Diabetes mellitus

Managing the diabetic cat: a guide for caregivers

Just like people, cats can develop diabetes mellitus, resulting in signs such as weight loss and drinking more water than normal. Caring for a cat with diabetes mellitus involves administering medication, feeding an appropriate diet and carrying out regular monitoring. These aspects can be challenging, but successfully managing your cat's diabetes can also be very rewarding.

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Introduction: a team approach is key

Diabetes mellitus ('sugar diabetes') affects middle-aged to older cats and is comparable to 'type 2' diabetes in people. It can be successfully managed in most cases, and some cats may even recover and become non-diabetic (remission). Although diabetes is a complicated condition requiring medications, changes in diet and monitoring by the veterinary team and caregiver, affected cats can have an excellent quality of life.

Why cats develop diabetes mellitus

To understand diabetes, it is important to know a little about how blood sugar (glucose) levels in the body are controlled. In healthy cats, the pancreas (Figure 1; an abdominal organ involved in both digestion and blood sugar regulation) produces a hormone called insulin. Insulin is released in response to a rise in blood glucose and allows the body to take up and use the nutrients present in the food.

Diabetes occurs when either the pancreas does not make enough insulin (type 1 diabetes) or the insulin produced does not work effectively (type 2 diabetes). In most cats with diabetes, the condition is 'type 2' in nature: their pancreas makes insulin but the hormone is not effective in reducing blood glucose levels; over time, insulin levels may also become inadequate. Various other conditions/ illnesses and even medications can contribute to cats developing diabetes; examples include obesity, 'acromegaly' (a condition where a tumour in the brain causes diabetes) and treatment with drugs such as corticosteroids.

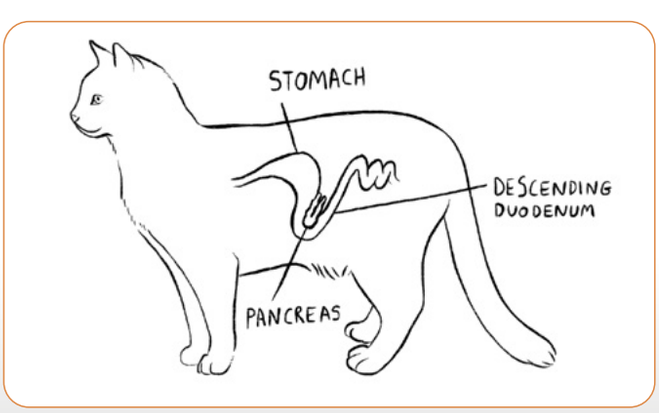

Figure 1: The pancreas is an organ in the abdomen with a vital role in producing insulin to control blood sugar, as well as producing digestive enzymes. Source: iCatCare

Risk factors for diabetes mellitus	
Increased Age	Most diabetic cats are middle-aged to older.
Male	Male cats are more likely to develop diabetes mellitus.
Obesity	Obesity (excessive weight) is a major risk factor for diabetes mellitus. Obese cats are up to four times more likely to develop the disease.
Inactivity	Along with obesity, a lack of exercise (due to an indoor lifestyle, for instance) may predispose to diabetes mellitus.
Genetics & breed	Genetics plays a role and a breed predisposition for Burmese cats has been reported in the UK and Australia. Up to one in 50 Burmese cats will develop diabetes mellitus and Norwegian Forest Cats, Tonkinese and Abyssinians have also been over-represented in studies of the disease. The genes involved have been studied and initial work suggested a role for the melanocortin 4 receptor gene.
Medication	Drugs (medications) can influence the development of diabetes mellitus. Corticosteroids may be necessary to treat various diseases caused by the immune system but can reduce the cat's response to insulin. Cats on corticosteroids (and some other medications such as progestogens) should be monitored for the condition, particularly if they have other risk factors such as obesity or if they are Burmese.

Source: iCatCare

Signs a cat may have diabetes mellitus

Cats with diabetes vary in how unwell they are when diagnosed. Most cats will show weight loss, will be drinking and urinating more than normal, and can have increased hunger levels. Cats who develop diabetic ketoacidosis, which is a severe complication of diabetes, become very unwell and will show more pronounced signs (see box, 'Diabetic ketoacidosis'). As diabetes can affect the nerves, cats sometimes develop an abnormal posture, where their hocks drop to the ground; this is referred to as a 'plantigrade' stance (Figure 2).

Figure 2: A cat with a plantigrade stance due to nerve damage from diabetes. Source: Sarah Caney

Cats showing signs of diabetes or potentially the more severe condition of diabetic ketoacidosis should see their veterinarian as soon as possible. The earlier a diagnosis is made, the better. Other conditions can cause diabetes-like signs, so caregivers should not hesitate to discuss any concerns with their veterinary team. Moreover, given that diabetes tends to arise from middle-age onwards, caregivers may also consider regular health checks for their cat as their pet ages.

How diabetes mellitus is diagnosed

Diabetes is diagnosed by detecting persistently high blood glucose levels and the presence of glucose in the urine. However, diagnosis can be complicated by the effects of stress. A visit to the veterinary clinic, for example, may be sufficient to cause raised blood glucose in cats without diabetes, and may even result in glucose in the urine. Cat Friendly Clinics (see **catfriendlyclinic.org**) go to considerable lengths to make the veterinary experience as low stress as possible; but, even so, diabetes should never be diagnosed on the basis of one abnormal result. The veterinary team will want to check the blood or urine glucose again and may sometimes ask the caregiver to measure it at home (see later). Other tests are available that can assess blood glucose levels over a number of days through the measurement of a specific protein called fructosamine.

Diabetic ketoacidosis

This condition, commonly referred to by its abbreviation 'DKA', is a life-threatening complication of diabetes. It can occur when a cat is first diagnosed with diabetes or may arise during treatment. Signs of DKA include vomiting, diarrhoea, refusal of food and lethargy, as well as the more classic signs of diabetes of drinking and urinating more than normal. DKA represents an emergency and usually requires the cat to stay in the veterinary clinic for treatment with fluids and other medications.

Managing a cat with diabetes mellitus

Cats with diabetes need prompt veterinary attention to avoid the risk of severe illness. Treatment involves either injectable insulin or oral medication in either liquid or tablet form. The choice will be dictated by several factors including caregiver commitments (work schedules, any challenges giving injections, etc) and the individual cat's health and temperament.

The veterinary team and caregiver should work together to create a treatment plan that best suits the individual situation. In doing so, the caregiver should be encouraged to be honest about what is realistic and achievable for them, as treatment will be lifelong for many cats (see box, 'Communication between the caregiver and veterinary clinic').

Communication between the caregiver and veterinary clinic

It is very important that caregivers share any concerns with their veterinary team. Caring for a diabetic cat can be challenging and sometimes overwhelming, particularly at the beginning.

Caregivers should be honest if they feel proposed treatment plans will be difficult for them to follow, and should feel comfortable asking questions or seeking reassurance, if concerned. In return, veterinary teams should provide practical demonstrations of correct injection and blood sampling techniques, and be available to provide more information as needed.

Insulin injections

While the thought of giving daily injections can be daunting for caregivers, research shows that, once taught, most find the process easy. Some types of insulin can be given with a dedicated dosing device ('pen') (Figure 3), which avoids the need to draw up insulin into a syringe. Other types of insulin need to be drawn out from a bottle (vial) into a syringe with a needle (Figure 4). The veterinary team will demonstrate how to correctly administer insulin under the cat's skin (Figure 5). International Cat Care's video '**How to give your cat an insulin injection**' explains the process for insulin administration requiring a syringe and needle.

Figure 3: Insulin can be given with a dosing 'pen' device. Source: Linda Fleeman

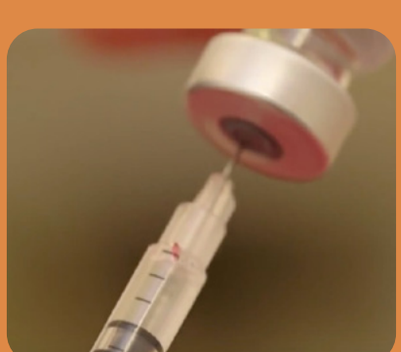

Figure 4: Insulin being drawn out of a vial with a needle and syringe. Source: Sam Taylor

Figure 5: Insulin being injected under the skin on the back of the neck, which is gently tented up. The location should be changed with each injection to avoid soreness. Source: Sam Taylor

For most types of insulin, doses are given twice a day, under the skin, around 12 hours apart. Treatment usually starts with a low dose, and dosing is progressively increased based on the cat's response.

Practical considerations related to insulin therapy

- Generally, insulin is given at the time of feeding. While this is not crucial for the cat, it does allow the cat's appetite to be assessed, as refusing food could be a concern. If a diabetic cat on insulin refuses food, the caregiver should contact the veterinary team.
- It is important to make the experience positive for the cat by offering a treat (if suitable with their diet), or by stroking or brushing the cat, according to their preference, while the medication is administered.
- Depending on the type of insulin, the vial may need to be gently rolled to mix the suspension; the veterinary team should provide guidance on this.
- Injection sites should be varied. Rotating around different sites on the back of the neck and over the shoulder blades and back on both sides avoids one area of skin becoming sore.
- For treatment to be sustainable, treatment plans must fit with caregiver commitments. Mild deviations in the timing schedule for injections are unlikely to be harmful.
- The amount of insulin given may need to be altered over time, but caregivers should never adjust a dose of insulin without prior discussion with the veterinary team.

Low blood glucose (hypoglycaemia)

Diabetic cats mainly struggle with their blood glucose being too high. However, insulin treatment in cats may also cause blood glucose to become too low (a condition termed 'hypoglycaemia'). Signs of hypoglycaemia include weakness, lethargy (not moving or wanting to play), shaking, walking in a 'drunken' or wobbly fashion, and even having fits. If concerned, caregivers should offer their cat something to eat with about 1 teaspoon of honey or sugar solution (sugar mixed with a little water) added (Figure 6a).

If the cat will not eat, then honey or sugar solution can be administered directly into the mouth using a syringe (Figure 6b). Occasionally, the veterinary team might advise that other medication is needed to manage low blood glucose. Glucagon, for example, can be administered into a cat's nose.

It is important to withhold any further doses of insulin until after the veterinary clinic has been contacted. It is usual for the insulin dose to be reduced after a diabetic cat experiences a hypoglycaemic event.

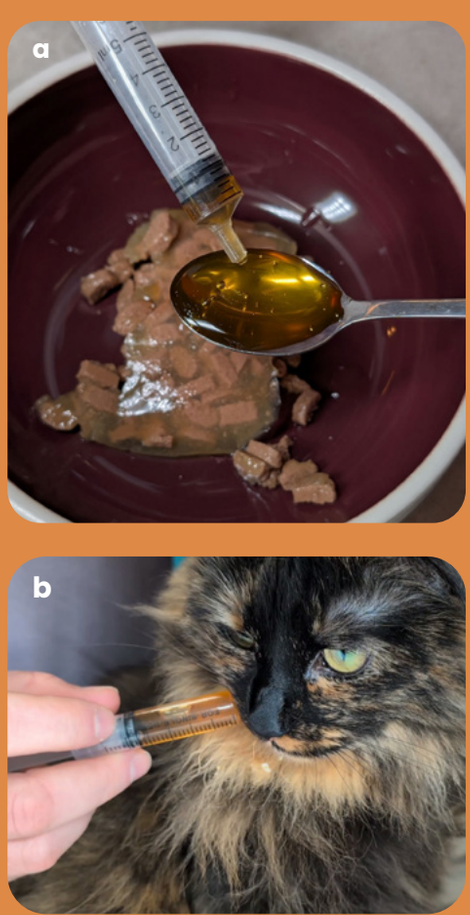

Figure 6: If low blood glucose (hypoglycaemia) is suspected, honey or sugar solution can be given. This may be either (a) mixed with food or (b) syringed directly into the mouth if the cat will tolerate this and can swallow normally. Source: Linda Fleeman

Oral medications (liquids/tablets)

Alternatives to insulin are suitable for a proportion of cats with diabetes. These medications (called sodium–glucose cotransporter 2 inhibitors [SGLT2is]) work by increasing the amount of glucose removed in the urine, in turn lowering blood glucose levels and resolving the signs of diabetes. As they are given by mouth or in food once a day, SGLT2is can be a very convenient option for caregivers. However, these medications are only suitable for diabetic cats who are otherwise healthy and in good body condition, without other problems such as diarrhoea, vomiting or poor appetite.

When starting treatment with SGLT2is, it is important to monitor the cat closely, especially in the first 2 weeks, paying particular attention to appetite and the cat's demeanour (mood). If a cat starts to show signs of illness such as vomiting, diarrhoea and a reduced appetite, or otherwise seems quiet and unwell, prompt veterinary assessment is very important. Some cats will need to be changed to insulin for ongoing management of their diabetes. Caregivers may also monitor for indications the treatment is not suitable by testing the cat's urine or blood for ketones every 1–2 days (see later).

Dietary management

Dietary management aims to help the cat maintain a good body condition and support the other treatment approaches for the cat's diabetes. **When first starting insulin or SGLT2i treatment, it is not recommended to change a cat's diet.** Cats who are presented with a sudden diet change may refuse the new food and/or develop diarrhoea, and this could affect their response to treatment and make them unwell. Once stable on treatment, a dietary change may be recommended by the veterinarian.

When changing a diet, it is worth considering the cat's preferences in terms of dry or wet food and specific flavours and textures. Offering the new diet with the old diet initially, and then slowly reducing the proportion of the old diet over 1–2 weeks as intake of the new diet increases, is recommended. The caregiver should alert the veterinary team if the cat refuses the new food, as it is important they eat well. In some cases, the choice of diet may be influenced by other health issues, such as kidney disease or the cat's weight. Overweight cats may benefit from a supervised weight loss programme designed by the veterinary team.

Remember water intake

The increased urination shown by diabetic cats can leave them prone to dehydration, although most will drink more to make up for the loss of water. It is worth encouraging diabetic cats to increase their water intake, and detailed information on how to achieve this is provided in International Cat Care's Cat Carer Guide, 'Encouraging your cat to drink', available at **icatcare.org/cat-advice/cat-carer-guides.**

Recommendations include providing water in wide-brimmed bowls on every level of the house indoors, as well as outside if the cat has outdoor access. Many cats also enjoy drinking moving water from a water fountain (Figure 7).

Figure 7: Water intake is important for diabetic cats and can be encouraged with the use of water fountains. Source: Sam Taylor

Monitoring a cat on treatment for diabetes mellitus

Managing diabetes requires close monitoring and, in many cases, adjustments in treatment plans over time. Caregivers play a vital role in assessing their cat's health and, in combination with other ways of monitoring, what is noticed at home is usually a good indicator of how successfully the diabetes is being managed.

Diabetes diary

Information from caregiver diaries can provide useful details for the veterinary team managing the diabetic cat. Records of the cat's appetite, activity level, water drunk (which can be measured by putting a known amount in the bowl each day) and body weight provide an accurate reflection of diabetic control. Whether in electronic or paper form, the diary can also include the dosage of insulin or oral medication given. Various smart phone applications are available that allow recording of information on diabetic cats. The 'diabetic clinical score' is a further tool that can help the veterinary team assess the success of diabetes treatment; an example form that caregivers can complete and take to each appointment is available **here**.

At-home measurement of blood sugar or ketones

Visiting the veterinary clinic will, as mentioned, result in some degree of stress for the cat, and there is a risk that any resultant increase in blood glucose could lead to incorrect decisions about dosages of insulin. Hence, checking blood glucose in the home environment can provide a more accurate measurement. Using a fine needle or lancing device, a small drop of blood can be obtained from the edge of the cat's ear, from which a blood glucose reading can be obtained using a glucometer (Figure 8). International Cat Care's video on '**Home blood glucose testing for your cat**' is a useful resource that will complement the veterinary team's demonstration of the technique. The team will also guide the caregiver on how frequently to measure blood glucose or ketones, as it can help them to have a series of measurements recorded at intervals during the day.

Figure 8: Blood glucose or ketones can be checked at home using a glucometer or ketone meter, respectively. Source: Richard Murgatroyd

Continuous glucose monitoring systems

Another way of monitoring a cat's response to treatment for diabetes is to use a glucose monitoring system, which involves placing a small disc-shaped sensor just under the skin on the neck, side of the chest (Figure 9) or back. Glucose levels in the fluid in this area are broadly comparable with blood sugar levels, and this technique avoids the need for blood sampling. The sensor communicates with a smartphone or dedicated reader device and records the glucose levels continuously. The system is well tolerated by many cats and functions for a maximum of 14 days (although often fewer, as it is designed for human skin, not cat skin). Complications are very rare; occasional skin soreness or early removal by the cat are the main concerns.

Figure 9: A cat fitted with a sensor for continuous glucose monitoring. A reader device or smartphone app is used to record the data, which can be shared with the veterinary clinic. Source: Sam Taylor

Weighing the cat at home

Monitoring a diabetic cat's weight can be very useful in monitoring their health. If the cat is overweight, it can prompt a programme of safe slow weight loss; if underweight, it can provide the veterinary team with useful information on the success of therapy. Scales designed for small animals or babies are widely available and recording a weekly reading complements other methods of monitoring.

Urine testing

For cats who use a litter tray, testing of urine at home using 'dipsticks' (small plastic strips with chemical pads) can provide valuable monitoring information. By using small amounts of the cat's regular litter in the tray, or special litter that does not absorb liquid, a sample of urine can be collected for dipstick testing (Figure 10); alternatively, the dipstick can be pressed onto a puddle of urine/wet litter. If urine has dried, a little water can be added to the sample to allow testing. Two videos from International Cat Care, '**How to collect your cat's urine**' and '**How to test urine for substances like glucose and ketones**', provide practical guidance.

Figure 10: Urine can be collected for testing using small amounts of normal litter in the tray or, as pictured here, litter that does not absorb the urine. Source: Sam Taylor

The veterinary team will instruct the caregiver on how to interpret the results, whether testing for glucose or for ketones. During initial treatment of diabetes with SGLT2is, it is particularly important to check the urine for ketones, which can indicate that adjustment to the treatment plan may be needed by the veterinary team; if cats treated with insulin develop ketones in the urine, this also requires treatment adjustments. Cats treated for diabetes will usually have some glucose in the urine, which is not a cause for concern; in this scenario, medication dosages should not be adjusted based on urine test results alone. By contrast, cats entering 'remission' from diabetes (see below) may have no glucose in their urine. Reporting of any negative glucose results to the veterinary team is, therefore, also important.

Outcome of treatment of diabetic cats

Most diabetic cats can live a normal, good quality life. The initial treatment period may involve adjustments in medication and visits to the clinic, and it can take anywhere from a couple of weeks to a few months to settle on a dosage of insulin or to ensure the SGLT2i treatment is effective. However, with good support from the veterinary team, caregivers become very capable at managing the condition.

For some cats, treatment may allow the diabetes to resolve as their pancreas recovers and the insulin they produce resumes working normally. This positive state of remission is more likely in cats who have not been diabetic for long or who developed diabetes due to treatment with certain medications, as well as those who respond well to treatment. The veterinary team will discuss how remission is detected and managed.

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