Exercise with Diabetes for Young People using Insulin Pumps

Regular physical activity is encouraged for all children and young people and has important long-term health benefits. For young people with diabetes, exercise needs a little extra consideration to keep blood glucose levels in range - but this should not stop you enjoying it or performing to your best.

Exercise may cause blood glucose levels to go up or down depending on the person doing it, the type, duration and timing of exercise after food. The effect of exercise on blood glucose levels may also happen some hours after it has finished.

Regular blood glucose checking is absolutely essential for you to understand your diabetes and blood glucose response to different exercise and activities, and will enable us to come up with a plan for managing BG levels with sports.

What effect can exercise have on Blood Glucose levels?

Some types of exercise are likely to cause BG levels to fall

These include endurance exercise such as jogging, cycling, swimming; or stop-start exercise such as football, rugby and other team sports.

Why?

1. The action of muscle activity pulls glucose from the blood as fuel. Insulin also moves glucose from the blood. If you don’t reduce insulin when you exercise, BG levels can drop quickly.
2. The body uses its stores of glucose during exercise - so as you exercise for longer, BG levels risk going low. Often people need extra carbohydrate to maintain BG levels if exercise lasts longer than an hour.

Some types of exercise can cause BG levels to rise

These include short bursts of exercise such as sprinting or weight lifting. Sometimes BG levels go high before or during matches or competitions.

Why?

1. During short, intense exercise the body releases glucose into the blood from its stores to be readily available fuel for muscles. Usually this will reduce once exercise recovery is complete, but some people find they need to adjust their insulin to prevent high levels.
2. Stress hormones associated with matches and competitions can make BG levels rise. This means your BG may respond to exercise differently in training and on competition days.
What can I do to avoid hypos or high BGs during exercise?

It’s a balancing act …… between:

We don’t want to change the exercise - so you may need to make changes to the insulin or carbohydrate to keep blood glucose levels stable.

BEFORE AND DURING EXERCISE

Aim for BG levels to be 5-8 mmol/l before you start

<table>
<thead>
<tr>
<th>Blood Glucose (mmol/l):</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 4 (hypoglycaemic)</td>
<td>Treat the hypo as usual and go on to start or continue exercise once your BG has recovered to above 5 mmol/l. Be aware that you are more likely to have a hypo again before or after the exercise.</td>
</tr>
<tr>
<td>4-5</td>
<td>Before exercise: have a small snack containing 10g slower-acting carbohydrate (e.g. cereal bar, small banana). During exercise: use 10g fast-acting carbohydrate (e.g. 150ml Lucozade Sport, 3 dextrose tablets). If exercise is less than 2hrs after a meal, see note below.</td>
</tr>
<tr>
<td>5-8</td>
<td>This is an ideal place to start exercise. For exercise under 1 hour you will probably not need any extra carbohydrate - However, you may need 10-15g fast-acting carbohydrate as you start IF: you have had a meal in the last hour with full insulin; or are doing exercise that has caused hypos in the past. For exercise over 1 hour or high intensity exercise - You may need top ups of 10-15g of fast-acting carbohydrate every 30 minutes.</td>
</tr>
<tr>
<td>8-15</td>
<td>Go ahead and exercise, but drink plenty of water or sugar-free drinks before and during your activity. Remember that muscles don’t work well if BG levels are high and BG levels may go even higher during and after exercise.</td>
</tr>
<tr>
<td>Over 15</td>
<td>If your BG level is more than 15 mmol/l, check for ketones. - If your ketone level is more than 1 mmol/l, do not exercise but give an insulin correction dose and wait for the ketone level to fall before exercising. - If your ketone level is less than 1 mmol/l go ahead and exercise, but drink plenty of water or sugar-free drinks before and during your activity.</td>
</tr>
</tbody>
</table>

REMEMBER: check your BG levels before & during exercise, especially if you want to perform at your best. Muscles will only work properly at a BG level of between 5 and 8 mmol/l.
Adjusting insulin before exercise

BASAL insulin
If exercise is planned, you can start a temporary basal rate 30-60 minutes before you begin. This may be a 25-75% reduction for exercise that causes hypos. For exercise known to cause BG levels to rise, you may need to increase the basal rate to ensure BGs do not go above 8 mmol/l.

BOLUS insulin
If exercise is being done within 2 hours of a meal, you may need to reduce the bolus insulin dose given at that meal by 30-50% to keep your BG level above 5 mmol/l and prevent the need for extra carbohydrate before and during exercise. However, only do this if you notice that your BG levels regularly fall below 5 mmol/l or you hypo during the exercise (but not on other days).

Adjusting insulin during exercise

BASAL insulin
Most sports will require a reduction in basal rates if insulin pumps are left on. Start using a 50% reduction and consider reducing further if hypos occur.

Taking insulin pumps off during exercise
Contact sports and swimming can require pumps to be removed. For activity that lasts less than an hour, this is usually fine to do. However, for activity an hour or longer, you may need to replace half the amount of basal insulin that will be lost while the pump is disconnected. This will need to be given as a bolus.

If the exercise is aerobic (and likely to drop BG levels) give this bolus at the END of exercise. If you are taking your pump off for longer than an hour - you should repeat this each hour throughout (for example, at half-time during a match, then at the end).

If the exercise is anaerobic (and likely to cause BG levels to rise) give this bolus at the START of exercise, just before you remove your pump.

If you are taking off your pump frequently for exercise - discuss with your Diabetes Team, as there may be other ways for you to manage your insulin.

Exercise after hypoglycaemia earlier in the day

Be aware that you are more likely to have a hypo again during or after the exercise. Consider having extra carbohydrate before you start and using a larger reduction in basal rates than you would usually.
## AFTER EXERCISE

Always check blood glucose levels as soon as possible.

**BG may be high or low**

<table>
<thead>
<tr>
<th>Blood Glucose</th>
<th>Why?</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High</strong></td>
<td>Type of exercise (usually short bursts such as sprinting). Adrenaline (during matches). Too much carbohydrate before or during. Not enough insulin during exercise. Too much of a reduction in insulin before or during. Basal insulin not replaced if pump disconnected.</td>
<td>Smaller snack or less sports drink during exercise. Do not take off pump or replace half the basal insulin (see above). Consider giving half your usual correction dose if levels do not start to come down within a couple of hours.</td>
</tr>
<tr>
<td><strong>Low (hypo) Can be up to 6 hours after exercise</strong></td>
<td>Type of exercise (usually longer-lasting exercise such as jogging, swimming, cycling). Not enough carbohydrate. Not enough of a reduction in insulin.</td>
<td>If hypos occur, treat them in the usual way and check that BG levels have come up above 5 mmol/l. Be aware that you may have further hypos. If this happens regularly after a particular exercise, consider actions to prevent delayed hypos in future (see note below).</td>
</tr>
</tbody>
</table>

*Usually high levels will return to in range after a few hours.*

*Delayed hypos happen as the body replenishes its stores of glucose used up during exercise.*
Preventing delayed hypos after exercise

There are a number of strategies to try if you notice hypoglycaemia happens 4-6 hours after you exercise. You may not need to use all of them - see which one suits your routine best.

IN THE FIRST HOUR AFTER EXERCISE - ‘The Golden Hour’

Have a snack containing a mix of 10-15g carbohydrate AND protein (e.g. yoghurt tube or 200 ml milk, cheese and crackers, nuts and dried fruit) within 1 HOUR of finishing exercise WITHOUT INSULIN. This is the time when the body is most able to replenish stores of glucose used during exercise.

Or, if you are going to eat a meal, then reduce the insulin given by 30-50%.

LATER AFTER EXERCISE

Insulin adjustments at mealtimes
Reduce mealtime insulin by 30-50% in the time period 4-6 hours following exercise.

Insulin adjustments - basal doses
Using a temporary basal rate with a 30% reduction for 3-4 hours after exercise can help prevent delayed hypos. If you do this, then you may need less adjustments of bolus insulin doses.
If night-time hypos have happened, then try using a 10-20% reduction for 3-4 hours as you go to bed.

Bedtime snack
Exercise later in the day can cause lows during the night if glucose stores have not fully been replaced. A small bedtime snack (10-15g carbohydrate) may prevent night-time hypos, especially following afternoon or evening exercise. This may require reduced or no insulin, depending on the individual response.

REMEMBER YOUR RESPONSE TO EXERCISE IS VERY INDIVIDUAL.
You need to monitor your BG level during and after exercise to learn how best to manage it.

For more information on sports and Diabetes ask your Diabetes Team

For those participating in more intense training programmes or competing at high levels:

- Ask about our specific Sports and Exercise Education Session, where you can find out more about what happens in your body when you exercise and what you can do to manage your diabetes to gain optimal performance.
- You may also wish to look at www.runsweet.com.
- You may be eligible to attend our Specialist Sports Clinic - please ask your doctor at your next regular clinic appointment.