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Introduction to session 4

Welcome to session 4. We hope you are getting to grips with carbohydrate counting now and are beginning to have a better idea about your insulin requirements.

In this session we are looking at managing diabetes during exercise. We will provide an overview of exercise, giving general information and advice. For more specific advice, tailored to your own requirements, we advise that you discuss this with your own diabetes specialist team. We will hear from Victoria Rettie how she plans and manages her exercise programmes.

We also learn about the screening and monitoring that is carried out as part of good routine care in diabetes and how the complications of diabetes have affected someone with diabetes.

We invite you to join us for a virtual meal to gain experience in carb counting when dining out. We also discuss the effects of alcohol.

Professor Sandra MacRury will speak about some of the current research that will improve the lives of people who live with diabetes.

Complications

Long term complications of diabetes

The potential long term complications of diabetes are traditionally described as microvascular and macrovascular, based on the size of the affected blood vessels.

Microvascular complications

So called microvascular complications occur due to exposure of small blood vessels (capillaries) to higher than normal blood glucose levels over many years and include damage to nerves (neuropathy), kidneys (nephropathy) and the eyes (retinopathy).

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Macrovascular complications

Problems affecting the larger blood vessels can also affect patients without diabetes and are known as macrovascular complications. These include heart attacks, strokes and problems affecting the blood supply to the feet.

Picking up problems early

Annual screening checks are designed to pick up any complications before they become symptomatic. If complications are picked up at a very early stage they may be reversible or the risk of progression can be minimised by improving glucose control and other risk factors.

For example, retinal screening allows photographs to be taken of the back of the eyes to look for any signs of retinopathy. It is common for most patients to have minor changes relating to diabetes, or so-called background retinopathy, after having had diabetes for more than 5 years.

This is not a concern and should not affect your vision, but diagnosing more significant eye problems early may also allow early referral to the eye clinic and consideration can be given to laser treatment to prevent progression of retinopathy.

Foot screening aims to pick up nerve damage or circulatory problems early and identifies patients at risk of developing foot problems who may benefit from regular podiatry input. Urine testing is also important as this can detect microscopic amounts of protein in the urine - an early sign of diabetic kidney disease.

Specific medications (ACE-inhibitors) can then be given to lower the amount of urinary protein.

Reducing your risk

The risk of developing complications can be dramatically reduced by maintaining good blood sugar control over a number of years, hence why doctors often focus on the HbA1c blood test.

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However, complications may develop despite your best intentions. Indeed, unknown genetic factors may play an important role in some individuals.

Other factors which can reduce the risk of complications include stopping smoking, control of high blood pressure and medications which lower cholesterol. These may be particularly important in reducing the risk of heart attacks and strokes, as is the case in individuals without diabetes.

What if problems do develop?

Your diabetes team may refer you on to other doctors such as an ophthalmologist, cardiologist or renal physician, who may offer specialist treatments.

Diabetes foot disease can present in a number of ways e.g. numbness, or burning pains, although it may present as a new foot ulcer. Regularly podiatry input may be needed and special scans may be required to look at the circulation. If painful neuropathy is a problem various tablets and creams can be used to reduce discomfort.

Video: [Avoiding complications with diabetes](#) (1:50)

Exercise

Current advice is that to stay healthy or to improve health, adults should take two different types of exercise every week. We need to take part in some aerobic exercise and we also need to take some exercise that will help keep muscles strong.

The challenge of managing this with Type 1 diabetes is of course that exercise uses glucose very quickly and there have to be adjustments made to insulin or to carbohydrate intake. Exercise without making any adjustments can cause hypo glycaemia so there often needs to be some forward planning to prevent that.

If you don't take any regular exercise at the moment, have a look at the links provided and see if any of the suggestions would encourage you to increase your level of physical activity. Then we will discuss appropriate diabetes management.

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[NHS: Physical activity guidelines for adults](#)

[Diabetes UK: Getting active and staying active](#)

Managing diabetes for sport and exercise can be difficult and you need to find out what works for you.

You also need to ensure you keep well hydrated during exercise. Wear ID and always carry something to treat a hypo.

Aerobic exercise

Aerobic exercise is also described as 'cardio', because it requires the heart to pump oxygen round the body to the large muscles. When we start exercising, our demand for energy increases. The energy comes from glucose that is stored in the muscles. That stored glucose doesn't last very long and the body soon requires the liver to start making new glucose to provide energy. If your exercise session lasts for more than 20 - 30 minutes, your body will run out of stored glucose for energy and change to using new glucose made in your liver.

In a non-diabetic situation, the insulin production would switch off to maintain the glucose balance but in diabetes, where insulin is injected artificially it isn't possible to do that. The level of insulin will stay the same and there will be an imbalance causing glucose levels to fall.

There is another process going on that will increase the risk of hypoglycaemia. Glucose is transported into cells by special transporters called Glut 4 transporters. When we exercise, these transporter cells increase in number and glucose moves more efficiently. That is why the effects of exercise can last into the next day and there is a risk of hypoglycaemia after exercise.

So, we need less insulin circulating during exercise but achieving this can be difficult. Your options are either to reduce insulin prior to the exercise, or to take some glucose to top up. If the exercise is planned, then reducing insulin can be a useful strategy. If it isn't planned, you may have to top up your carbohydrate intake instead.

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Anaerobic exercise

Anaerobic exercise is usually high intensity exercise of short duration. This type of exercise requires high energy fuel directly from the stored energy source. These exercises tend to be around building strength rather than endurance and include things like weight lifting or sprinting.

In order to allow stored glucose to be released, the body produces hormones such as Adrenaline and other stress hormones. These cause glucose levels to rise rather than fall.

Video: [Exercise and diabetes](#) (1:56)

Some general exercise advice for aerobic exercise

If you have listened to Vicky talking about how she plans for exercise you will have heard her talk about ideal glucose levels for exercise. You should try to aim for around 6 - 9mmol/l immediately before exercise.

If glucose levels are:

- 10mmol/l - 14mmol/l - check for ketones and consider taking a correction dose.
- above 14mmol/l or if you have ketones greater than 0.6mmol/l - you should **not** exercise until you have treated the situation.
- less than 4mmol/l - you **must** treat your hypo. Do not exercise until you have recovered.
- 4 - 6mmol/l - you should consider topping up your glucose level with some fast absorbing carbohydrate, about 20 - 30g, to avoid hypoglycaemia during the exercise.

If you are exercising soon after a meal you will need to consider reducing your meal time bolus.

As a starting point you could try reducing your bolus by 50% if you are eating within an hour of taking your insulin. If it's within 1 - 2 hours, try a 25% reduction. You will need to test during and after exercise to see what works best for you.

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Remember that that the effect of exercise on the glucose transporting cells will continue for several hours after the exercise.

For that reason, you should consider a reduction of your long acting insulin at bedtime. A starting point might be 20%. Do some overnight testing to assess the right adjustment.

Alcohol

We briefly mentioned alcohol earlier when we discussed nutrition. We know that alcohol is a nutrient, but it is also a powerful and potentially dangerous mood altering drug.

Many health problems are as a direct result of over consumption of alcohol, such as liver disease and some head and neck cancers. Other health problems have a strong association with excess alcohol use, such as heart disease.

This is the reason that there are guidelines that suggest safe limits. These guidelines have been revised and changed recently. The guidelines for alcohol consumption are the same when you have Diabetes as for the rest of the UK population.

Men and women should consume no more than 14 units of alcohol per week, 2-3 units per day and should aim for two alcohol free days per week.

What is a unit of alcohol?

You can calculate the number of units in your drink by applying the following formula:

$$\text{ABV} \times \text{volume of alcohol (ml)} \div 100$$

Examples of units in standard measures are below.

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Examples of units in standard measures are below.



Pint of lager
4% ABV
2.3 units



Pint of bitter
5% ABV
2.8 units



Pint of strong
beer/lager/cider
5.2% ABV
3 units



500ml Can of lager
3.8% ABV
1.9 units



750ml Bottle of
wine
13.5% ABV
10 units



175ml Glass of red
or white wine
13% ABV
2.3 units



250ml Glass of red
or white wine
13% ABV
3.3 units



50ml Glass of
fortified wine
20% ABV
1 unit



25ml Single spirit
and mixer
40% ABV
1 unit



50ml Double spirit
and mixer
40% ABV
2 units



275ml Bottle of
alcopop
5% ABV
1.4 units



50ml Double Irish
cream liqueur
20% ABV
1 unit

Pure alcohol contains 7 calories per ml and therefore can contribute to weight gain. Some alcoholic drinks have a high sugar content such as fortified wine, sweet wine, stout, ale flavoured with honey,

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alcopops, flavoured ciders and liqueurs which may lead to further weight gain and should be consumed in moderation.

How does alcohol affect blood sugars?

To understand this, we need to look at what the liver does (see Session 2: The balancing act).

How alcohol effects the processes in the liver is complicated. When you are fasting or not eating carbs, excess protein and fat is being converted to glucose. This process is called gluconeogenesis.

There is also some stored glucose (glycogen) in the liver. This ensures that when you are fasting for a period of time, there will be fuel (glucose) in the blood stream for the body to function normally.

When you drink alcohol the liver becomes very busy. Its main job during drinking time is to break down the alcohol and clean it up by turning it into other chemicals and energy (7 calories per gram).

While the liver is busy cleaning and sorting out the alcohol it is unable to do its usual work.

This means:

1. Gluconeogenesis is stopped or slowed and so your body can't make or won't make as much glucose.
2. The breakdown of the stored glucose in your liver (glycogen) is also stopped or slowed down - so you don't even have your glucose reserves in your liver to draw upon.
3. When all the alcohol is broken down the liver gets back to its usual jobs mentioned above. This increases insulin sensitivity, so glucose in the blood may be used up more quickly and hypo risk is increased up to 12 hours after a session with alcohol.

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So in summary, alcohol reduces the amount of glucose the liver produces and the situation is made worse when you have not eaten (starvation or fasting).

What do I need to think about when I drink alcohol?

We now know how the liver works with Diabetes and alcohol, but what does this mean in terms of having a drink when you have Diabetes?

Alcohol ultimately causes a blood glucose lowering affect. Therefore, it may cause hypoglycaemia if not managed correctly. Where the hypo occurs depends on many factors, some of which are listed below:

Carbohydrate content of the drink

If the drink has no carbohydrate in it, for example, whisky, and you drink enough of it to have an impact on how the liver's functioning (this is individual but usually about 2 units) then your blood sugars are likely to drop soon after the drink.

If your drink is high in carbs (e.g. sweet flavoured cider) and you have several, your blood sugar will at first increase and may become high.

Your blood sugar will eventually decrease because of the effect of the alcohol, but it may be some time after the drink.

Carbohydrate consumption before, during and after the alcohol

As you know, carbohydrates have a huge impact on blood sugars. If you are drinking alcohol and you do not have any carbohydrate to eat, the chances are that your sugars will drop and you will be at risk of a hypo. The timing of the hypo will depend on many factors.

If you have carbohydrate before, during and after drinking alcohol, you lower your risk of hypos because you are continually digesting the carbohydrate which will end up in your blood stream and prevent your sugars from dropping.

It is important that you don't take rapid insulin with your before bed snack.

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Amount of insulin in the body

If you have too much insulin in your body - for example you might have corrected for a high blood sugar or taken too much insulin for the carbohydrate meal you had before you went out for a drink - you will be at greater risk of having a hypo.

There will be excess insulin in your body, which will naturally need to do its job of getting sugar in the blood to the cells in the body. So the blood sugar will fall. This drop will be further affected by the alcohol and its effect on the liver.

Physical activity sometimes associated with alcohol

There are many activities associated with alcohol. To name a few: dancing, walking from restaurant to pub, to night club and walking home. There may also be the possibility of the activity of sex at some point during the drinking session, if alcohol is not taken in excess!!

All these activities will lower blood sugars and with the lowering effect of the alcohol that is keeping the liver from doing its job, hypo risk is even greater.

[Alcohol and diabetes](#)

Remember: initially when drinking, glucose levels can be high, especially if the drink has a high carbohydrate content. You are advised not to correct this with rapid insulin, but you must take your basal insulin as normal to prevent hyperglycaemia.

Key Messages to make drinking with diabetes safer:

- If possible, let the people you are drinking with know that you have diabetes.
- Carry hypo treatment with you at all times.
- Have ID that states that you have diabetes.
- Never drink on an empty stomach.
- Alternate between alcoholic and non-alcoholic drinks.
- Try and avoid alcohol with a high sugar content such as alcopops, fruit ciders, sweet wines, liqueurs.
- Don't bolus for carbohydrates in drinks.

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- Don't use a correction dose for high sugars.
- Have carbohydrate snacks during the drinking session and before you go to bed.
- Watch out for hypoglycaemia for the next 24 hours.
- **ALWAYS take your long acting insulin as usual to prevent hyperglycaemia.**

Dining out and take-aways

In many ways the flexibility of carbohydrate counting can make situations such as dining out, getting a take away, parties, barbeques and other social events easier to manage and less restrictive.

Take a moment to think about these social situations and how you have managed your Diabetes in the past. Is dining out a regular experience? If you were diagnosed as an adult and can remember back to before your diagnosis, how does dining out compare now? What problems come up if any at all?

Discuss your experiences further on the blog. You might want to chat about what you find challenging and any strategies you have used to overcome these difficulties.

Challenges when carbohydrate counting

What might be the potential problems of carbohydrate counting and insulin dose adjustment when you are dining out or getting a takeaway?

Discuss your thoughts.

Here are some problems that people with Diabetes have highlighted on previous courses:

"..difficult to estimate amount of carbohydrate of food you haven't cooked yourself."

"..can't weigh foods and feel embarrassed looking up pictorial carbohydrate guides."

"Restaurant or takeaway food may have additional sugar to enhance flavour of sauces."

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"Restaurant or takeaway food may be high in fat and so alter absorption of carbohydrate into the blood stream."

"No control over timing of meal, particularly if it is a number of courses over a long period of time."

At social events like barbecues, people get chatting, and distracted, particularly when alcohol is involved and food is delayed.

Alcohol can go hand in hand with dining out and will have its impact on blood.

There may be a large quantity of carbohydrate in the meal; this means digestion is delayed and the rise in blood glucose is slow, but may be very high several hours after the meal.

[Let's go for a virtual meal!](#)

Have a look at the virtual restaurant activity in the online version of this resource.



Some useful tips

- Start by identifying where the carbohydrate is in the meal.
- 'Guestimate' or use pictorial food guides such as the Carbs and Cals book or App to estimate the carbohydrate content of the meal.
- Identify whether the meal is high in fat and therefore more slowly absorbed. To do this think of the cooking method (fried, baked grilled). Is the food naturally high in fat, for example steak, skin on chicken, avocado, cheese?

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- Identify whether the food could be slowly absorbed because it has a low glycaemic index - for example dhal is made from lentils and they would be low GI and so slowly absorbed. You may want take your insulin at the end of the meal or consider splitting your dose. You may get away with slightly less insulin if the meal is all very low GI.
- Consider the duration of the meal and how long you might have to wait between courses. For example, you may need to take your insulin before the second course or split your dose.
- Consider the portion size of the meal and the carbohydrate within it. If it has a lot of carbohydrate (over 100g) then you might want to take your insulin midway or at the end of the meal.

The future

Do you remember at the beginning of the course we talked about setting goals?

There was even an exercise where you could have a think about small goals you wanted to achieve through the course and write them down on a SMART goal setting sheet.

There was also the opportunity to look at your motivation for achieving these goals through assessing how important you thought the goal was and how confident you felt in being able to achieve the goal.

This was a very personal exercise, but you were able to discuss it in the discussion forum with colleagues or tutors if you wanted to.

How did you get on in working towards your goal?

Now the course is drawing to a close, you may want to revisit your goals. It might be helpful to ask yourself the following questions:

- Were there any obstacles or barriers in the way that made achieving the goal difficult?
- Were you able to overcome these barriers or change the goal so that it was more realistic to you?

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If you gave yourself an importance and confidence score at the beginning of the course, have a go at it again about the same goal and see if the score has changed. Who knows it may be that in working towards your goal you have become more confident in your ability to achieve it.

Video: [Looking to the future for diabetes treatments](#) (4:17)

We hope you have enjoyed taking part in this programme and that you have found it helpful.

It takes practice to be a competent carb counter. Now you have the skills you can use them in your daily life. Every meal or snack gives you the opportunity to practice and become an expert carb counter!

Remember your diabetes team are there to support you.