Ketones and Ketoacidosis

If you have diabetes and become unwell or have high blood glucose levels of 14 mmol/L or more please check for ketones

If the body does not have enough insulin its energy levels will fall, the body stores its energy inside cells as glucose but it needs insulin in the correct amount to do this.

When insulin levels are insufficient the body breaks down fat to produce the energy it needs, chemicals called KETONES are made as a by product of this process. Ketones are acids and if this acid level rises too high this can be very dangerous if you have diabetes.

Ketosis describes the increased level of ketones in the blood. Prompt action is essential to avoid hospital admission and treatment with intravenous insulin and fluids.

Ketoacidosis describes how acidic the blood has become because there is NOT enough insulin in the body.

Ketoacidosis can be dangerous and life threatening and can develop within a few hours, especially for insulin pump users. IMMEDIATE ACTION IS REQUIRED.

Increasing ketone levels affect the function of the heart, lungs, digestive system and brain and in the worst situation can cause coma and death.

Recognizing the signs and treating early is essential:-

EARLY Signs that your child is developing ketoacidosis

- Blood glucose level is rising and typically greater than 14 mmol/L
- Ketones are present in the blood or urine
- Confusion
- Tiredness
- Increased thirst
- Becoming dehydrated

LATE signs that your child has developed or is developing ketoacidosis

- Nausea
- Vomiting
- Headache
- Abdominal pain
- Breath smells of acetone /pear drops
- Deep/Sighing breathing * Seek Urgent Medical Attention
Ketoacidosis is always caused by insufficient insulin please check for ketones:

- If your child is acutely ill or feeling unwell
- If the blood glucose has been higher than 14 mmol/L for 2 hours
- If your child feels sick or has vomited
- If your child is feeling under stress
- If you are on an insulin pump you are at greater risk of developing ketoacidosis because you only have a small depot of fast acting insulin and you no longer have any long acting insulin working in the background. Pump users must be more vigilant and test for ketones after any raised blood glucose result that has not been resolved by one correction dose by the pump.

Check ketones
Correction dose by pen if the ketones are present
Change your pump to a new site
Check you had not run out of insulin?
Check your old cannulae was not bent?
Check for air in your line?
Confirm ketone level after 2 hours is 0.6mmol/L or reducing
Contact diabetes team if no improvement

Measuring ketones at home using a blood ketone monitor

Ketones can be measured at home by a simple finger prick blood test. This method is more accurate than the urine ketone test which in Leeds is no longer routinely used. If this is all you have, check the expiry date on the strips, dip stick your child’s urine and if ketones are positive you need to contact the diabetes team for an assessment and advice.

We highly recommend the use of the blood ketone monitoring equipment especially if your child is unwell. The results from this simple finger prick test will tell you if your ketone level is normal or elevated. The higher the result the quicker you need to act. This result can tell you if your child has diabetic ketoacidosis. Please refer to the guideline chart below to help interpret the results but if unsure contact your diabetes team for immediate advice.

Delayed treatment for high blood ketone levels can be life threatening. Identifying rising ketone levels early can avert an emergency situation or hospital admission. If identified early and with appropriate advice and treatment from the diabetes team ketone levels usually decline into the safe range. Managing this may take up to 24 hours and requires extra insulin doses and careful observation of fluid intake and regular telephone contact.

Individual assessment is essential and in some cases admission to hospital may be unavoidable.

If your child is unwell please establish if it is the diabetes causing the symptoms from ketone production by checking the blood ketone level. If the blood ketone level is below 0.6mmol/L and the blood glucose is less than 14 mmol/L this indicates the insulin level is fine and it is likely to be some other underlying illness causing the symptoms.

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BLOOD KETONE LEVELS - WHAT I NEED TO DO

Think of the results like a set of traffic lights

**Green**: blood ketones in the normal range  
**Amber**: blood ketones please be careful  
**Red**: blood ketones very high risk of ketoacidosis

<table>
<thead>
<tr>
<th>Blood glucose level</th>
<th>Blood ketone level</th>
<th>What do I do</th>
</tr>
</thead>
</table>
| Blood glucose 8-14 mmol/L | Blood ketones below 0.6mmol/L | The ketone level is in the normal range.  
- Give a correction dose to get back to your target blood glucose level if needed  
- Recheck Blood glucose and ketone in 2hrs  
- Important to have carbohydrate as usual and give appropriate insulin. |
| Blood Glucose 14 mmol/L or more | Blood Ketones Below 0.6mmol/L | The ketone level is in the normal range  
- Correction dose is needed for high blood glucose level  
- Give extra sugar free fluids  
- Recheck Blood glucose and ketone in 2 hours as the level may improve without any further extra insulin.  
- If glucose level still high give some extra fast acting insulin as correction dose as per your personal instructions. If ketone level rising see below.  
- Important to have carbohydrate as usual and give appropriate insulin, if not hungry have liquid exchanges instead.  
- If unsure contact the diabetes team |
| Blood Glucose 14 mmol/L or more | Blood Ketones Between 0.6 and 1.5 mmol/L | The ketone level may become serious without extra insulin.  
- Give extra insulin immediately. Pump users to give using a pen injection and re-site pump needle.  
- All to recheck blood glucose and ketones in two hours. If unsure of how much to give then contact the diabetes team.  
- Give extra sugar free fluids.  
- Recall team in 2 hours with update and for ongoing advice  
- Important to have carbohydrate as usual and give appropriate insulin, if not hungry have liquid exchanges instead. Despite these actions your child could deteriorate very quickly into the high risk category - **any signs of nausea, vomiting or abdominal pain seek advice immediately** or take to the accident and emergency department.
BLOOD GLUCOSE LEVEL MAY BE NEAR NORMAL or HIGH

Very serious, particularly if associated with vomiting, cold peripheries and deep sighing breathing. Call ambulance immediately.

Blood Ketones Above 3.0mmol/L is Serious Risk

The ketone level is seriously high.

- Your child needs a rapid assessment of the severity of ketoacidosis.
- TAKE TO EMERGENCY DEPARTMENT IMMEDIATELY
- If very dehydrated and breathing fast further insulin under the skin is unlikely to work, hospital admission is urgently required.

**Starvation Ketones** can occur when the body is starved of glucose for prolonged periods of time. The blood glucose level is usually normal or no greater than 10 mmol/L. Typically present first thing in the morning.

Starvation ketones are made from fat just the same but the levels do not usually rise above 1.0 mmol/L.

- Eat a carbohydrate meal and give usual insulin.
- Retest after four hours and the ketones should have gone.
N.B. It can be normal to have a small amount of ketones in the blood this is harmless.

NEVER stop giving your insulin if you are unwell or have ketones.

It is not advisable to exercise if you have ketones and high blood glucose levels.

This leaflet has been specifically written to explain ketones and their potential effects please refer to the illness management leaflet for more specific illness advice.

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