

## How to Manage Illness in Type 1 Diabetes and Prevent Diabetic Ketoacidosis (DKA)

- Being sick can make your blood sugar hard to control. Low blood sugar can happen if you are throwing up or not eating. Most of the time being sick will cause your blood sugar to go up. It also increases the risk of diabetic ketoacidosis (DKA).
- DKA is a life threatening condition.
- DKA happens when there is not enough insulin, which leads to a build-up of acids called ketones in the blood. People on insulin pumps are at greater risk of DKA. Ask your diabetes educator for a separate handout on pump specific DKA prevention guidelines.
- Pregnant women with type 1 diabetes are at greater risk of DKA, as they become less sensitive to insulin due to hormones produced during pregnancy. DKA during pregnancy can result in the loss of the baby.

### Steps for Preventing DKA

#### 1. Know when you are at risk for DKA:

- illness or emotional stress
- nausea, vomiting, or diarrhea
- infection
- injury or day surgery
- missing insulin dose(s)
- insulin pump/infusion malfunction
- pregnancy and type 1 diabetes
- taking an SGLT2-inhibitor or GLP-1 agonist

#### 2. Know the symptoms of DKA:

- nausea and/or vomiting
- trouble breathing
- fast heart beat
- pain in your abdomen
- “fruity” smelling breath
- lightheadedness

#### 3. Take these actions when you are at risk for DKA:

- Check your blood sugars more often and always before bed.
- Never stop your basal insulin even if you can't eat. Basal insulins include: Humulin<sup>®</sup>N, Novolin<sup>®</sup>NPH, Insulin detemir (Levemir<sup>®</sup>), glargine (Lantus<sup>®</sup> or Basaglar<sup>®</sup>), glargine 300 (Toujeo<sup>®</sup>), and degludec (Tresiba<sup>®</sup>) or the basal insulin delivered by the insulin pump.
- Use the guidelines on the other side of this page to help you correct high blood sugars and prevent DKA.
- Test for ketones at home using items you can buy at the pharmacy. These items are urine ketone strips or a glucose meter that also measures blood ketones.
- Contact your diabetes team if you need help. If your team has 24 hour phone service, phone them at \_\_\_\_\_

#### 4. Go to the emergency department for any of these reasons:

- You have ketones, you need help, and you cannot contact your diabetes team.
- You have blood ketones 3 mmol/L or greater, or you have urine ketones reading moderate to large (40 mg/dL or more, 2+ or more).
- You are throwing up and can't keep fluids down for more than 4 hours.
- You have symptoms of DKA or dehydration.

## Prevention of Diabetic Ketoacidosis (DKA) Guidelines

Test for ketones if you have type 1 diabetes and have any of these:

- blood sugar greater than 14.0 mmol/L
- symptoms of DKA **even if your blood sugar is normal** (nausea, vomiting, abdominal pain, lightheadedness, fruity smelling breath, or shortness of breath)
- illness
- symptoms of dehydration (dry mouth, dry tongue, or cracked lips)

Then follow the steps below:

Urine ketones Negative or Trace Blood ketones 0.5 mmol/L or less	Urine ketones Above Trace (above 5 mg/dL) Blood ketones are 0.6 mmol/L or more*
<ol style="list-style-type: none"> <li>1. Take your usual insulin correction bolus (if unsure see <b>Option 2</b>).</li> <li>2. Drink 250 ml (1 cup) of calorie free fluids every hour.</li> <li>3. Recheck blood sugar in 2 hours. If your blood sugar is:               <ul style="list-style-type: none"> <li>• less than 14 mmol/L, continue usual insulin dose</li> <li>• 14 mmol/L or more, retest ketones</li> </ul> </li> </ol>	<ol style="list-style-type: none"> <li>1. Take 1.5 times the usual correction bolus by pen or syringe (if unsure see <b>Option 1 or 2</b>).</li> <li>2. Drink 250 ml (1 cup) of calorie free fluids every hour.</li> <li>3. Recheck blood sugar in 2 hours. If your blood sugar is:               <ol style="list-style-type: none"> <li>a. less than 14 mmol/L, continue usual corrections</li> <li>b. 14 mmol/L or more, retest ketones</li> </ol> </li> <li>4. If ketones are present for more than 6 hours go to emergency department.</li> <li>5. If you're on an SGLT2 inhibitor or GLP-1 agonist, stop taking it. Contact your diabetes doctor. You may need extra insulin and possibly carbohydrate.</li> </ol>
<p>* <b>3 mmol/L or greater, go to the emergency department.</b> See the first side of this handout for other times to go to the emergency department.</p>	

**Option 1:** Treating ketones if using an insulin sensitivity factor (ISF): If you use an ISF (correction factor), and you have positive ketones as described above, use one of the following formulas:

$$1.5 \times \text{Usual correction insulin dose} = \text{units to give to correct blood sugar}$$

OR

$$1.5 \times \frac{(\text{blood sugar} - \text{target blood sugar})}{\text{ISF}} = \text{units to give to correct blood sugar}$$

**Example:**

Susan's blood sugar was 19.0 mmol/L. She washed her hands and checked again. The second reading was 18.6 mmol/L. She checked for ketones, which were moderate. Her usual correction dose for this blood sugar without ketones would be 6 units.

- She gave 9 units (1.5 x 6 units) to correct the high blood sugar with ketones.
- She checked blood sugar in 2 hours. It was 18 mmol/L. Her ketones were moderate.
- She gave another correction since it had been 2 hours since her first correction. She used the same formula as above with actual blood sugar of 18 mmol/L.
- She checked again in 2 hours. Her blood sugar was 12.3 mmol/L and her ketones were trace. She did not give any more correction insulin.
- She checked again in 2 hours. Her blood sugar was 7.8 mmol/L.

**Option 2:** Treating ketones **if not** using an insulin sensitivity factor (ISF): Use this section **only** if you do not use an ISF (correction factor) **and** your healthcare provider has circled one of the following options:

1. Give extra insulin following the instructions your educator has circled below.
2. Talk with your healthcare provider to see if an ISF should be created for you.

If total daily dose of insulin is <b>less than 50</b> units		
Blood sugar level	Rapid or short-acting insulin to give if <b>no or trace ketones</b>	Rapid or short-acting insulin to give if <b>ketones are positive</b>
14 to 17	2	3
17.1 to 20	3	4
Over 20	4	6

**OR**

If total daily dose of insulin is <b>more than 50</b> units		
Blood sugar level	Rapid or short-acting insulin to give if <b>no or trace ketones</b>	Rapid or short-acting insulin to give if <b>ketones are positive</b>
14 to 16	3	4
16.1 to 18	4	6
18.1 to 20	5	7
Over 20	6	9

## More Tips if You are Sick

- If you can't manage your diabetes on your own, you need to have someone stay with you. This person should know the signs of high and low blood sugars and DKA.
- Remember **never** stop taking your insulin. You may need less insulin if your blood sugars are under 6 mmol/L and you are throwing up. Take meal insulin only if you are eating or drinking fluids with sugar.
- Replace solid foods with liquid fluids if you are feeling sick to your stomach or can't eat. If your blood sugars are under 12 mmol/L, your fluids need to have sugar in them (see List 1).

<b>List 1: Fluids with sugar in them</b>
Options to drink when you are sick and your blood sugar is <b>under 12</b> mmol/L
<ul style="list-style-type: none"><li>• fruit drink or fruit juice</li><li>• Gatorade® or other sports drinks</li><li>• regular pop</li><li>• regular powdered drinks (e.g. Kool-Aid® or Tang®)</li><li>• popsicle</li><li>• Jell-O®</li></ul>

- Drink fluids that are sugar-free if your blood sugars are over 12 mmol/L (see List 2).

<b>List 2: Fluids with no sugar in them</b>
Options to drink when you are sick and your blood sugar is <b>over 12</b> mmol/L
<ul style="list-style-type: none"><li>• water</li><li>• clear bouillon or broth</li><li>• diet pop</li><li>• sugar free Kool-Aid® or Crystal Lite®</li><li>• black coffee and tea</li><li>• diet popsicle</li><li>• diet Jell-O®</li></ul>

- Consider speaking to your doctor or pharmacist for treatment options for nausea and vomiting.

### References:

1. Abbott Precision Xtra Blood Glucose and Ketone Monitoring System User Manual. [https://www.abbottdiabetescare.com/dms/abbott-diabetes-care/document/Precision-Extra/Owners-Guide/ART21070-101\\_Rev-A\\_web.pdf](https://www.abbottdiabetescare.com/dms/abbott-diabetes-care/document/Precision-Extra/Owners-Guide/ART21070-101_Rev-A_web.pdf) Accessed 16/12/2013.
2. Correlation between urine ketones and capillary blood ketones (3 beta hydroxybutarate) in hyperglycemic patients. Diabetes and Metabolism. 33 (2):135-3, 2007