future, they may have many months to years where insulin is not required.

Diabetes in cats can be treated and controlled if proper therapy is sought and attention is given, allowing the affected cat to live a long and healthy life.

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