University Hospitals Coventry and Warwickshire NHS Trust

Patient Information

Department of Nutrition and Dietetics

Diabetes Type 1: Information for children, young people and families about exercise, type 1 diabetes and insulin pump therapy

Introduction

Being active is an important part of a healthy lifestyle, but can make blood glucose levels harder to manage at times. This information sheet will help you to understand how to keep your blood glucose levels stable during exercise.

About exercise and diabetes

You need to know a bit about different kinds of exercise to help you keep your blood glucose levels stable. Your blood glucose levels can be affected by:

- Different types of exercise (aerobic or anaerobic).
- The amount of insulin in your body.
- How long your exercise or activity lasts. Exercise that lasts longer than one hour will normally have more of a blood glucose lowering effect.

What happens during and after exercise?

We have a store of fuel (glycogen) in our muscles and liver that can be used for energy at the beginning of exercise. The stores usually last about 45 minutes. If insulin levels are high (for example just after a meal bolus) the liver cannot produce glucose for the muscles to use and blood glucose can drop rapidly.

Remember: you need just enough insulin during exercise to allow your liver to produce the right amount of glucose for your working muscles.

Caution: low insulin levels allow the liver to release too much glucose and ketones may appear. If you have ketones and a high blood glucose level you need to treat this before you exercise.

Aerobic exercise (which uses oxygen) will usually lower your blood glucose during and after exercise; examples of aerobic exercise include running, swimming and cycling.

- If your exercise lasts longer than 30 minutes you will probably need to reduce your insulin and/or have extra fast acting carbohydrate.
- For exercise that lasts for less than 30 minutes you may not need to lower your insulin but you may need a little extra carbohydrate.

Anaerobic exercise (which does not need oxygen) may make your blood glucose rise during the exercise and fall after the exercise. Anaerobic sports are usually short, sharp and fast or strength and power sports. Examples include, sprinting, basketball and weight lifting.

Some sports will be a mixture of aerobic and anaerobic exercise such as football and team sports. Mixed exercise may produce steady blood glucose levels.

Exercise can lower blood glucose levels for up to 12 hours. You may be more sensitive to your insulin and need to use temporary basal rate decreases and/or reduced bolus ratios with food. Sometimes blood glucose levels can increase immediately after exercise. If this happens you may need to use a temporary basal increase or a ½ correction dose. High blood glucose levels at the end of exercise may drop without extra insulin. Checking blood glucose levels is the only way to learn what happens during exercise

Blood glucose monitoring and exercise

Check your blood glucose levels before any exercise, every 20-30 minutes during exercise and at the end of the exercise and between 2.00am and 3.00am after vigorous/hard or long bouts of exercise. This will help you to understand how different types of exercise affect your blood glucose levels.

Adjusting your insulin

You should aim to keep your blood glucose level around 6-8mmol/L before and during exercise. You can adjust your basal and bolus insulin to do this.

If your blood glucose level is between 5 and 8mmol/L at the beginning of your exercise you may need to start having your exercise snacks at the start of the activity.

Try to avoid long periods (more than an hour) of exercise without your pump on as this may cause high blood glucose levels after exercise.

Bolus meal time insulin

If you eat 1-2 hours before exercise, you can make a reduction in your mealtime bolus insulin dose to help prevent low blood glucose levels during sport.

To prevent low blood glucose levels after exercise reduce your bolus with meal or snack taken after your activity.

- Lower your insulin by 25-75% if you give a bolus 1-2 hours before exercise.
- If your exercise is more than 2 hours after a meal bolus you may not need to make any reductions.

Bolus insulin before exercise should be given before the meal and only a standard bolus should be used.

Basal insulin

Use a temporary basal rate (TBR) to reduce the amount of background insulin when you exercise.This is very useful for aerobic activity to prevent low blood glucose levels.

Start your basal reduction 60-90 minutes before exercise that lasts 60 minutes or longer.

You may also need to lower your basal rates by 20% between midnight and 3.00am after any strenuous or hard exercise in the afternoon/evening. Set up a second basal rate profile to do this.

If you have problems with hypoglycaemia after exercise, continue the reduced basal rate after exercise as needed.

If you have high blood glucose levels at the end of exercise you can; use a 150% temporary basal increase starting just before the end of the activity or a 50% correction dose (i.e. half of what you would normally take to correct high blood glucose when you are not exercising). Check your blood glucose levels to make sure this doesn't cause hypoglycaemia later.

Insulin on board

Use the information available from your bolus wizard/advisor before exercise to check how much insulin on board (active insulin) is present. If your blood glucose levels before exercise are ok (5-8mmol/L) and you have insulin on board you can either;

- Increase the amount of carbohydrate you have during the exercise, (reverse your insulin to carbohydrate ratio to work out how much extra carbohydrate you need)
- Use a bigger temporary basal decrease

Pump off during exercise

For some sports you may need to take your pump off (such as swimming and for contact sports). If your activity lasts longer than an hour you need to check you blood glucose levels.

For sports like basketball, sprinting and weight lifting, you may need to inject some insulin or reconnect the pump and bolus during the exercise if your blood glucose goes up.
At the end of exercise you will need to replace some of the missing basal insulin.
Try either:

- A temporary basal increase to 150% for 30-60 minutes
- A 50% (half) correction bolus to manage high blood glucose levels
- Replace half of the missing basal as bolus at the end of the activity
  Check blood glucose levels regularly, as your blood glucose levels may start to fall 1-2 hours after exercise.

Exercise guide

Blood glucose	Aerobic exercise	Anaerobic Exercise
Less than 5mmol	Bring blood glucose back to normal, have extra carbohydrate and use temporary basal or remove pump for exercise.	Bring blood glucose back to normal, have extra carbohydrate and use temporary basal or remove pump for exercise

Blood glucose	Aerobic exercise	Anaerobic Exercise
5 -8mmol	Have exercise snacks and/or use temporary basal decrease for exercise longer than 30 minutes	No changes required if the activity is less than 30 minutes. Consider exercise snack or temporary basal decrease if exercise lasts longer than 30 minutes.
8 – 11mmol/l	No change required for activities less than 45 minutes if “on board” insulin levels are low. If exercise lasts longer than 45minutes exercise snacks will be needed. Use temporary basal rates according to normal blood glucose responses to activity.	No changes required if exercise is for less than 30 minutes. Exercise snacks may need additional insulin. If disconnecting pump blood glucose level may rise. See exercise with pump off advice.
11 + mmol/L	Check for ketones and correct* blood glucose if ketones are present. Adjust basal rates according to usual BG responses. Have exercise snacks with insulin for performance. Drink plenty of fluids to prevent dehydration.	Check for ketones and correct* blood glucose if ketones are present. Anaerobic exercise with pump off and high blood glucose will raise blood glucose levels. Cover exercise snacks with insulin. Drink plenty of fluids to prevent dehydration.

*use only a half correction dose during exercise

If you have a high blood glucose level and ketones you should delay your exercise until the ketones have gone.

Exercise snacks

Carbohydrate snacks can be used to prevent low blood glucose levels during exercise. The amount you need will depend on the insulin adjustments you have made and the type and duration of activity you are doing.

Aerobic exercise that is more strenuous or intense or that lasts longer than 45 minutes can need 1g carbohydrate for every kilo you weigh.

To start, try having 10-15g of carbohydrate for each 30 minutes of activity and monitor your blood glucose levels regularly (every 20-30 minutes). The amount of carbohydrate you need will vary with different activities as some sports use up more calories (energy) than others.

Suitable exercise snacks include:

- Sports drinks/gels
- Jelly sweets
- Ordinary sugar containing drinks (not fizzy)
- Dried fruit
- Jaffa cakes

Drinks for sport

It is important when you are being active that you have plenty to drink.

- Drink 2-300ml water or dilute sugar free squash, before any exercise.
- Try and drink during your exercise as well, about 100ml every 10-15 minutes.
- If you are exercising for an hour or more always have a sports drink, to ensure you get the fluid you need and the extra carbohydrate as well.
- If you are exercising for less than 60 minutes water is fine if you have carbohydrate snacks. You can use sports drinks if you need extra carbohydrate.

Sports performance snacks

If you exercise for 60minutes or longer and need sports performance snacks you may need to bolus for these snacks. During exercise use a reduced bolus. Try half your normal insulin to carbohydrate ratio and check blood glucose levels every 20-30 minutes if possible.

Food after exercise

Eat a snack before bed whenever you have done 60 minutes, or more exercise in the afternoon or evening. This helps to maintain blood glucose levels overnight. A mixture of carbohydrate and protein helps your muscles and liver to replace their glycogen stores. Examples of good bed time snacks include milk shake and fruit, cereal and milk, crumpets with peanut butter.

Useful contacts

Diabetes UK - Tel: 020 74241000 Careline – Tel: 0845 120 2960
Website: http://www.diabetes.org.uk
Diabetes UK is a useful source of additional information about diabetes, for you to read, order, or download. They also have books to buy, details of local diabetes groups and general news/articles about diabetes.

Coventry and Rugby Paediatric Dietitians Telephone: 024 7696 6161

This information is based on information produced by Francesca Annan BSc, MSc, RD Paediatric Dietitian, Alder Hey Children's Hospital, Liverpool.

The Trust has access to interpreting and translation services. If you need this information in another language or format please contact 024 7696 6161 and we will do our best to meet your needs.

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