

# University College Hospital

## Ketones & Diabetic Ketoacidosis

### Children and Young People's Diabetes Service

#### What are ketones?

When the body can't use glucose for energy, it uses fat instead. When fats are broken down for energy, chemicals called ketones are produced in the liver. In a person without diabetes, insulin, glucagon and other hormones prevent ketone levels in the blood from becoming too high. However, for children and young people with Type 1 Diabetes, there is a risk that if untreated, levels of ketones will increase and become too high, leading to Diabetic Ketoacidosis.

#### Circumstances where ketone levels might be raised:

- Shortage of food/ low carbohydrate diets – sometimes called 'starvation ketones' - where the body uses fat for energy because there is not enough glucose. Starvation ketones develop more quickly in children than in adults and the blood glucose level can be normal or low. The treatment is often to have carbohydrate to eat/drink.
- Insufficient insulin – sometimes called 'diabetes ketones'. When the body has insufficient insulin, it cannot move glucose from the blood into the body's cells to use as energy and will use fat instead. This will then produce ketones. A high blood glucose level together with blood ketones is a warning sign that there is not enough insulin in the body. The treatment is to give more quick acting insulin (e.g. NovoRapid, Humalog Lispro or Apidra).
- Alcohol excess – when drinking alcohol, the pancreas may stop producing insulin for a short time. Without insulin, your cells won't be able to use glucose for energy and will start to use fat instead.

## Testing for ketones

Blood testing using a meter measuring 3-beta-hydroxybutyrate is the most accurate way to test for ketones. The meters that are able to test blood ketone levels are the Optium Neo or Freestyle Libre (Abbott) and the GlucoMen LX Plus (Menarini).

The levels of ketones in the body can be anywhere from zero to very high and are measured in millimoles per liter (mmol/L).

- Negative ketone level: less than 0.6 mmol/L
- Low to moderate ketone level: between 0.6 to 1.5 mmol/L
- High ketone level: 1.6 to 3.0 mmol/L
- Very high ketone level: greater than 3.0 mmol/L

It is also possible to test urine for ketones (measuring acetoacetate) but this has been shown now in lots of different studies to be less accurate than blood ketone testing, where the initial severity of ketones is underestimated.

## When are ketones dangerous?

Sometimes, in people with diabetes, ketones can build up to a dangerous level and this is called diabetic ketoacidosis or DKA. This may be caused by illness, high stress levels, or lack of insulin delivery e.g. a dislodged insulin pump cannula or missed insulin injections.

### Symptoms of DKA are:

- High level of blood ketones
- High blood glucose levels
- Loss of appetite
- Stomach ache
- Difficulty breathing
- Weakness and sleepiness
- Smell of ketones on breath
- Rapid, panting breath ('Kaussmaul' breathing)

### Treatment for DKA needs:

- Treatment in hospital
- Fluids to reverse the dehydration
- Insulin (via a drip) to force glucose into cells
- Electrolytes such as sodium and potassium to replace those lost in the urine

**See our 'Sick day rules' for advice on what action to take if you find your child has ketones.**

## How to prevent DKA?

- Take insulin and check blood glucose levels regularly
- If blood glucose level is more than 14 mmol/L, check for blood ketones
- Don't stop taking insulin if you are unwell
- Drink enough water to prevent dehydration
- Don't exercise if you have blood ketones more than 1.0 mmol/L
- Call the Diabetes team for advice if you are concerned or unsure of what to do

## Contact Details:

**Office Hours (Mon-Fri 9am to 12pm):** 020 3447 9364 (Children's Diabetes Nurses)

**Emergency mobile (Mon-Fri 8am – 6pm):** 07940476811

**Out of Hours:** 020 3456 7890 and page Paediatric On-call Registrar

**Email:** [uclh.cdtime@nhs.net](mailto:uclh.cdtime@nhs.net) or [uclh.cdorange@nhs.net](mailto:uclh.cdorange@nhs.net)

Further information and fact sheets can be found on our Children and Young People's Diabetes web page at [www.uclh.nhs.uk/T1](http://www.uclh.nhs.uk/T1)

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