University Hospitals Coventry and Warwickshire NHS Trust

Dietetics

Diabetes - Physical Activity and Insulin- Type 1 Diabetes

Physical activity is a very important part of the treatment of diabetes. It is proven to have both short and long term benefits on blood sugar control. It is recommended that everyone living with diabetes takes regular physical activity – whatever their age and level of health.

Physical activity will affect the way your body uses glucose (also called sugar) and insulin and can affect your blood glucose levels in different ways. This information aims to help you understand what is happening to your body during activity and provide you with some guidance on how you can adjust your diet and insulin to maintain stable blood glucose levels both during and after your exercise.

Everyone will react differently to exercise. It is important to monitor your blood sugars regularly during and after exercise to see how your own body reacts to your chosen exercise. **Also, whatever you are doing, make sure you have some hypo treatment to hand in case your blood sugars drop unexpectedly.**

What happens when I exercise?

During exercise, your body needs fuel, which is provided by the carbohydrate, fat and protein in your diet. The most important fuel for your muscles is carbohydrate, which is broken down into glucose. Your muscles need insulin to use glucose.

The body uses different sources of fuel depending on the length and intensity of the exercise. When exercise starts, the body uses glucose

stored in the muscles. These stores run out very quickly and the body then starts to use glucose from the blood stream. The glucose in the blood is topped up by supplies of glucose from the liver. To use the glucose for fuel, the muscles need insulin. If the exercise goes on for longer the body will use fat for fuel.

What are the effects of exercise on my blood glucose levels?

What happens to your blood sugars during physical activity will depend on the amount and timing of carbohydrate that you eat or drink, the level of insulin in your blood and the how long and intense the activity is.

A low blood glucose level (hypoglycaemia) can be caused by

- Eating too little carbohydrate for the activity
- Starting the activity when your blood glucose level is already low
- Too much insulin
- Absorbing more insulin because an injection is given or a pump cannula is put in the arm or leg which is doing the physical activity (e.g. a thigh when running or cycling)
- Having a hypo within the last 24 hours

A high blood glucose level (hyperglycaemia) can be caused by

- A lack of insulin because the muscles cannot use glucose for fuel and the glucose builds up in the blood. This may lead to the production of ketones
- Anaerobic, high intensity activity such as weightlifting or sprinting
- Adrenaline in the blood, which can stop the insulin from working properly, this could arise in a competitive sporting situation.

The body is more sensitive to insulin after physical activity or exercise. Glucose stores in liver and muscle need to be replaced as well. Both of these factors can lead to low blood glucose levels or hypos in the hours and days after the activity.

How can I avoid hypo- or hyperglycaemia?

You can have extra carbohydrate to match the amount used up or change the amount of insulin before or during exercise. You can also do a combination of both. Frequent blood glucose monitoring will help you to see how your body responds to the type and duration of your activity.

Preparing for activity – adjusting insulin

The best time to exercise is around two hours after a meal when you still have active insulin working. If it is more than four hours since your last insulin injection or bolus then your blood glucose may rise due to lack of insulin.

If you are on mixed insulin you should not adjust your insulin, but instead you should eat or drink enough carbohydrate to prevent your blood glucose going low.

If you are on a basal bolus insulin regime – if you eat around two hours before exercising, you can reduce your insulin dose at this meal by between 25-75% to help prevent low blood glucose levels.

You may also choose to reduce your long-acting insulin dose by 25-50% if:

- you know you are going to be unusually active all day, or
- your activity is likely to be strenuous, or
- you will be exercising the next day – on an activity holiday, for example.

If you use an insulin pump then you can also use a TBR (temporary basal rate) to reduce the amount of background insulin to prevent low blood glucose. Start your basal reduction 60-90 minutes before exercise that is going to last 60 minutes or longer. If you have problems with hypoglycaemia after exercise, you can continue to use the reduced basal rate.

Just before starting activity

Before starting, check your blood glucose level.

Blood glucose level	**Can I exercise?**
Lower than 7mmol/L	At this level you are at risk of a hypo. You should eat 15-20g carbohydrate before starting, unless you are doing anaerobic exercise and you know that your blood glucose tends to rise during this type of activity.
7 -15 mmol/L	It should be fine to exercise.
Higher than 15 mmol/L	At this level there may not be enough insulin to use glucose. Check for ketones. If ketones are below 1.5 mmol/L, give 30% of your usual correction dose and proceed to exercise. If ketones are above 1.5 mmol/L, give a full correction dose and don't exercise until blood glucose levels have come down.

For some sports, such as swimming or contact sports, you may need to take your insulin pump off. If your activity lasts longer than an hour you should check your blood glucose levels, and you may need to bolus insulin if your blood glucose levels have risen.

During activity

For all types of activity, it is good to monitor blood glucose levels frequently, aiming for a level of around 6-8 mmol/L. Have hypo treatment with you, and it is a good idea to tell someone else when you plan to come back if you are out exercising alone. It is helpful to know how much carbohydrate is in any drinks or snacks that you use during exercise. Some drinks and snacks and their carbohydrate content are listed at the end of this leaflet.

After activity

It is helpful to monitor your blood glucose levels frequently in the hours after activity. For anaerobic intense exercise you may find your blood glucose levels are high afterwards. After prolonged aerobic activity, your blood glucose is more likely to be low. A 10-second sprint after moderate intensity exercise releases hormones that can help to prevent hypoglycaemia.

Exercise makes your insulin work better and uses up the glucose stored in the muscles and liver which must be replaced in the hours afterwards. Because of this you are more likely to have a hypo after activity. You may need to have carbohydrate snacks and/or reduce your insulin doses in the 24 hours following exercise. If you are on mixed insulin you should eat rather than reduce your insulin dose.

If you removed your insulin pump for exercise, you may have to calculate and give the missed basal insulin as a bolus after you re-connect the pump.

Try the following:

- A temporary basal increase to 150% for 30-60 minutes, or
- A 50% correction bolus to manage high blood glucose levels, or
- Bolus half of the missed basal at the end of the activity.

Adjusting insulin and carbohydrate intake

Use the following table as a guide for adjusting insulin and carbohydrate intake (mixed insulin should not be adjusted).

Exercise	Example	Rapid acting insulin adjustment	Carbohydrate
Gentle exercise, less than 30 minutes	Walking the dog	No adjustment	Have hypo treatment with you

Gentle exercise, 30 minutes	Leisure swimming Supermarket or clothes shopping for more than an hour	No adjustment, or minimal (0-25%) reduction prior to exercise **Insulin pump:** TBR 10-25% reduction starting up to 30 minutes prior to exercise	Additional 10-20g carbs per hour. Have hypo treatment with you
Prolonged or intense (up to 4 hours)	Jogging, football	30-50% reduction prior to exercise. 10-50% reduction following exercise. **Insulin pump:** TBR 30-50% reduction starting 30-60 minutes prior to exercise	Additional carbs during exercise (30-60g per hour). Have hypo treatment with you
Prolonged exercise over 4 hours	Hiking, golf, endurance sports DIY e.g. painting, or stripping wallpaper	50% prior to and during exercise. 30-50% reduction following exercise. 10-20% reduction for up to 24 hours afterwards **Insulin pump:** TBR 50% reduction starting 30-60 minutes prior to exercise and possibly continued afterwards.	Additional carbs (30-60g per hour). Have hypo treatment with you. Extra carbs may also be needed post-exercise.

Exercise snacks

The following table may help you plan your exercise snacks when needed.

Fast-acting carbohydrates	Carbs
200 ml Lucozade Energy	18g
250 ml Lucozade Sport	16g
150 ml fruit juice	15g
165ml (half a can) non-diet cola	18g
9 jellybeans	15g
5 Fruit Pastilles	15g
4 jelly babies	15g
4-5 glucose tablets	15g

Slow-acting carbohydrate	Carbs
A small banana	15g
One medium slice toast	15g
Two finger chocolate wafer	13g
Small box raisins (14g)	11g
2 Digestive biscuits	18g
1 Weetabix + 100ml milk	19g
Half a pint of milk	14g
125g low fat yogurt	15g

Always double check the labels to be sure.

Listeriosis risk: foods to avoid

Avoid ready-to-eat cold smoked or cured fish products such as smoked salmon or gravlax due to an increased risk from listeriosis. Listeriosis is an infection caused by bacteria called listeria. People with diabetes are at higher risk of serious illness from listeriosis. Further information on how to reduce the risk of listeriosis can be found at:

- NHS www.nhs.uk/conditions/listeriosis
- Food Standards Agency www.food.gov.uk/listeria

Useful resources

- http://www.runsweet.com/
- Diabetic Athlete's Handbook, by Sheri R Colberg

Your Dietitian is:
Contact Number:

Further Information

This leaflet was produced by Coventry and Rugby Dietitians, University Hospitals Coventry & Warwickshire NHS Trust. If you have any other questions or would like further information, please contact the team on 024 7696 6161.

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