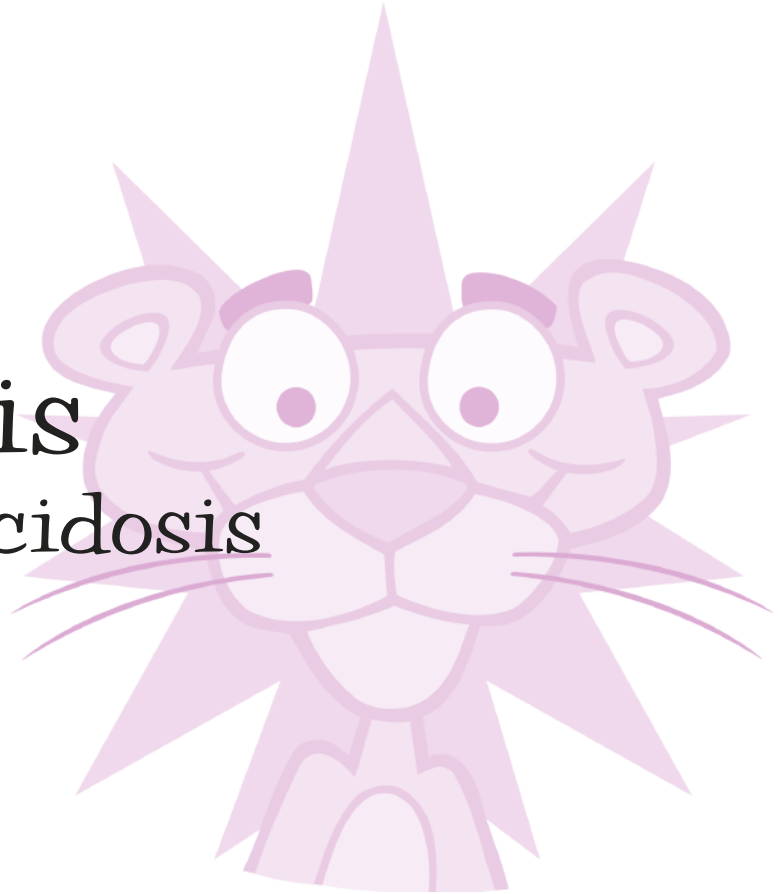


Chapter 15

Ketonuria and Acidosis (Diabetic Ketoacidosis or DKA)



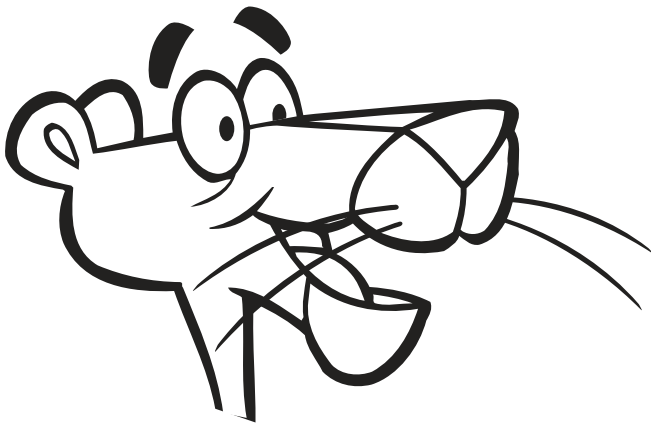
This is the second emergency (the other being low blood sugar) of type 1 diabetes.

WHAT LEADS TO DKA?

DKA occurs when *ketones* build up in the body because there isn't enough insulin.

Ketones are:

- made by the body from breaking down fat when sugar cannot be used for energy (not enough insulin in the body)
- an acid that forms when the body uses fat for the energy it needs



HOW DOES IT START?

- The body will first spill ketones in the urine (**ketonuria**) when there isn't enough insulin.
- If the body still doesn't get the insulin it needs, then the ketone (acid) level in the blood builds up (**DKA: Diabetic KetoAcidosis**).



High blood sugar will make you thirsty.
Drinking fluids helps "wash-out" ketones.

WHAT ARE THE MAIN CAUSES OF KETONURIA OR OF DKA?

- 1 Forgetting to give one or more insulin shots. Giving “spoiled” insulin (insulin that got too hot [over 90° F, 32° C] or froze).
- 2 Illness: the amount of insulin needed is usually more so the body will have the extra energy it needs to fight the illness.
- 3 Not enough insulin (dose too small).
- 4 An insulin pump that is not working or has been disconnected from the body.
- 5 Traumatic stress on the body (particularly type 2 diabetes).

DKA can be very dangerous. It usually does not occur unless large urine ketones or blood ketones above 3.0 mmol/L have been present for several hours. It usually occurs in people with known diabetes who forget to check blood or urine ketones as instructed (see below).

WHAT SHOULD BE DONE TO PREVENT DKA?

- check for blood or urine ketones:
 - any time the morning blood sugar is above 240 mg/dl (13.3 mmol/L)
 - any time the blood sugar is above 300 mg/dl (16.7 mmol/L) at any time of day
 - with any illness (**even vomiting one time**)
- Call the diabetes care provider immediately if urine ketones are found to be moderate or large or if the blood ketones are above 1.0 mmol/L.
- When moderate or large urine ketones or blood ketones above 1.0 mmol/L are found, extra rapid-acting insulin is given every two to three hours to help stop ketones from being made.
- The family should then make repeat calls every two to three hours to the doctor or nurse. Extra doses of rapid-acting insulin will be needed every two hours until the high blood ketones or the moderate or large urine ketones are gone.
- It is also important to drink extra liquids. The extra liquids help to wash out the ketones.
- It is best **NOT** to exercise as the ketone level may increase. When the blood sugar is below 150 mg/dl (8.3 mmol/L), juices and other liquids with sugar can be added.
- It is important to keep the blood sugar level up so that enough insulin can be given to turn off ketone production without having low blood sugar.
- People taking metformin (Glucophage) should stop this medicine until the illness is over.

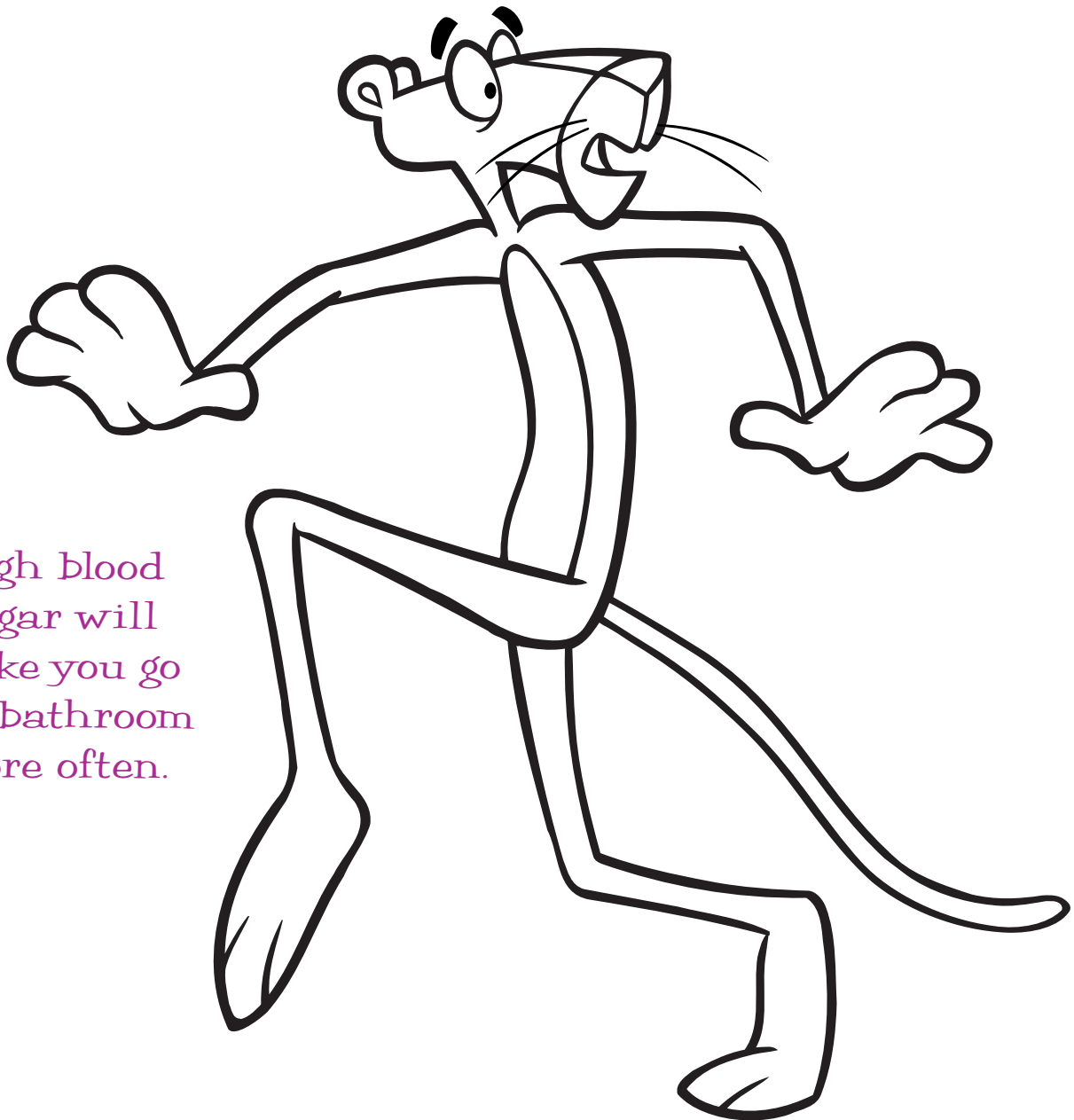
We have found that DKA can be prevented 95% of the time if the instructions in this chapter are followed.

WHAT ARE THE SIGNS OF DKA?

- Usually the blood sugar is high. High blood sugars cause thirst and frequent urination.

- A stomachache, vomiting, or a sweet odor to the breath can occur with high ketones.
- Large urine ketones or blood ketones above 3.0 mmol/L have been present for many hours, deep or troubled breathing can occur. This is a sign to go to the emergency room.

High blood sugar will make you go the bathroom more often.





HOW TO CHECK FOR KETONES:

**Blood sample:* the most important ketone (called beta-hydroxybutyrate [β -OHB]) can be measured with the Precision Xtra™ meter. The blood ketone test result is given as a number and is the most accurate method to use.

Urine sample: check a urine sample using a urine dipstick test such as Ketostix™ that measures a different ketone (called acetoacetic acid). Then compare the color of the pad on the stick with the color chart. The test result is read as negative, trace, small, moderate, large or very large.

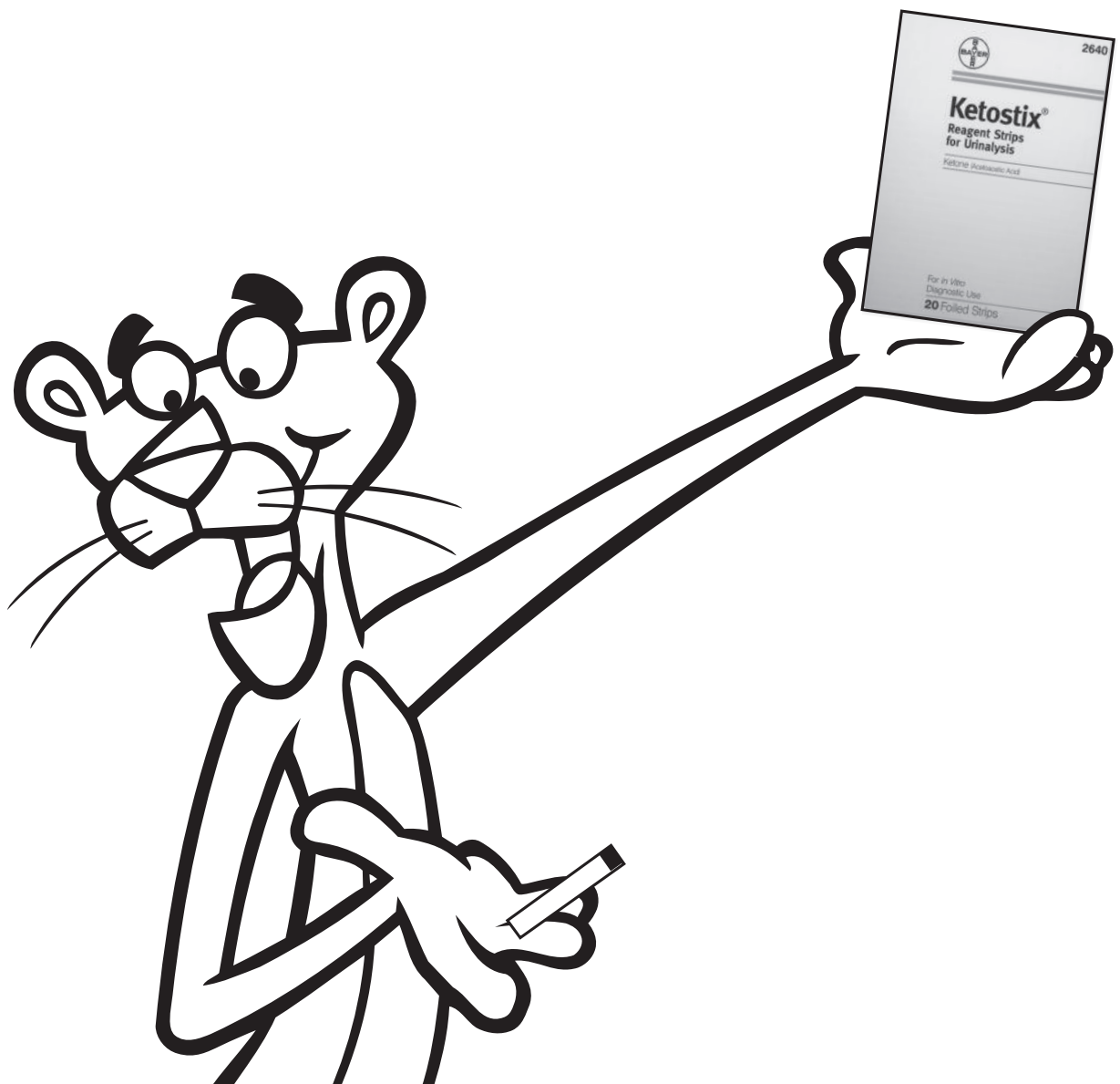
* *One research study found that families were more likely to test for ketones with illness if they used the **blood/meter** (91%) as compared with those using a urine dipstick (56%).*

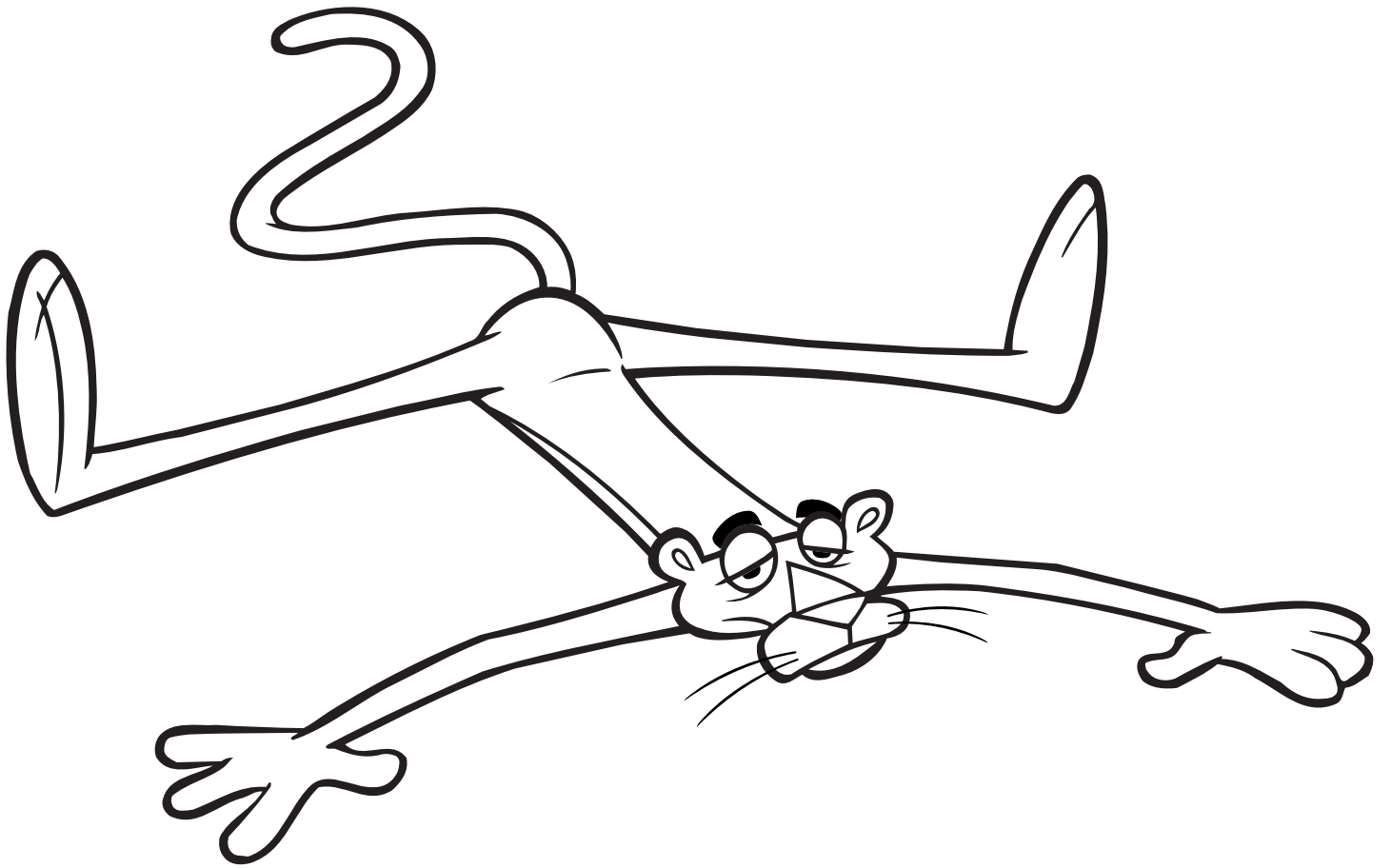
**Table
Comparison of Blood and Urine Ketone Readings**

Blood Ketone (mmol/L)	Urine Ketone		
	Strip color	Level	Action to take
less than 0.6	slight/no color change	negative	normal - no action needed
0.6 to 1.0	light purple	small to moderate**	extra insulin & fluids***
1.1 to 3.0	dark purple	moderate to large**	call MD or RN**
greater than 3.0	very dark purple	very large	<u>go directly to the E.R.</u>

**It is usually advised to call a health care provider for a blood ketone level greater than 1.0 or with urine ketone readings of moderate or large.

***If the blood glucose level is below 150 mg/dl (8.3 mmol/L), a liquid with sugar (e.g., juice) should be taken.





Check your ketones before calling your doctor
when you aren't feeling well.