

K.A.R.E.N.

King's Mill **A**djusting **R**egime for **E**ating **N**ormally

Carbohydrate Counting Course



Workbook

Reproduced with the permission of the
Type 1 Diabetes Collaboration
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About this workbook

Welcome to the face-to-face group of the K.A.R.E.N. Course.

This work book aims to offer background information to support the course programme, but it is not designed to provide stand-alone information.

Some of the topics in the workbook are addressed using a question and answer technique and these sections try to cover the most frequently asked questions. There are also practice questions in the workbook to assess if you understand the skills learnt during the online course modules you will be working through remotely. Whilst watching the online modules, you will be instructed to which activities you are required to complete for each specific module.

What do the symbols mean?



This symbol indicates something for you to think about or question.



This symbol highlights a module activity you are required to complete.

K.A.R.E.N. Course philosophy

Type 1 diabetes is a complex condition which affects virtually all aspects of an individual's daily life. It is important that the person with diabetes takes responsibility for managing their diabetes. This means balancing the effects of insulin, food, activity and stress on their blood-glucose levels. The person with diabetes is required to make treatment decisions and choices to balance and maintain good blood-glucose control and reduce the risk of developing any of the long-term complications associated with diabetes.

People with type 1 diabetes require knowledge, appropriate skills and support to achieve this balance.

Participating in and attending the K.A.R.E.N Course will help you to learn the skills to manipulate your insulin treatment so you can make informed choices about your food intake and match your insulin dose and lifestyle appropriately to maintain good blood-glucose levels.

Sherwood Forest Hospitals NHS Foundation Trust's shared 'CARE' values and behaviours are embedded in the K.A.R.E.N course philosophy, course content and delivery to fulfil the trust wide ambition to provide outstanding care to the people we serve and each other.

During the course the person with diabetes has the right to expect from the health care professionals delivering the course:

C Communicating and working together	- A forum to identify and review their needs, concerns and personal goals in relation to their diabetes. - The provision of current, consistent evidence based information relating to their diabetes management to address their needs, concerns and personal goals.
A Aspiring and improving	To receive constructive feedback to enhance and encourage learning.
R Respectful and caring	- An open, supportive, honest, non-judgemental relationship, Showing respect, care and compassion within a supportive and courteous environment. - To be treated as an individual which includes respect for their health beliefs.
E Efficient and safe	- Competent and professional course facilitators who demonstrate reliability, consistency, efficiency and respect. - Delivery of information in a structured manner, employing appropriate adult learning theories which is flexible to cater for individual learning needs.

Your course facilitators will achieve this by :

C Communicating and working together	Engaging with the person with diabetes and work towards gaining their trust.
A Aspiring and improving	Help the person to explore and understand the choices they make, and recommend possible alternatives where appropriate.
R Respectful and caring	Exploring their health beliefs and factors which drive current self-care behaviour in the management of their diabetes.
E Efficient and safe	Provide an appropriate forum conducive to delivering new information, knowledge and skills to help the person with diabetes adopt appropriate self-care behaviour to support appropriate decision making.

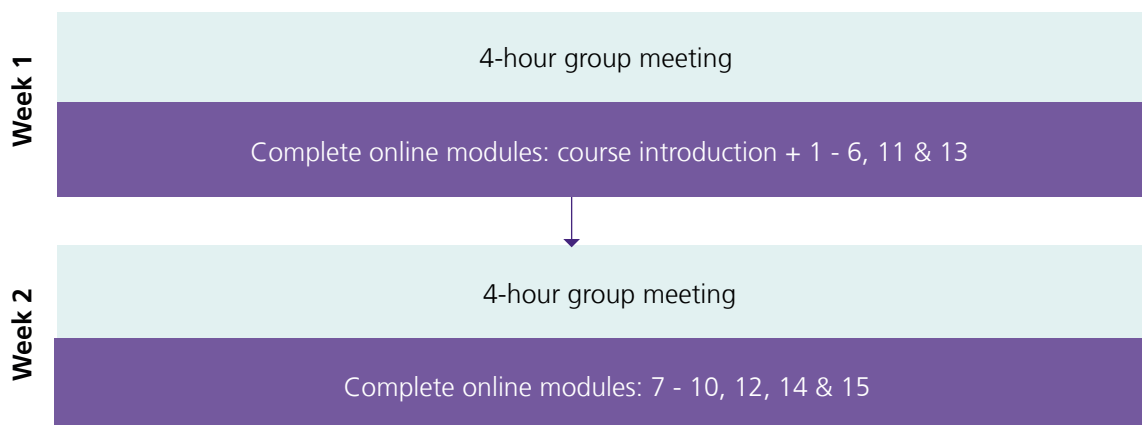
The aim of the K.A.R.E.N. course

Is to facilitate you to take ownership of your diabetes, self-care management with support from your clinical team. To increased time in range, reduce HbA1c (estimated or actual) and improve overall quality of life while living with diabetes.

K.A.R.E.N. Course programme

The K.A.R.E.N course runs over four weeks with all course content delivered face to face. You will join four-weekly virtual group meetings with your course facilitators and other course delegates to discuss the course content covered by working through the online course modules and completing the module tasks and assessments set for that week. These weekly meetings will also involve a review of your blood-glucose levels and your tailored treatment to make adjustments where necessary. We will also review your carbohydrate counting skills and support you to ensure you are confidently carbohydrate counting and adjusting your insulin doses accordingly throughout the course duration and beyond.

Course programme structure



Attendees to the K.A.R.E.N. course are therefore also expected to adhere to the following standards throughout the course duration and beyond:

- Remain respectful of other course attendees and course facilitators at all times.
- Self-monitor your blood-glucose levels and keep a record of the data to report back to the facilitators each week.
- Complete a food diary showing your carbohydrate counting during each week and bring to each session for review by the course dietitian.
- To be proactive in your diabetes management and to contact your clinical team to discuss any arising issues related to their diabetes.

K.A.R.E.N. Course weekly timetables

Week 1

A four-hour group meeting with the Diabetes Specialist Nurse, Diabetes Specialist Dietitian and other course attendees.

We will:

- Discuss the course programme.
- Introduce the online modules and how to locate them.
- Give passwords to log in.
- Provide you with your diabetes treatment (Insulin: carbohydrate ratios and Correction factors) and explain how these are used.
- Answer any concerns or queries.

You will:

- Complete the initial course questionnaire and Treatment satisfaction questionnaire.

HOMEWORK to complete before group meeting 2

You will:

- Work through Modules 1-6, 11 & 13 and complete activities in your workbook.
- Check on sensor app or reader, before each meal and before bed time.
- Log your carbohydrate values for all your food over the next week on your sensor notes or in a food diary provided
- Ensure your Continuous Glucose Monitor (CGM) is linked or uploaded to the relevant platform or your bring the reader / receiver with you.

Please contact us via email if you have any questions or concerns between our group meetings.

Week 2

A four-hour group meeting with DSN and Dietitian and other course attendees.

We will:

- Review your Blood-glucose and carbohydrate counting data and use this to make any adjustments to your treatment as necessary.
- Check on sensor app or reader, before each meal and before bed time.
- Log your carbohydrate values for all your food over the next week on your sensor notes or in a food diary provided.
- Introduce you to the online modules 7-10 and modules 12, 14 & 15 to complete over the next week and the module activities in your workbook.
- Answer any Q&As.

You will:

- Complete course evaluations.

Course Completed

Online K.A.R.E.N. Course modules

Week 1

Course Introduction.

- Module 1: What is Diabetes?
- Module 2: Food and carbohydrate counting
- Module 3: Methods of carbohydrate counting
- Module 4: Snacking and Insulin stacking
- Module 5: Hypoglycaemia
- Module 6: Diabetes and Driving Regulations
- Module 11: Sport Exercise and Diabetes
- Module 13: Diabetes and pregnancy

Week 2

- Module 7: Carbohydrate counting difficult foods
- Module 8: Glycaemic index
- Module 9: Alcohol consumption and Type 1 Diabetes
- Module 10: Management of Diabetes during illness and 'Sick Day Rules'
- Module 12: Healthy eating
- Module 14: Long-term effects of Diabetes
- Module 15: Diabetes technology

Introduction

Type 1 diabetes is a complex condition to manage, and may pose challenges for you on a day to day basis. The more information, knowledge and skills you can acquire about your diabetes, may help to make it easier to manage and also make it easier to interpret your blood-glucose readings and adjust your insulin doses accordingly.

The K.A.R.E.N course will discuss how insulin requirements are constantly changing, and how food, exercise, illness and stress all affect blood-glucose levels.

Our aims are to:

- Listen to your views
- Enable you to more closely match your insulin to your food and lifestyle
- Enable you to manage your diabetes with fewer restrictions
- Share experiences with others

Thinking about the following questions may help you get the most from your course.



What are your reasons for attending the course?

How will using the information you will learn help you?

What currently frustrates you the most about your diabetes?

What personal goals would you like to set (and achieve) in relation to your diabetes?

My short-term goals are:

My long-term goals are:

Small changes I will make to my daily routine to help me to achieve my goals and support I need for myself / from others to achieve this:

K.A.R.E.N. Programme Week 1

Group meeting

Homework: complete online modules 1-6, 11 and 13

Aims of this session:

- To get to know group participants, facilitators and course programme.
- To gain an understanding of insulin use in relation to Type 1 diabetes.
- To gain an understanding of carbohydrate counting and insulin dose adjustment.
- Update on the practical aspects of insulin therapy and blood glucose monitoring.
- To be able to define hypoglycaemia, understand the symptoms, causes and treatment of hypoglycaemia.
- To gain an understanding of the management of diabetes when undertaking physical activity.
- To provide information in relation to pre pregnancy planning.

HOMEWORK to complete before group meeting 2

- Work through Modules 1-6, 11 and 13 and complete activities in your workbook.
- Check on sensor app or reader, before each meal and before bed time.
- Log your carbohydrate values for all your food over the next week on your sensor notes or in a food diary provided
- Ensure your Continuous Glucose Monitor (CGM) is linked or uploaded to the relevant platform or your bring the reader / receiver with you.

Please contact us via email if you have any questions or concerns between our group meetings.

Module 1: What is Diabetes?

Module aims and objectives:

Aim: Have an understanding of the different types of diabetes and the basic science behind Type 1 diabetes

Objectives: By the end of module 1 you will be able to:

- Identify normal ranges of blood-glucose values and HbA1c.
- Explain how insulin works in relation to blood-glucose levels and food intake.
- Understand how and why insulin requirements can vary.
- Understand your own insulin to carbohydrate ratio and correction dosage.
- Understand how carbohydrate content in foods and drinks impact blood-glucose levels.
- Identify foods which contain carbohydrate, and foods which do not.
- Become familiar with and use practical methods to estimate carbohydrate content of your dietary intake.

What is Diabetes?

Type 1 diabetes is a metabolic condition that results in increased blood-glucose (commonly called sugar) levels due to a total lack of the hormone insulin. Although type 1 diabetes can occur at all ages, it mostly occurs in children and young adults, with a peak around pre-school and puberty.

Type 1 diabetes results from autoimmune destruction of the islet cells in the pancreas that produce insulin.

This may be due to:

- Environmental factors.
- Viruses.
- Genetic tendency.

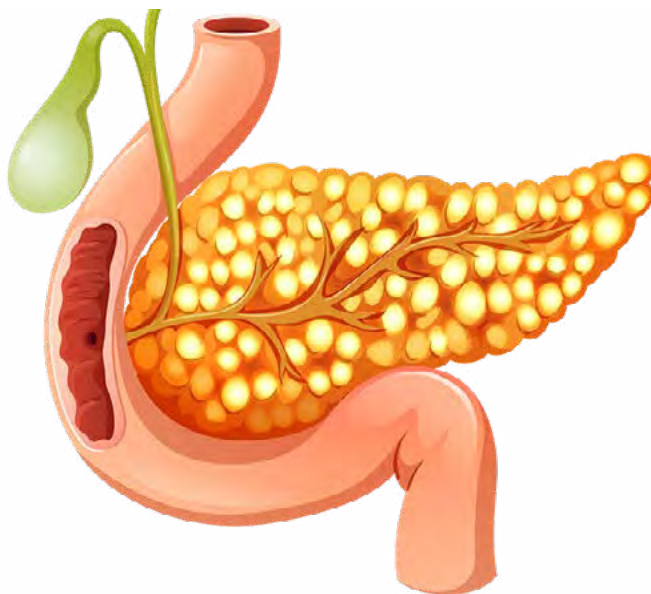
Type 1 diabetes is treated by a combination of insulin injections and diet.

Why is insulin necessary?

- The body needs a constant supply of glucose that it uses as a fuel for energy.
- This supply of glucose comes from the food we eat and from stores in the liver.
- It is mainly the carbohydrate in our food that is broken down into glucose and absorbed into the blood stream.
- The glucose cannot enter the cells of the body and be used for energy without insulin.
- Insulin acts like a key. It unlocks the door of the cell and allows the glucose to enter, the body then uses the glucose as fuel.
- Surplus glucose is stored in the liver and muscles as glycogen. Once the liver and muscles are full, the rest is stored as fat.
- In people without diabetes, the amount of insulin is increased or decreased automatically to keep the blood-glucose levels within specific parameters.

What happens in type 1 diabetes?

- People with Type 1 diabetes produce no / very little insulin.
- This leads to glucose being unable to enter the body's cells and therefore the glucose levels rise in the blood.
- The body tries to get rid of this extra glucose by passing more urine, which in turn leads to thirst and dehydration.
- As the cells are starved of glucose, this leads to tiredness, lethargy and a lack of energy.
- The body turns to other sources to provide the body with energy and begins to use body fat for energy, leading weight loss.
- As soon as you start to inject insulin, the cell doors can open and glucose is now available for energy.



What are the usual blood-glucose levels in people without diabetes?



What is the risk of developing Type 1 diabetes?

It is estimated that:

10 % of people with diabetes have Type 1 diabetes.

90% of people with diabetes have Type 2 diabetes.

More than **85%** of Type 1 diabetes occurs in individuals with no previous first degree family history.

The risk among first degree relatives is about **15 times higher** than in the general population.

On average:

- If a **mother** has the condition, the risk of developing it is about **2-4%**
- If a **father** has the condition, the risk of developing it is about **6-9%**
- If **both parents** have the condition, the risk of developing it is up to 30%
- If a **sibling** develops the condition, the risk of developing it is **10%** (rising to **10-19%** for a **non-identical twin** and **30-70 %** for an **identical twin**)

Insulin action

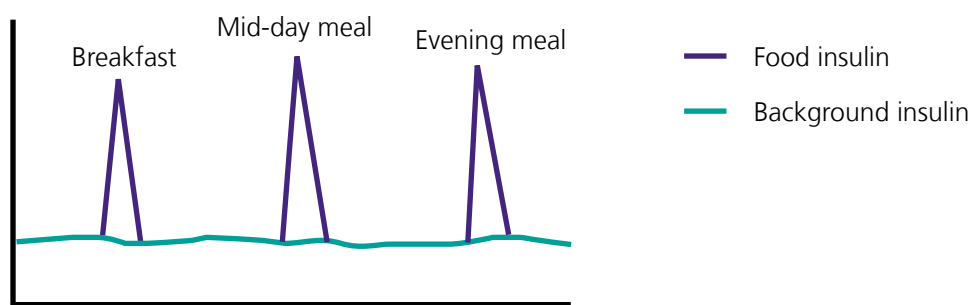
The diagram below represents what happens to insulin levels in someone without diabetes.

Insulin is necessary to maintain ambient blood-glucose levels whether people are eating or not. The pancreas produces a small amount of insulin (background) continually to maintain blood-glucose levels within a specific range. The pancreas automatically increases or decreases insulin production according to the blood-glucose level.

When food containing carbohydrate is eaten, the pancreas produces exactly the right amount of insulin to keep blood-glucose levels within the normal range. The insulin that is secreted after breakfast, lunch, evening meal and snacks is shown by the three peaks in the diagram below.

The pancreas also produces a hormone called Glucagon which is produced when the blood-glucose level is low. Glucagon forces the liver to release stored glucose which causes the glucose level to rise.

Insulin and glucagon work together to balance the blood-glucose levels and maintain at an ambient level of between 4 and 7.8 mmols.



The aim of your insulin treatment and diabetes management is to try and reproduce what happens in people without diabetes. This can be achieved by giving background insulin and a rapid-acting insulin with meals. However your 'ambient' or 'target' range may be different.

The ideal blood-glucose targets for people with Type 1 diabetes is:

- Before breakfast (often referred to as fasting) between 5 and 7 mmols
- Before meals between 4 and 7mmols
- 90 minutes after meals between 5 and 9 mmols

What is your personal Blood-glucose Target?

My Blood-glucose targets are:



Before Breakfast _____ mmol/l

Before Meals _____ mmol/l

After Meals _____ mmol/l

Before Bed time _____ mmol/l

You will have agreed your personal blood-glucose target during the group meeting in week one.

You will be supported throughout the course to try and achieve the targets you have chosen.

In order to try and achieve the blood-glucose targets you have discussed / chosen, this is achieved by giving a basal insulin, this may be referred to as your background insulin, and by giving bolus insulin (rapid / quick-acting insulin) with meals.

The basal or background insulin for people with Type 1 diabetes is provided by your long-acting insulin.

This may need to be injected once or twice a day. Your diabetes health care professional will advise you as to how often you will need to inject your long acting insulin.



What is the name of your background / long-acting insulin?

How would you check to see if your background / long-acting insulin dose is right for you?

The bolus / mealtime insulin for people with Type 1 diabetes is provided by a rapid-acting insulin often referred to as quick-acting or fast acting insulin.

What is the name of your rapid / quick-acting insulin?

What things may you need to consider before deciding on your rapid-acting insulin dose?

The amount of insulin you need with food is called the 'insulin to carbohydrate ratio' (ICR).

Your ICR will express how much g CHO will be covered by one unit of insulin. This ratio may vary from person to person and we calculate your individual ratio by applying the 500 rule.

Using the 500 rule

$$\frac{500}{\text{total daily dose of insulin}} = \text{insulin:carbohydrate ratio}$$



My insulin to carbohydrate ratio is:

1 unit of rapid acting insulin to cover _____ g carbohydrate

Example: ICR = 1 unit per 10g CHO

Your estimated CHO content of a meal is 60g therefore you would need to give yourself six units of bolus insulin.

What would you give if your ratio is 1 unit to 15g CHO?

$$\text{Dose of food bolus} = \frac{60\text{g of CHO}}{15} = \text{_____ units of insulin}$$



When do you give your bolus insulin?

Ideally the insulin dose should be given 15 – 20 minutes before eating a meal / snack.



How would you check to see if your food insulin is right for you?

Your ICR is correct if your blood-glucose levels two hours after you have eaten are within 3mmol of your pre-meal reading.

Correction Doses

What if my blood-glucose levels are outside my target range?

If your blood-glucose levels are higher than your target range before you eat, you may consider giving extra insulin in addition to what you have calculated for the meal you are going to eat. This is called a correction dose.

The correction dose tells you how many mmols your blood-glucose will reduce for every one unit of rapid-acting insulin you inject. This is individual to you and may change over time and need to be recalculated.

The most widely used term for this is 'correction dose' or 'insulin sensitivity factor'. It varies between people, but is usually calculated using the 100 rule:

$$\frac{100}{\text{total daily dose of insulin}} = \text{correction dose}$$



My insulin to carbohydrate ratio is:

1 unit of rapid acting insulin reduces my blood-glucose level by _____ mmol

Example: ICR = 1 unit per 10g CHO

You are about to eat. Your blood-glucose level is 12mmols.

Your target range is 5-8mmols.

How much insulin will you need for a correction to bring your blood-glucose level within target?

_____ units



Consider using the correction dose cautiously or a reduced amount.

- After exercise
- Within 24 hours of having a hypoglycaemia.

Other considerations when you use your correction

- Have I had any insulin within the last two hours?
- Am I planning any exercise?

You can also use a correction dose during times of illness or if your blood-glucose is high and you do not want to eat.

Look at the following examples of blood-glucose levels. Where would you use a correction dose and how much insulin would be needed?

1. Brian's correction dose: one unit reduces blood-glucose level by 2mmols. His target is 5-7mmols.

	Breakfast	Lunch	Dinner	Bed
BGL	6.4	7.2	11.1	

When does he need to correct? _____

How much does he need for a correction dose? _____



2. Kelly's correction dose: 1 unit reduces blood-glucose level by 3 mmols. Her target is 5-8mmols.

	Breakfast	Lunch	Dinner	Bed
BGL	14.1	8.3	9.9	8.0

When does he need to correct? _____

How much does he need for a correction dose? _____



3. Chris's correction dose: 1 unit reduces blood-glucose level by 2.5 mmols. His target is 5-7mmols.

	Breakfast	Lunch	Dinner	Bed
BGL	5.9	8.0	7.1	10.1

When does he need to correct? _____

How much does he need for a correction dose? _____



Blood-glucose monitoring

- In order to use insulin correctly, you need to know what your blood-glucose levels are, so blood-glucose monitoring is an essential part of managing your diabetes.
- By using your blood-glucose results you can learn how different things can affect your diabetes, such as the food you eat, the exercise you take, or the effects of illness and stress.
- Blood-glucose monitoring will give you information about your response to all these. It should help you see what is working and what is not. Each blood-glucose reading is a learning experience.
- If your blood-glucose is above your target, you can administer a correction dose to reduce the level. If your reading is low then you need to know how to quickly raise your blood-glucose, and when to seek help.
- There are some very clever meters on the market now that can have your insulin to carbohydrate ratio and insulin programmed to make the maths and calculations easier.
- Whilst attending the course we ask you to test a minimum of four times per day, before each meal and before bed. However, we do recommend testing two hours after you have eaten when possible. This will give us more information on the accuracy of your Insulin:CHO ratio and insulin sensitivity factor (correction dose).

Continuous glucose monitoring

In the last few years there has been an exciting new development in the world of checking glucose levels. A new device has been introduced that is available for people with type 1 diabetes, to check glucose levels without the need for a finger stick test. Continuous glucose monitoring involves a little sensor under the skin and a small plastic device attached to the skin over the sensor. The glucose value is taken by waving a meter (or an app enabled mobile phone) over the sensor. This picks up the glucose level of the fluid in between the cells. It is not quite as accurate as the blood-glucose test but it does have some advantages.

Storage of Insulin

You can keep the insulin you are using at room temperature for about one month before its activity is affected. All spare insulin not in current use should be kept in a fridge. It is a good idea to check the expiry date on your insulin before you use it.

Injection sites and technique

There are four main areas you can use to inject insulin: the upper outer arms, abdomen, buttocks and upper outer thighs. The absorption varies from one site to another and you will discuss this further in your group. If you use the same place to inject your insulin, you may find that you develop lumpy tissue and this will affect the rate at which your insulin is absorbed. It is a good idea to rotate your sites.



Do you fold up some skin to inject into?

What angle do you hold your injection pen/syringe?

Where do you usually inject your insulin?

Can you feel any lumps?



Module 1 Assessment

What Is Diabetes?



Insulin

Which of the following are helpful pieces of advice? (tick all correct options)

- ☐ A. Heat may increase insulin absorption
- ☐ B. Exercising the limb that you have injected, e.g. injecting in your leg and then going running, may decrease absorption
- ☐ C. Rapid acting insulin should be injected into the abdomen as this is the quickest absorption area
- ☐ D. All spare insulin should be kept in the fridge
- ☐ E. Rapid acting insulin should be injected into the legs, thighs or buttocks
- ☐ F. Always check the date of your insulin

Blood-glucose levels

What are the reasons for testing your blood-glucose levels? (tick all correct options)

- ☐ A. I have been told to
- ☐ B. So I know if I need a correction dose
- ☐ C. So I can see if my insulin to carb ratio is correct
- ☐ D. So I know if I am going hypo

Background insulin

What is the main purpose of your long acting insulin?

- ☐ A. Insulin to cover carbohydrates with meals
- ☐ B. Insulin to cover snacks
- ☐ C. Continuous insulin cover
- ☐ D. None of the above

When is the best time to give your long acting insulin?

- ☐ A. The time does not matter as long as it is given every day
- ☐ B. Within an hour of eating a meal
- ☐ C. Whenever you remember
- ☐ D. Same time once or twice each day

How can you check that your long acting insulin dose is correct?

The dose is suitable if your blood-glucose level...

- ☐ A. Remains stable even if you miss a meal
- ☐ B. Matches your target before bed
- ☐ C. Reduces a lot overnight but matches your target blood-glucose in the morning
- ☐ D. Is stable between bedtime and waking and matches your target blood-glucose

Quick-acting insulin

What is the main purpose of your quick-acting insulin?

Quick-acting insulin prevents blood-glucose rising too high after which nutrient is consumed?

- ☐ A. Protein
- ☐ B. Fat
- ☐ C. Carbohydrate
- ☐ D. All of the above

How long does it take for your quick-acting insulin to reach it's max strength (peak action)?

- ☐ A. 10 - 20 minutes
- ☐ B. 1 - 2 hours
- ☐ C. 4 - 5 hours

When you eat food that contains carbohydrate, what is the best time to inject your quick-acting insulin?

- ☐ A. 1 hour before eating
- ☐ B. Just before you start eating
- ☐ C. After you have finished eating
- ☐ D. 15 minutes before eating

How long does it take for your quick-acting insulin to finish working?

- ☐ A. 30 mins
- ☐ B. 1 - 2 hours
- ☐ C. 4 - 5 hours
- ☐ D. 8 - 12 hours

Insulin ratios

How do you know if your insulin to carbohydrate ratios are correct? (tick all correct options)

- ☐ A. Waking blood-glucose level matches your target
- ☐ B. Following breakfast your blood-glucose level matches your target before lunch
- ☐ C. Following lunch your blood-glucose level matches your target before your evening meal
- ☐ D. Following your evening meal your blood-glucose level matches your target before bed

Correction doses

Your blood-glucose level before lunch is 12.3 mmol/l. Your pre-meal blood-glucose target is 6 mmol/l. Your correction dose is one unit of quick-acting insulin to lower your blood-glucose by 3 mmol/l. You are not eating lunch today.

How much insulin would you need to give for a correction dose?

- ☐ A. 1 unit
- ☐ B. 2 units
- ☐ C. 3 units
- ☐ D. 4 units

Jane finds that her correction dose no longer works because her blood-glucose levels do not come back down to target when she's been high. Her current correction dose is one unit of quick-acting insulin to lower her blood-glucose level by 3 mmol/l.

What should she change her correction dose to?

- ☐ A. 1 unit lowers blood-glucose by 1 mmol/l
- ☐ B. 1 unit lowers blood-glucose by 2.5 mmol/l
- ☐ C. 1 unit lowers blood-glucose by 4 mmol/l
- ☐ D. 1 unit reduces blood-glucose by 5.5 mmol/l

Module 1 Complete

Module 2: Food and carbohydrate counting

Module aims and objectives:

Aim: To achieve competent carbohydrate awareness to support accurate carbohydrate counting.

Objectives: By the end of Module 2 you will:

- Understand how carbohydrate content in foods and drinks impact blood-glucose levels.
- Be familiar with the different types of carbohydrate found in foods.
- Be able to identify foods which contain carbohydrate, and foods which do not.
- Be able to confidently identify foods that you need to carbohydrate count and foods which you do not.
- Understand how other nutrients in foods impact glucose absorption into the blood after eating.

Introduction to carbohydrate counting

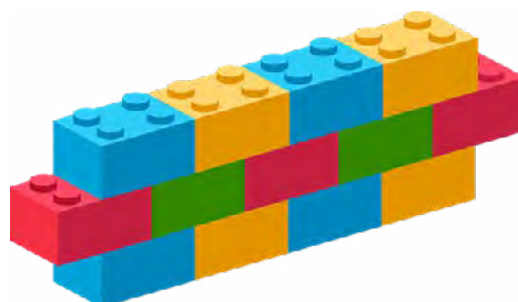
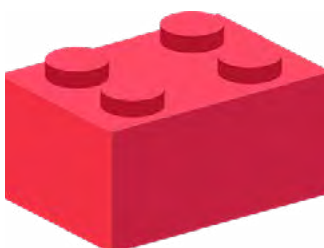
The main type of nutrient in food that affects your blood-glucose level is called carbohydrate (often written as CHO). Before you start Carbohydrate Counting you'll need to have a good knowledge of carbohydrate, its function in the body and the types of food and drinks it is found in.

What is carbohydrate?

Carbohydrates, fats and proteins are nutrients in foods and drinks that provide us with fuel for energy production. Most foods contain a mixture of fat, protein and carbohydrate, but foods containing mainly protein and fat have a minimal effect on blood-glucose levels compared to carbohydrate-containing foods. Carbohydrate foods are made of units of glucose (sugar) and it is these foods which will affect our blood-glucose levels. There are simple carbohydrates (made of a smaller number of glucose units) and complex carbohydrates (made of longer chains of glucose units).

A Glucose unit is like a building block - the simplest form of carbohydrate. Glucose enters the blood stream quickly causing a quick rise in blood-glucose levels.

Carbohydrates are made of chains of glucose units packed tightly together. A bit like bricks cemented together to make a wall. They are broken down into single units of glucose then enter the blood stream so cause blood-glucose levels to rise slower than simple sugars.

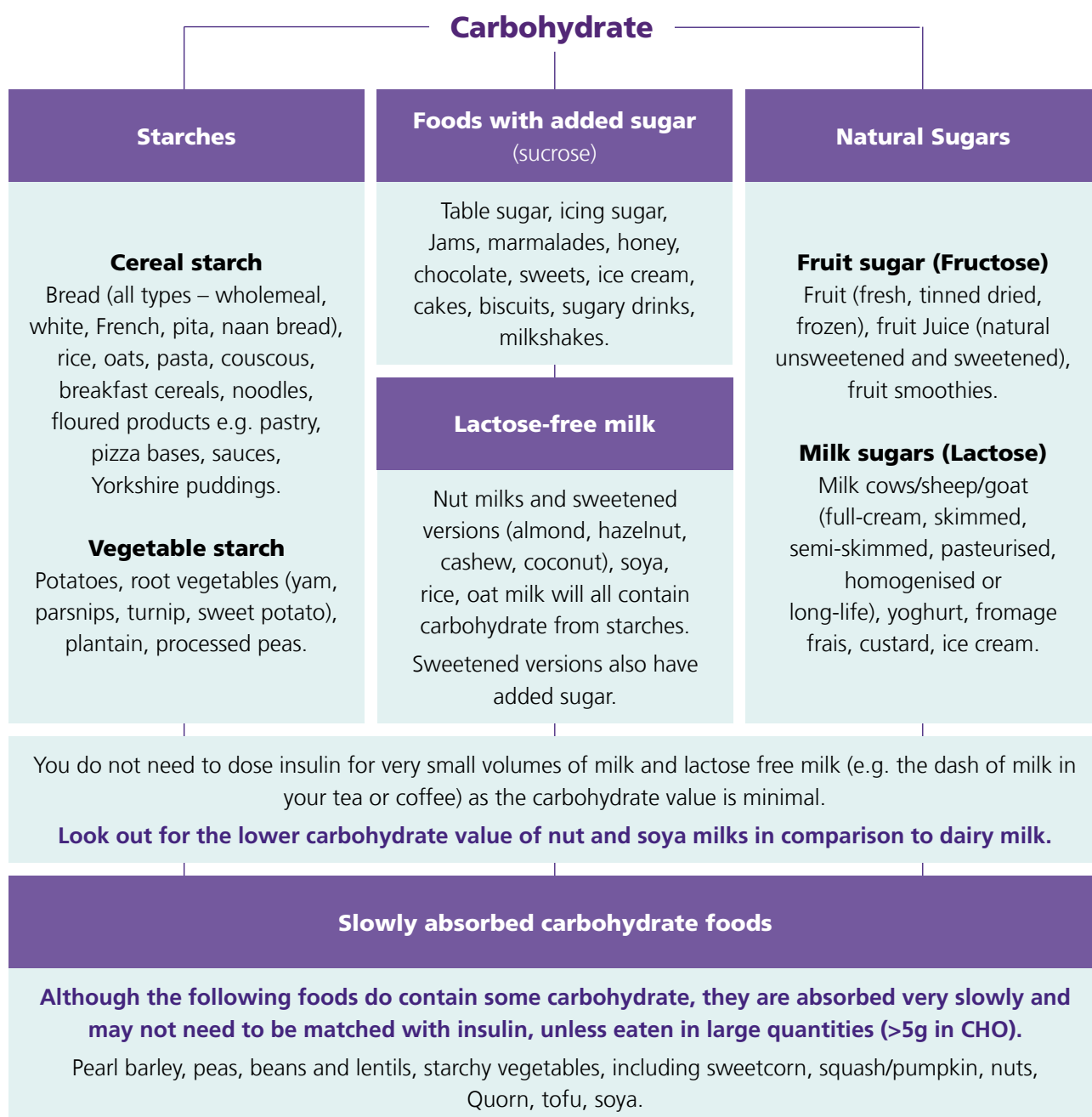


Carbohydrates are found mainly in starchy and sugary foods. All carbohydrates are digested into glucose and appear in your bloodstream between 10 minutes and 2 hours or more of eating.

Carbohydrate counting is a system of assessing the amount of carbohydrate in each meal or snack and injecting insulin to match the amount you have eaten.

Which foods contain carbohydrate?

Not all carbohydrate foods are equal in terms of the absorption rate and the effect it has on blood-glucose. Many foods are mixture of protein, fats and carbohydrates. The main carbohydrate containing foods are grouped below into sub categories.



Why is carbohydrate important in the diet?

Carbohydrate is the body's most readily available energy source and is essential for the body (especially the brain) to function normally. Some carbohydrate rich foods are also good sources of fibre, vitamins and minerals vital for good health. These foods also help to aid digestion, suppress appetite and support good gut health.

Foods with little or no carbohydrate

Protein Plain meat, fish, eggs, cheese, nuts, seeds, Quorn, tofu and soya.	Protein alone has little effect on blood-glucose but some protein foods have carbohydrate added during processing: Cereal flour (sauces, sausages), breadcrumbs/batter (fish fingers, chicken nuggets), pastry (meat pie, pasties, quiche, sausage roll)
Fat Butter, spreads, oils, mayonnaise, cream.	Fat has little effect on glucose levels after eating, but large amounts can slow the digestion of a meal and make your blood-glucose levels raise more gradually and over a longer period of time. Examples of high fat meals which may have this effect include fish and chips, hamburger and fries, and Chinese, Indian or Italian meals.
High fibre Salad and most vegetables.	These foods have a high fibre and water content and minimal amount of starch therefore have little effect on blood-glucose. Fibrous foods can slow the absorption of glucose from other foods that are eaten at the same time preventing post meal spikes in blood-glucose.
Sugar-free alternatives Sugar free drinks, no added sugar squash, artificial sweeteners.	Artificial sweeteners – saccharin, acesulfame K, aspartame, sucralose, Cyclamate are carbohydrate-free. Sugar alcohols (polyols): erythritol, isomalt, maltitol, mannitol, sorbitol, xylitol) contain some carbohydrate but in much smaller quantities and not all of it is absorbed therefore are not counted when counting carbs.
Dairy alternatives Unsweetened, soya milk, almond milk.	At 0.3g/100ml and 0.2g/100ml, unsweetened versions have minimal carbohydrate therefore even large volumes don't count.

Why do people use carbohydrate counting?

Different foods contain different amounts of carbohydrate. Carbohydrate counting can give you more choice and flexibility in both the type of food that you eat and in meal timing. It can also help you maintain your blood-glucose levels closer to normal levels.

Steps to carbohydrate counting

There are four steps to carbohydrate counting and dosing the correct amount of insulin for your foods and drinks:

1. Identify the carbohydrate containing foods and drinks you are about to consume (see page 20).
2. Calculate amount of carbohydrate in each food/drink you are about to consume (see below).
3. Work out amount of insulin required to cover carbohydrate portion (know your insulin:carb ratio).
4. Consider a correction dose or a reduction in insulin due to planned activity.
5. Decide when to inject insulin (before, during, after meal) - based on eating scenario and meal type.

Test your carbohydrate awareness knowledge

Looking at the food images on the online module, list the foods in the correct column below:



Carbohydrate foods to count	Non-carbohydrate foods – not to count

Module 2 Assessment

Food and carbohydrate counting



Carbohydrate awareness activity

Identify the carbohydrate containing foods within these meals. Write your answers in the box to the right of the image below:



Fish and chips



Shepherd's pie



Full English breakfast



Jacket potato with tuna and salad



Chicken curry with naan bread



Berry smoothie

Module 2 Complete!

Module 3: Methods of carbohydrate counting

Module aims and objectives:

Aim: To be confident carbohydrate counting and adjusting insulin doses accordingly

Objectives: By the end of Module 3 you will:

- Become familiar with and use a variety of practical methods to count the carbohydrate content of your dietary intake.
- Increase your confidence in identifying the foods you need to count in your meals and totalling up the overall carbohydrate count for meals.

Methods of carbohydrate counting

Nutritional labels

Many food manufacturers now supply information on the label about the carbohydrate content of that food. For carbohydrate counting you use total carbohydrate which includes all added, natural sugars and starch as all of these will break down into glucose.

Nutrition	Per 100g	Per 1/2 pizza	% adult RI
Typical Values (oven cooked as per instructions)			Per 1/2 pizza
Energy kJ	1016	1990	-
Energy kcal	241	473	24%
Fat	7.4g	14.5g	21%
of which			
- saturates	3.1g	6.1g	31%
- mono-unsaturates	2.9g	5.6g	-
- polyunsaturates	1.1g	2.2g	-
Carbohydrate	31.7g	62.1g	24%
of which			
- sugars	3.5g	6.9g	8%
- starch	28.2g	55.3g	-
Fibre	2.2g	4.3g	-
Protein	10.9g	21.4g	43%
Salt	0.86g	1.68g	28%

The information can be shown as either per 100g or per portion. If you use the value per 100g, then you will need to know the weight of the portion you are eating and you can then calculate the amount of carbohydrate in your portion.

You may find the information per portion more useful, but remember that your portion size may not match that recommended by the manufacturer.

$$\frac{\text{Amount of CHO per 100g}}{100} \times \text{Weight of food in grams} = \text{amount of CHO}$$

From the online module use the food labels displayed to work out the carb values for the following foods:



Two slices of white bread

Carb value: _____g



Four crackers

Carb value: _____g



Three fish fingers

Carb value: _____g

Carbohydrate reference tables

These tables contain information about typical portion sizes of the most commonly eaten carbohydrate foods in handy measures and weight per portion. They also list the amount of carbohydrate per 100g of the product - useful if you don't have the food label at hand.

Example from Carbohydrate reference tables:

Food Type - Apple	Typical Portion	Weight of Portion (g)	CHO (g)	CHO/100g
Fresh	1 fist size	170g	12g	10g
Stewed - no sugar	6 tbsp	85g	8.5g	10g
Juice	Small carton	200ml	21.2g	10.6g

Practice using your reference tables by looking up the CHO content of this breakfast meal:



Cornflakes (36/40g)

CHO _____g

Milk (150ml)

CHO _____g

Pure orange juice (150 ml)

CHO _____g

Total CHO _____g

Estimating carbohydrate from portion pictures

Your picture book provides you with images of different portion sizes of a number of difficult to measure foods. You can use these images to compare to your portion and estimate the carbohydrate in your portion size based on the carbohydrate values provided next to each portion.

You can also use other picture reference books and phone apps. Carbs and Cals is a very useful resource.

Homework: Using the carbs and cals book, or app, identify the carbohydrate foods and estimate the total amount of carbohydrate in the following meals:



Cooked breakfast	CHO _____ g
Cooked dinner (meat, potatoes, vegetables, Yorkshire pudding)	CHO _____ g
Lasagne, salad and jacket potato	CHO _____ g
Spaghetti bolognese	CHO _____ g
Shepherd's pie	CHO _____ g
Fruit crumble and custard	CHO _____ g
Omelette	CHO _____ g
2 slices of toast and jam	CHO _____ g
Sandwich, crisps and apple	CHO _____ g

Weighing food

You can weigh your food using kitchen scales and work out the amount of carbohydrate in your portion by using food charts or food tables. This system is useful for foods like breakfast cereals, potatoes, pasta and rice as portion sizes can vary quite a lot between different people. If possible, weigh food using metric scales as most food tables give information per 100g. Once you have weighed your portion of food, you can work out the amount of carbohydrate by doing the following:

- Weigh food in grams and note weight
- Look up the amount of carbohydrate per 100g in the nutrition table for the food you are eating and make a note (you can use reference books if there is no nutrition label available)
- Divide the amount of carbohydrate per 100g by 100 (this gives you the amount of carbohydrate in 1g of the product)
- Multiply the result by the weight of your portion

Or you can use the following formula:

$$\frac{\text{Amount of CHO per 100g}}{100} \times \text{Weight of food in grams} = \text{amount of CHO}$$



Use the formula to work out the following g CHO in food:

A portion of cooked white rice weighs 175g

Use your food reference tables to find how much carbohydrate per 100g _____

How much carbohydrate in this portion? _____

A portion of Frosted Flakes cereal weighs 80g

Use your food reference tables to find how much carbohydrate per 100g _____

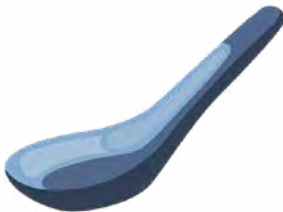
How much carbohydrate in this portion? _____

Handy measures

Some foods such as rice, pasta, potatoes are difficult to estimate as portion sizes can vary. We tend to have similar portion sizes for certain foods. For example you may have a particular cereal bowl you use and fills it to the same level each time.

It is useful to weigh your portion sizes first to get an accurate assessment of the carbohydrate content. After that you will know how much CHO is in the cereal if you use the same cereal bowl.

You can also use other handy measures such as spoonfuls, full cups or full bowls to estimate the content of future meals. We will practice these methods in week 2.



10g carbohydrate portions (cps)

CPs are an alternative method of carbohydrate counting where 1CP is equal to 10g of carbohydrate.



2 mini new potatoes or 1 egg sized potato = 10g (1 CP)



200ml dairy milk = 10g (1 CP)



1 thin slice of bread = 10g (1 CP)

Personal List of Carbohydrate counts

It is a good idea to make your own food lists with the measure that you use to dish it onto your plate and the grams of carbohydrate this measurement contains.



2 mini new potatoes or 1 egg sized potato
1 egg sized potato = 10g



1 thin slice of bread = 10g
1 medium slice of bread = 15g
1 thick slice of bread = 20g



Ciabatta/panini (100g) = 50g
CHO (1/2) weight



Fist size jacket potato (with skin) = 50g



1 apple = 15g CHO



Small banana = 15-20g
Medium banana = 25-30g
Large banana = 35-40g



150g cooked pasta = 50g
CHO (1/3) weight



1 pint milk = 30g CHO

Module 3 Complete

Module 4: Snacks and Insulin stacking

Module aims and objectives:

Aim: To understand carbohydrate counting for snacks and tactics to use when snacking

Objectives: By the end of Module 4 you will:

- Be able to count the carbohydrate content of snacks
- Know how to manage your Insulin for snacks
- Be able to Identify lower carbohydrate or carbohydrate free snack options

You may have found in the past you have had to snack to avoid episodes of hypoglycaemia. If your basal insulin dose is correct and you are applying the principles of carbohydrate counting, you may find the need to snack is based on choice of whether you want a snack, rather than needing to have a snack to avoid hypoglycaemia. If a snack contains 15 grams of carbohydrate or less, generally we know that for most people you will not be required to inject any insulin. However you are unable to have multiple 15 gram snacks between meals without needing some insulin.

If you enjoy snacking on foods containing more than 15 grams of carbohydrate, you will be required to have insulin for the snack. Try to avoid grazing, as this will make it harder to control your blood-glucose levels. Grazing will also run the risk of 'insulin stacking' if insulin is given for each snack eaten within 2 hours of each other. This can lead to hypoglycaemia.

Timing of your snack needs to be considered

1. If your snack is one hour prior to your mealtime you could wait and add extra insulin to your next mealtime insulin.
2. If the snack is two or more hours before your next mealtime, you should ideally take the insulin with the snack.

Missing meals

It may be possible to choose to miss a meal when you are applying the principles of carbohydrate counting. People however are usually advised to eat regular meals regardless if they have diabetes or not. This remains good healthy eating advice.

Insulin stacking



Scenario 1: Coffee shop

You meet your friend at a coffee shop and dose for a Large Latte at 20g of carbohydrate. You dose for this in the queue to allow the insulin 15 minutes to start working before consuming the latte. When you sit down your friend has bought you a slice of cake you look at the nutritional info on the website and see it is 45g. You have already dosed for the latte but want the cake too.

What do you do?

Scenario 2: 'Office morning munchies'

You have had breakfast an hour ago but find yourself taking a couple of biscuits from the office snack corner (every office has one right!?) and at 8g each the two will warrant an insulin injection which you give. An hour later you find yourself reaching for another three biscuits but only had your previous bolus 1 hour ago.

What do you do?

Scenario 3: All you can eat buffet restaurant

You are eating out for a friend's birthday and faced with the dilemma of when to dose your insulin for the consecutive courses you choose to have. You opt for a starter plate, a main and a dessert which will all be eaten within 2 hours.

What do you do?

Module 4 Complete

Module 5: Hypoglycaemia

Module aims and objectives:

Aim: To understand hypoglycaemia and how to manage it.

Objectives: By the end of Module 5 you will:

- Be able to understand and define hypoglycaemia.
- List the causes of hypoglycaemia.
- Be able to describe the warning signs of hypoglycaemia.
- Understand how to treat hypoglycaemia.
- Understand when you would need help from others.

Hypoglycaemia is defined as low blood-glucose and is commonly called or referred to as a 'hypo'.

Generally a blood-glucose level of 4mmols/l is defined as the onset of hypoglycaemia. The motto often used is "Make 4 the Floor".

Maintaining your blood-glucose no lower than 4mmols/l allows time for you to recognise any symptoms and take the necessary action.

Causes

The most common causes of hypos are:

- Too much insulin
- More physical activity than planned
- Not enough food
- Drinking Alcohol
- Extreme Temperatures (Hot/Cold)
- Lipohypertrophy (injecting in lumpy injection sites).

Symptoms

When the blood-glucose begins to fall symptoms occur which may be referred to as warning signs. These can vary from individual to individual.

The symptoms of hypos can be divided into mild, moderate and severe.

Mild symptoms

These can usually be treated independently by you. The symptoms may be feeling dizzy, shaking and sweating. This is caused by adrenaline release in response to low blood-glucose levels.

In conjunction with other hormones, adrenalin raises the blood-glucose by releasing stored glucose from the liver.

Moderate and severe symptoms

Moderate hypos often require the help of others and severe symptoms may mean a hospital admission.

These symptoms are caused by a lack of glucose supply to the brain and are responsible for changes in behaviour, namely disorientation, confusion, agitation, aggression and eventually unconsciousness if not treated.

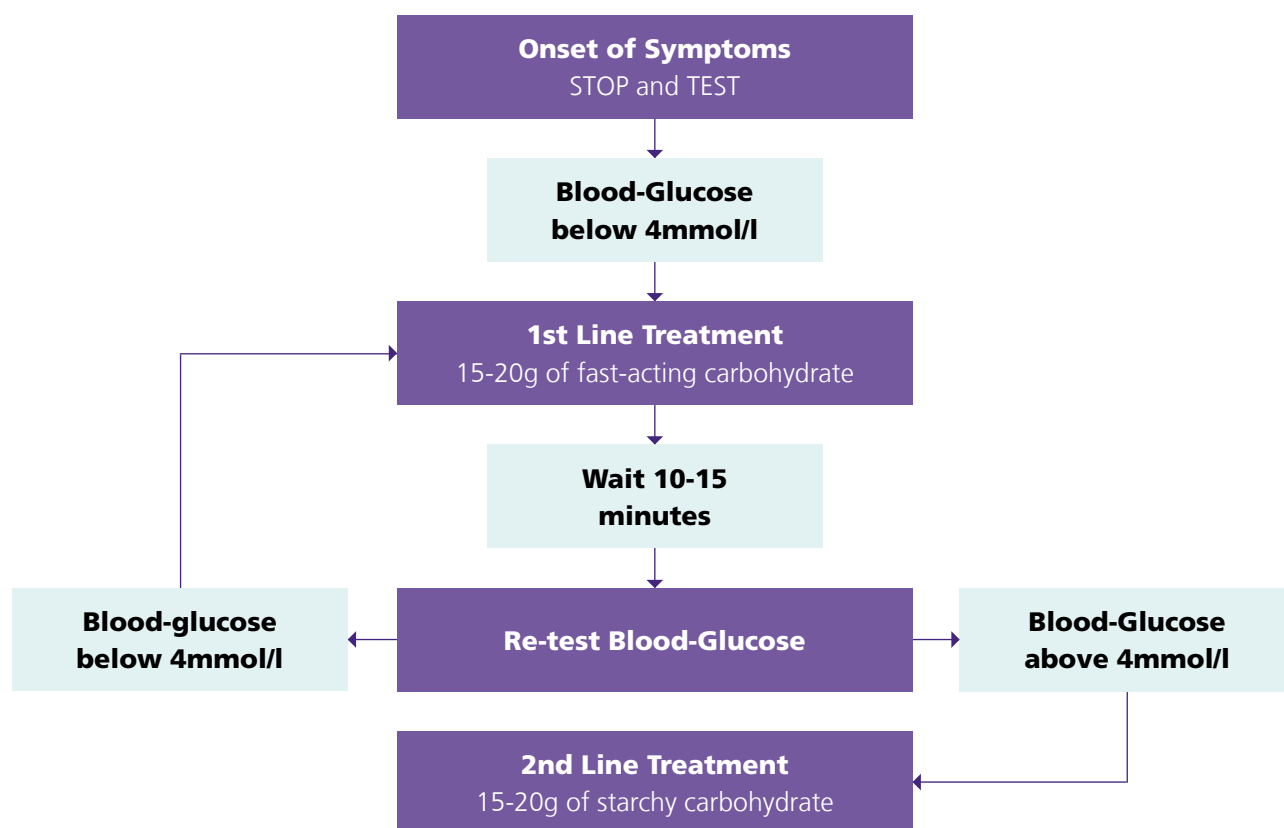
What blood-glucose level would you consider/count as a hypo?

Do you have warning symptoms at this point?

What are your hypo warning signs?



Treatment of Hypoglycaemia



1st Line Hypo Treatment - Fast-acting carbohydrate

In order to increase the low blood-glucose levels as quickly as possible, the ideal option is a glucose-rich foods or drink which contains 15-20 grams of fast-acting carbohydrate.

2nd Line Hypo Treatment - Slow-acting carbohydrate

Once your blood-glucose level is above 4mmols, you should then consume 20 grams of slow-acting carbohydrate. This will prevent your glucose level from dropping again as the fast acting carbohydrate effect wears off.

Which options would be suitable for:

- First Line Treatment
- Second Line Treatment
- Neither



Record your answers in the table below.



First Line Treatment	Second Line Treatment	Not Suitable

1st Line treatment - fast-acting carbohydrate

In order to increase the low blood-glucose levels as quickly as possible, the ideal option is a glucose-rich food or drink which contains 15-20 grams of fast acting carbohydrate.

The table below shows various options you can choose:

Food	15-20g fast-acting CHO is found in:
Dextrose tabs (3g carbs each)	5 - 7
Gluco tabs (4g carbs each)	4 - 5
Lucozade Energy Original	165 - 220ml
Cola-type fizzy drink	140 - 185ml
Jelly babies (large)	3 - 4 sweets
Jelly beans	8 - 11 sweets
Fruit pastilles	5 - 6 sweets
Small carton of fruit juice	150 – 200ml
Glucogel (10g carbs per tube)	2 x tubes

2nd Line treatment - slow-acting carbohydrate

Once your blood-glucose level is above 4mmols, you should then consume 20g of slow release carbohydrate. This will prevent your glucose level from dropping again as the fast acting carbohydrate effect wears off.

The table below shows some examples:

Food	20g slow-acting CHO is found in:
Thick slice of bread	1 slice
Medium banana	Medium
Digestive biscuit	2 biscuits
Rich tea biscuit	3 biscuits
Glass of milk + biscuit	200ml glass milk + 1 biscuit

Help from others

The treatments on the previous page should only be given if you are able to swallow. If you are unable to swallow, no food or drink should be put in your mouth.

Glucose gel is a fast acting gel that can be used in these circumstances.

The gel is placed between the gum and cheek and is quickly absorbed through the mucous membrane. The outside of the cheek can be gently rubbed to help absorption. Glucose gel is available in a triple pack of 3 tubes and each tube contains 10grams of carbohydrate.

Glucogel should never be given or used if you are unconscious as it may cause choking.

If you have a severe hypo and become unconscious, we may consider Glucagon for this group of patients. We will need to educate and teach a family member, partner or friend how to give you a glucagon injection.

Glucagon is a natural hormone made in the pancreas. It raises blood-glucose levels by releasing stores of glucose from the liver (glycogen). Glucagon is naturally released by the liver when the blood-glucose level falls below 4mmols. Administering an injection of glucagon, called Glucagen accelerates this natural process and causes the liver to release glycogen at a faster rate.

Module 5 Assessment

Hypoglycaemia



Which symptoms may occur when hypoglycaemic (hypo)? (tick as many as apply)

- ☐ A. Sweating
- ☐ B. Shakiness
- ☐ C. Thirst
- ☐ D. Lack of concentration
- ☐ E. Passing more urine

A hypo is when your blood-glucose level is what?

- ☐ A. Lower than 2 mmol/l with or without symptoms
- ☐ B. Lower than 3.5 mmol/l with or without symptoms
- ☐ C. Lower than 4 mmol/l with or without symptoms
- ☐ D. Above 5 mmol/l with symptoms?

Which of these foods would be suitable as a rapid acting carbohydrate for initial treatment of a hypo? (tick as many as apply):

- | | |
|---------------------------------------|--|
| ☐ A. Banana | ☐ E. Jelly babies |
| ☐ B. Chocolate | ☐ F. Lucozade |
| ☐ C. Digestive | ☐ G. Milk |
| ☐ D. Glucogel | ☐ H. Orange Juice |

Module 5 Complete

Module 6: Diabetes and driving regulations

Module aims and objectives:

Aim: Understand the regulations in relation to diabetes and driving.

Objectives: By the end of Module 6 you will:

- Be familiar with the legal requirements to inform the DVLA about your type 1 diabetes and any relevant changes to your treatment and management.
- Be familiar with the DVLA guidance on applying for a driving licence.
- Be familiar with the safe driving tips and advice.
- Know how to safely treat a hypo when driving.
- Understand how to use CGM or blood sugar tests for driving

Safe driving and the DVLA

Having diabetes does not mean that you have to give up driving, but it does mean that you need to plan in advance before you get behind the wheel.

Hypoglycaemic episodes 'hypos', when your blood-glucose levels are too low can affect your concentration and may cause confusion and can therefore affect your ability to drive and increase the risk of accidents.

Complications associated with diabetes can also affect your ability to drive, as well as your risk and awareness of hypos.

The following information is based on the guidance issued by the DVLA in relation to people with Type 1 diabetes:

- Type 1 diabetes is treated with insulin injections therefore if you drive you are required to inform the DVLA and it is your responsibility to do so – your car insurance will be invalid if you fail to do so.
- You can also be fined up to £1000 if you do not tell the DVLA about a medical condition which affects your driving. You may be prosecuted if you are involved in an accident as a result.
- The main concern while you are driving is hypos which could cause an accident. The DVLA do not have concerns about high blood-glucose levels and driving.

Car or Motorcycle 1-2-3 year licenses (Group 1)

You must meet the following criteria and inform the DVLA:

- You have adequate awareness of hypoglycaemia.
- You have no more than one episode of severe hypoglycaemia in the preceding 12 months.
- Appropriate blood-glucose monitoring.
- You are not regarded as a likely risk to the public while driving.
- You meet the visual standards for acuity and visual field.

You will have to sign to say that you comply with healthcare professional instructions and report any change in your condition to the DVLA.

Bus and lorry (Group 2) 1-year licenses (Require annual review)

You must meet the following criteria:

- You have full awareness of hypoglycaemia.
- No episode of severe hypoglycaemia in the preceding 12 months.
- You must use a blood-glucose meter with sufficient memory to store 3 months of readings.
- You can demonstrate an understanding of hypoglycaemia risk.
- You have no disqualifying complications of diabetes, such as problems to your sight.

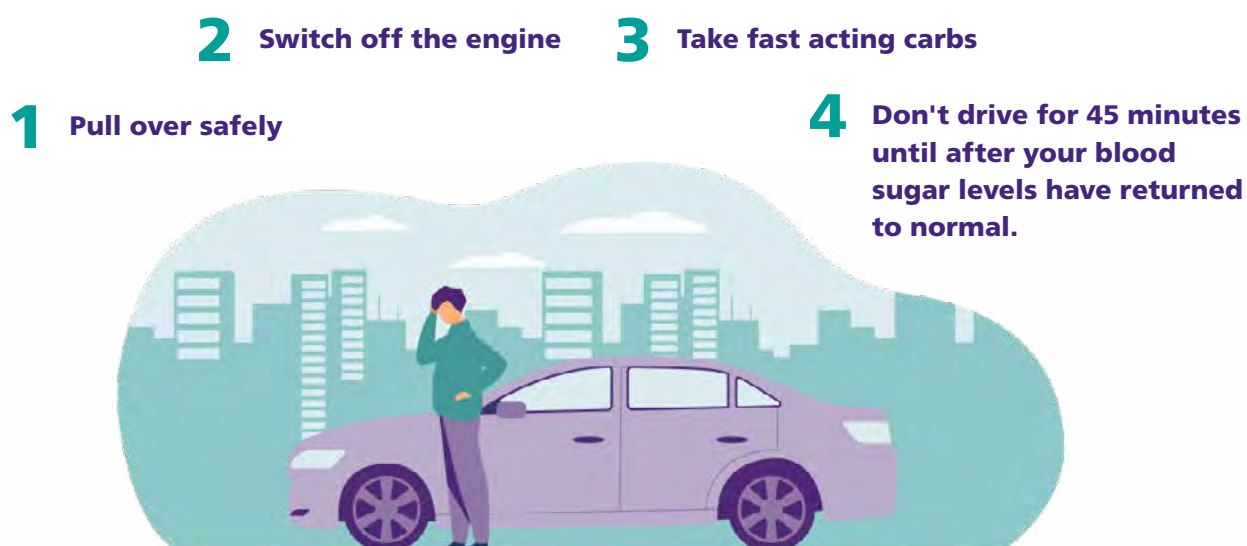
Once you have informed the DVLA, you should always update and inform them if your circumstances change.

These such circumstances are:

- You have no more than one episode of severe hypoglycaemia during the day in the preceding 12 months. Appropriate blood-glucose monitoring / CGM use.
- You develop impaired awareness of hypoglycaemia (difficulty in recognizing the warnings symptoms of a low blood-glucose).
- You need laser treatment to both eyes, or in the remaining eye if you have sight in one eye only.
- You are unable to read (with glasses or contact lenses if necessary) a car number plate at 20 metres (65 feet).
- You have problems with the circulation or sensation in your legs that means you have to drive automatic vehicles or vehicles with a hand operated accelerator or brake.
- An existing medical condition gets worse or you develop any other conditions that may affect you driving safely.

Safe driving tips

- Check your blood-glucose before driving, unless you have checked within the last two hours.
- Check your blood-glucose or CGM levels every two hours on long journeys.
- Do not drive if your blood-glucose is less than 5mmols, think of the motto '5-to-drive'.
- If your blood-glucose is 4-5 mmols eat a small starchy snack e.g.2 plain biscuits, piece of fruit.
- If your blood-glucose is less than 4mmols, treat the hypo and do not drive for at least 45 minutes after you have recovered from the hypo.
- Always keep hypo treatments in reach in the car at all times.
- Always carry your blood-glucose meter even if you are using a CGM device.
- Always carry diabetes identification with you.



If you have a hypo whilst driving:

- Stop the car as soon as possible and is safe to do so.
- Remove the keys to demonstrate you are not in charge of the car and move into the passenger side if safe to do so.
- Treat the hypo.
- Do not drive for at least 45 minutes after you have recovered from the hypo because your response rate will be slower.

Continuous glucose monitoring and driving

If you use a continuous glucose monitor to check your blood-glucose levels this can be used for the purpose of checking your blood-glucose before you drive and is endorsed by the DVLA. However the following exceptions should always be followed:

- If your CGM shows your glucose level is less than 4mmols you should check a finger prick blood-glucose before driving.
- If you have **symptoms of a hypo** you should check a finger prick blood-glucose.
- If your CGM gives a **reading that's not consistent with the symptoms** you're getting - for example, if you feel like you're having a hypo but the reading doesn't show this, you should check a finger-prick blood-glucose.

What if I lose my license?

- If you have your license revoked then you can nearly always reapply for it after some time. It depends why you lost your license.
- The most common reason is because of severe hypos, which is where you need help and can't treat it on your own.
- You can apply for a new license up to eight weeks before the date given on your refusal notice.
- What happens then will depend on why your license was taken away.

Module 6 Complete

Module 11: Sport, exercise and Diabetes

Module aims and objectives:

Aim: Gain an understanding of the management of type 1 diabetes when undertaking physical activity.

Objectives: By the end of Module 11 you will:

- Be familiar with the health benefits of physical activity
- Be familiar with the government recommendations for weekly physical activity level.
- Understand the different types of activity and different effects on blood-glucose levels.
- Understand the effects of physical activity on the body in reference to blood-glucose regulation.
- To understand the potential causes of hyperglycaemia and hypoglycaemia from exercise in someone with type 1 diabetes.
- To understand the risks of hypoglycaemia during exercise
- To be familiar with recommendations and strategies to reduce the risk of hypoglycaemia during exercise

What are the benefits of exercise?

People with diabetes are often encouraged to take exercise.

Regular exercise can:

- Improve general health and well-being.
- Lower risk for coronary heart disease.
- Improve circulation.
- Strengthen the heart, muscle, lungs.
- Help control body weight.
- Tone the body.
- Provide enjoyment.
- Fight depression.

What are the general guidelines for physical activity level to aim for?

Public health guidelines in the UK recommend 150 minutes of moderate intensity activity per week (for example, 30 minutes 5 days of the week) or in bouts of 10 minute intervals over the week. Or 75 minutes of Vigorous intensity exercise a week, AND strength building activities two days of the week.

Moderate activity

Working at a moderate intensity which increases the heart rate and body temperature but you are able to hold a conversation (walking, cleaning, gardening, decorating, active occupational activity).

Vigorous activity

Working at a harder intensity, becoming breathless, hot and sweaty and unable to hold a conversation (walking uphill, stair climbing, running, swimming, cycling).

Strengthening activity

Strengthening muscles using body weight or working against a resistance (gardening, lifting heavy items, weight lifting, pushing the lawn mower, yoga and Pilates).

How can I find out how exercise affects me?

The response to exercise is very individual. Understanding what happens to your body during exercise will help you to manage your diabetes more effectively by avoiding hypoglycaemia (hypos), maintaining blood-glucose levels and improving performance.

Planning ahead for exercise can help reduce the risk of hypoglycaemia and testing blood-glucose levels before, during and after exercise can provide information about your body's response to exercise. You may find that your insulin doses and your food intake may need some adjustment.

What affects exercise blood-glucose responses?

Exercise	Regimen changes
Type/mode, frequency, intensity, duration, timing, and training status.	Starting blood-glucose levels, circulating insulin levels and food intake.
Environment	Hypoglycemic-associated autonomic failure
Heat, humidity, cold and altitude.	Prior hypoglycaemia and prior exercise.
Bodily concerns	
Physical and mental stress, nutritional status, hydration, muscle/liver glycogen levels and menstrual cycle phase (in women).	

What happens to the body during physical activity?

Glucose is used by the muscles to provide energy during exercise.

As exercise continues, glucose is taken up by muscles from the bloodstream, which causes blood-glucose levels to fall. However, blood-glucose levels are kept in a narrow range by the release of glucose from the liver.

During exercise, our body cells become more sensitive to insulin to efficiently take up glucose from the blood for extra energy production. A normal functioning pancreas would offset the fall in BG by reducing the amount of insulin being produced and increase production of glucagon and other hormones. This aids the release of glucose from the liver and thus preventing hypo.

In diabetes the insulin injected cannot be reduced once already circulating and as a result glucose is taken from the blood. The presence of insulin prevents the liver from releasing its own supply of glucose into the blood and results in a hypo.

As exercise continues further, other fuel sources become available e.g. fat from fat stores, which can be used by the muscles directly.

After exercise, insulin sensitivity continues to be increased to help the muscles to restore glucose used during activity.

The impact of exercise on the body

Heart  - Increases heart rate. - Insulin and glucose are pumped to muscles much quicker.	Adipose (fat) tissue  - Increases fat breakdown. - Increases ketones (if there is not enough insulin on board).
Muscle  - Glucose and fat are used for energy. - Increases insulin sensitivity and glucose uptake from the blood.	Blood circulation  - Increases vasodilation results in quicker insulin absorption. - Glucose and insulin transports much faster.
Liver  - Reduces glucose uptake. - Increases the amount of glucose released into the blood.	Pancreas  - Increases in insulin sensitivity reduces secretion, requiring less. - Increases glucagon and more glucose is released by the liver.

Causes of hypoglycaemia during and after exercise:

- Type of activity: **Aerobic (oxygen fat burning)** activity. This includes continues walking, running, cycling, swimming, Zumba, housework. The increase in heart rate and heat will increase the speed of insulin absorption and will act faster.
- Injecting insulin in the area of working muscle will result in an increased insulin absorption because of the increased blood flow, e.g. if you are cycling, avoid injecting insulin into your legs.
- Duration and intensity of activity (> 30minutes)
- Missed meal prior to activity.
- A hypo event prior to the activity will increase risk of a second hypo as the sensitivity to insulin will be increase.
- A high level of insulin in the body will counteract the release of glucose from the liver, therefore increased risk of a hypo.
- Glycogen stores in the liver and muscle are decreasing during exercise and need to be replenished after exercise. Therefore the risk of a hypo is increased for several hours, and in some cases up to 24 hours, following exercise.

Why can hypos be more difficult to detect during exercise?

Many of the recognised symptoms of a hypo are often experienced during normal exercise, for instance, feeling hot or sweaty and noticing an increased heart rate.

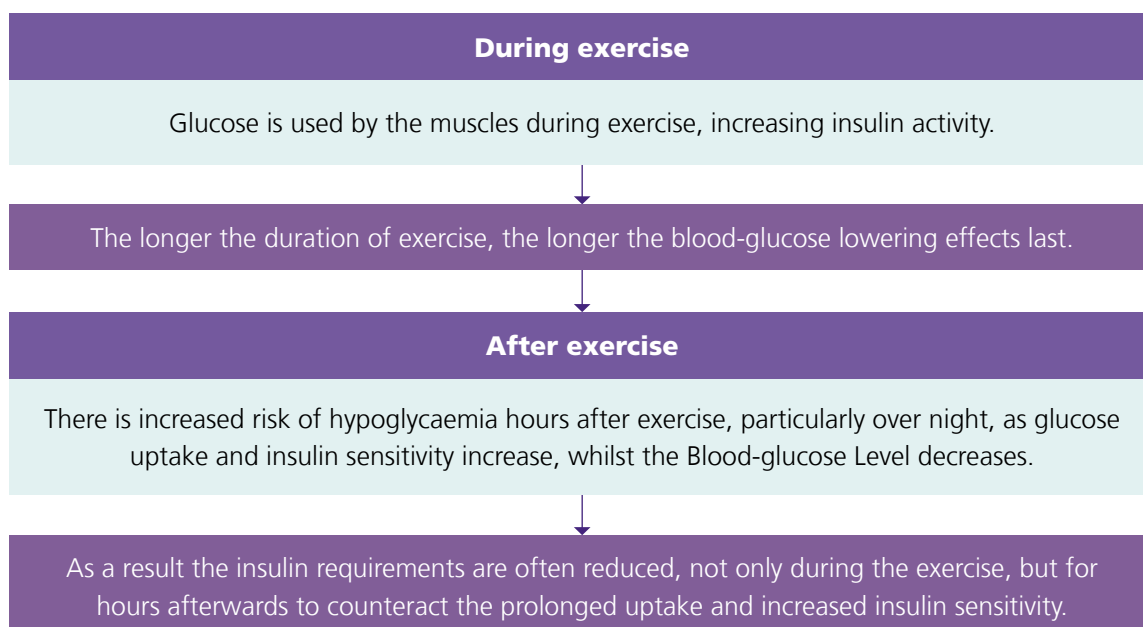
Checking your blood-glucose level (BGL) will help you to make the necessary adjustments. A previous hypo during the last 24 hours may increase your risk of further hypos and this risk is further increased by exercise.

It is advised to do BGL before, during and after each different activity, to get an understanding of how the different activity and change in your individual BGL. This will help you devise an action plan for when you are doing the activity in the future.

Causes of hyperglycaemia during and after exercise

- Type of activity: **Anaerobic (oxygen fat burning)** This includes short sharp bursts of activity (vigorous intensity and strength based activity) e.g. weight lifting, pushing / pulling / throwing objects, sprinting short distances.
- The body uses glucose from glycogen stores. Stress hormones are released e.g. adrenalin, which causes glucose production to rise and BGL to rise in the process.
- If there is a shortage of insulin (eating before an activity without giving insulin), glucose cannot enter the muscle cells and the blood-glucose levels will rise.
- The body recognises an increased need for glucose to provide energy and will release glucose from the liver stores.
- At the same time if there is a lack of insulin, fat will be broken down which can produce ketones. This will put you at risk for developing ketoacidosis.

How exercise can lower blood-glucose for hours later:



Top tips for doing exercise

- Appropriate blood-glucose levels on starting exercise are between 8-10mmol
- Care should be taken if your diabetes is poorly controlled or your blood-glucose levels is >13mmol/l prior to activity.
- If BGL >13mmol without ketones, consider a small correction to: 8-10mmol.
- Avoid exercise if ketones are present
- If BGL <8mmol prior to activity, you may want to take 10-15g CHO snack
- You may need additional carbohydrate during your exercise depending on the duration of the activity
- The insulin bolus for snacks / meals may need to be reduced before and/or after activity.
- Keep hypo treatment with you
- Adequate hydration

What exercise should I choose?

Whilst any exercise is beneficial, you should choose an activity that best meets your goals and is safe for you to do. Prolonged aerobic activity at low intensity is best for weight control. The management of blood-glucose levels during exercise is a trial and error process.

You will need to monitor your blood-glucose levels closely to understand what works for you as an individual. This will allow you to work out what adjustments you need to make to your insulin and/or carbohydrate for the activities that you do.

Is it safe for me to exercise?

Exercise is vital to staying fit and healthy. Before starting a new exercise regimen, you may wish to discuss insulin adjustment with your diabetes team. This will be particularly important if you have complications of diabetes that affect your feet, heart, eyes or blood pressure.

Activity and insulin adjustment

The first thing you will need to consider is if the activity is planned or not. If it is planned you can usually make a choice to decrease your insulin or eat more carbohydrate.

Are you doing the activity to lose weight or just to stay fit?

Planned activity		Planned activity
Do you wish to lose weight?		Have extra Carbohydrate before, during or after the activity.
YES	NO	
Insulin is best reduced	Either reduce insulin or eat extra CHO	

The following diagram will help you to make decisions on whether to reduce insulin or take an extra CHO snack. Also discuss this with your diabetes health care professional.

Activity	Duration	Suggestion
Gentle e.g. a gentle walk to the shops or walking the dog	Less than 30 minutes	- No insulin adjustment usually needed. - Have hypo treatment with you.
Medium e.g. bike ride or a brisk walk, gardening	30 - 1 hour	- Extra 10-20g CHO without bolus depending on your BGL. Or reduce food bolus by 20-25% if activity 1-2 hours after a meal. - Have hypo treatment with you.
Prolonged / Intense e.g. running, gym / fitness class, football	Up to 4 hours	- Reduce food bolus by 30-50% prior to activity, 10-20% reduction at next meal. - You will need 30 - 60g CHO during each hour of activity or 0.5 - 1g/kg/hour). - Additional CHO following exercise. - Have hypo treatment with you.
Prolonged e.g. cycle race, marathon run	More than 4 hours	- You may need to omit the food bolus prior to the exercise and take extra 30-60g CHO during each hour of exercise and extra CHO following. - Reduction of 50% with food bolus after exercise if meal taken. - Reduction of 10-20% on long acting insulin following exercise. - Have hypo treatment with you.

Preparing and responding to activity



Scenario 1

You plan to decorate all day (painting and wall papering). How would you plan your day to avoid hypos?

Scenario 2

You are taking the dog for a walk before breakfast and your blood-glucose level is 9.6mmol/l on waking up. What do you do?

Scenario 3

You are going for a 1 hour run after work. Your last meal was 3 hours ago. Your blood-glucose level is 14.2mmol/l before starting your run. What do you do? You will have your dinner 1 hour after your run. Any other considerations you will take at this time?

Module 11 Complete

Module 13: Diabetes and pregnancy

Module aims and objectives:

Aim: Understand the importance of managing diabetes before, during and after pregnancy.

Objectives: By the end of Module 13 you will:

- Understand the importance of planning pregnancy
- Be aware of the risk having diabetes can pose before and during pregnancy
- Understand the steps to take before becoming pregnant

What to know before you become pregnant

If you have Type 1 or Type 2 diabetes and are thinking of becoming pregnant you need to talk to your diabetes team before you start to try to become pregnant.

Most women with diabetes have healthy babies if their diabetes is well controlled and they are in good general health. If diabetes is uncontrolled pre and during pregnancy this can cause an increased risk of miscarriage, stillbirth, congenital malformations and is also linked to larger than average birth weights.

The key to a healthy pregnancy is to be as healthy as you can before becoming pregnant, optimising your diabetes control and thinking and planning ahead.

What are the general guidelines for physical activity level to aim for?

If you are thinking about having a baby, follow these steps:

- Meet your diabetes care team for specialist advice on planning your pregnancy. Preconception care/advice is delivered by a specialist team so you may need to ask your GP to refer you.
- Ask for advice before stopping contraception
- Take Folic acid 5mgs daily for 3 months prior to conceiving. This is a higher dose of folic acid and is unavailable over the counter. You will need a prescription for this.
- Discuss your current medication with your diabetes care team – you may have to stop or change certain medicines
- Discuss tests and screening (rubella screening, kidney and retinopathy screening)
- Stop smoking
- Stop drinking alcohol
- Maintaining good control of your blood-glucose levels. The HbA1c target for pregnancy is below 48mmols for 3 months prior to conceiving without causing problematic hypoglycaemia.

The target blood-glucose range during pregnancy (without causing problematic hypoglycaemia) is:

- Fasting 5.3mmol/L
- One hour after meals: 7.8mmol/L OR two hours after meals: 6.4mmol/L

If you require any further information or advice speak to your diabetes care team who will be happy to discuss preconception advice further, and arrange an appointment if appropriate.

Module 13 Complete

K.A.R.E.N. Programme Week 2

Group meeting

Homework: complete online modules 7-10 , 12, 14 and 15

Aims of this session:

- To gain understanding of insulin adjustment in relation to individual blood glucose profiles.
- Gain further knowledge and skills to improve carbohydrate counting.
- To gain tips on carbohydrate counting and social events e.g. eating out, alcohol.
- To understand the role of healthy eating within the food freedom offered by carbohydrate counting.
- To be able to safely manage diabetes when unwell.
- To gain an understanding of the long term effects of diabetes.
- To be updated in the diabetes technologies available.

HOMEWORK to complete

- Work through modules 7-10, 12, 14 and 15 and complete activities in your workbook.
- Check on sensor app or reader, before each meal and before bed time.
- Log your carbohydrate values for all your food over the next week on your sensor notes or in a food diary provided
- Ensure your Continuous Glucose Monitor (CGM) is linked or uploaded to the relevant platform or your bring the reader / receiver with you.

Please contact us via email if you have any questions or concerns between our group meetings.

Module 7: Carbohydrate counting difficult foods

Module aims and objectives:

Aim: To be able to carbohydrate count difficult to measure foods confidently.

Objectives: By the end of Module 7 you will:

- Be able to calculate the carbohydrate value of obscure portion sizes using the carb value per 100g on food labels.
- Use food labels, picture portion resources and handy measures to carbohydrate count pasta/rice and potatoes.
- Be able to distinguish between uncooked and cooked values on food labels for foods that change weight during cooking.
- Be able to carbohydrate count recipes.

Calculating carbohydrate content from food label information

Nutritional labels: Recap

Most food packaging will display nutritional information in a table or list format (see examples below).

For carbohydrate counting you use total carbohydrate which includes all added, natural sugars and starch as all of these will break down into glucose. Do not use 'of which sugars' value to carb count with as this will only capture added and natural sugars and miss out the starch.

Nutrition			
Typical Values (oven cooked as per instructions)	Per 100g	Per 1/2 pizza	% adult RI Per 1/2 pizza
Energy kJ	1016	1990	-
Energy kcal	241	473	24%
Fat	7.4g	14.5g	21%
of which			
- saturates	3.1g	6.1g	31%
- mono-unsaturates	2.9g	5.6g	-
- polyunsaturates	1.1g	2.2g	-
Carbohydrate	31.7g	62.1g	24%
of which			
- sugars	3.5g	6.9g	8%
- starch	28.2g	55.3g	-
Fibre	2.2g	4.3g	-
Protein	10.9g	21.4g	43%
Salt	0.86g	1.68g	28%

You will see values per 100g of weight and in most cases values for a specific portion weight too. Your portion might differ from this recommendation though.

To carb count foods that you are not going to eat the portion size recommended on the food label you will need to use the carb value per 100g.

If you use the carb value per 100g, then you will need to know the weight of the portion you are eating and you can then calculate the amount of carbohydrate in your portion. Familiarise yourself with the calculation below and practice using it.

$$\frac{\text{Carbohydrate per 100g}}{100} \times \text{Portion weight (g)} = \text{Carbohydrate per portion}$$

Or if you do not have scales available, you can use a fraction of the whole portion to calculate the carbs in your portion.

You will need the following information from your food label:

- The total weight of the whole food/drink in grams.
- A good estimation of the fraction of your portion from the whole weight of the food.
- The amount of carbohydrate per 100g of the product OR the amount of carbohydrate of the recommended portion size.

Nutrition			
Typical Values (oven cooked as per instructions)	Per 100g	Per 1/2 pizza	% adult RI Per 1/2 pizza
Energy kJ	1016	1990	-
Energy kcal	241	473	24%
Fat	7.4g	14.5g	21%
of which			
- saturates	3.1g	6.1g	31%
- mono-unsaturates	2.9g	5.6g	-
- polyunsaturates	1.1g	2.2g	-
Carbohydrate	31.7g	62.1g	24%
of which			
- sugars	3.5g	6.9g	8%
- starch	28.2g	55.3g	-
Fibre	2.2g	4.3g	-
Protein	10.9g	21.4g	43%
Salt	0.86g	1.68g	28%



This is an example of a label with nutritional information from a pizza. It gives information both per 100g and for ½ of the pizza. The whole pizza weighs 390g.

If you ate the whole pizza how much carbohydrate would you have? : _____g

There are 2 ways of working this out:

½ pizza = 62.1g CHO

Therefore 62.1 x 2 = **124.2g**

OR

100g = 31.7g, the whole pizza = 390g

Therefore 31.7/100 x 390 = **124.2g**

Carbohydrate counting using handy measures, weighing scales and food label

Step 1: Zero the scales with a cereal bowl placed on and fill the scoop full with muesli.

Step 2: Pour the muesli from the scoop into the bowl and take the portion weight.

Step 3: Use the CHO /100g on the food label and the portion weight of the muesli to calculate the carbs in your scoop portion.

Step 4: Make a note of the carb value for 1 scoop of muesli.

Step 5: Zero the scales with the cup placed on them.

Step 6: Pour milk into the cup up to the line.

Step 7: Note the portion weight.

Step 6: Use the CHO / 100g * portion weight equation to calculate the carbs in the cup of milk.

Step 7: Add the carb value for 1 scoop of muesli and 1 cup of milk together for total carb value.



Using nutrition tables to carb count for difficult portion sizes

Example: Calculate the carbs in your portion (1/4 of the packet).



Typical values	Values per 100g
Carbohydrate	53.0g

1) Find total carbs in whole packet (in 150g)

$$53/100 \times 150 = 79.5\text{g}$$

2) Find carbs in 1/4 of the packet

$$79.5\text{g} / 4 = \mathbf{19.9\text{g carbs}}$$

Use the food labels to work out the carb values for the meals below. Work out the portions specified for each food item then add up the total carbs for each meal.

Meal 1 - 1/3 of a whole pizza, 1/4 of an apple pie and 1/2 a carton of custard



Use the food labels presented on the webinar slides to work out the amount of carbohydrate in the given portion.

1/3 pizza CHO _____ g

1/4 apple pie CHO _____ g

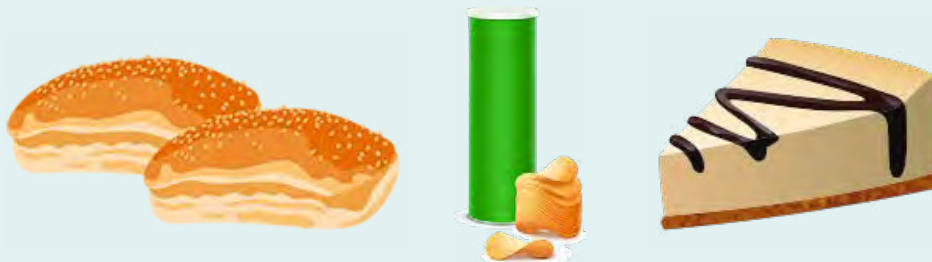
1/2 carton custard CHO _____ g

Total CHO _____ g

Using your carb:insulin ratio, work out the dose of insulin you would give with this meal.

_____ Units

Meal 2 - 2 rolls, 1/3 of a tube of crisps and 1/4 of a cheesecake



Use the food labels presented on the webinar slides to work out the amount of carbohydrate in the given portion.

2 rolls CHO _____ g

1/3 tube crisps CHO _____ g

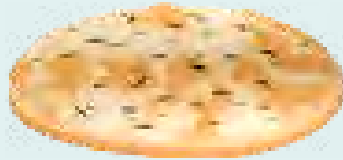
1/4 cheesecake CHO _____ g

Total CHO _____ g

Using your carb:insulin ratio, work out the dose of insulin you would give with this meal.

_____ Units

Meal 3 - 1/2 of a lasagne ready meal, 1/3 of a garlic flatbread, 125g of yogurt and 160g of frozen fruit



Use the food labels presented on the webinar slides to work out the amount of carbohydrate in the given portion.

1/2 lasagne Ready meal CHO _____g

1/3 garlic flat bread CHO _____g

125g yogurt CHO _____g

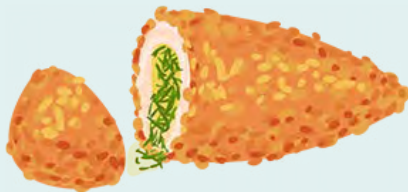
160g frozen fruit CHO _____g

Total CHO _____g

Using your carb:insulin ratio, work out the dose of insulin you would give with this meal.

_____ Units

Meal 4 - 1 chicken kiev, 130g of oven chips, 1/2 a tin of baked beans and 1/4 of a chocolate cake



Use the food labels presented on the webinar slides to work out the amount of carbohydrate in the given portion.

1 chicken kiev CHO _____g

130g oven chips CHO _____g

1/2 tin of baked beans CHO _____g

1/4 chocolate cake CHO _____g

Total CHO _____g

Using your carb:insulin ratio, work out the dose of insulin you would give with this meal.

_____ Units

Other consideration when counting carbohydrates

Foods that increase or decrease in weight during cooking can cause confusion when trying to carb count as you need to decide if you are carb counting an uncooked portion weight or a cooked portion weight and ensure you use corresponding values on the food label.

Pasta / rice / other grains

- These foods increase in weight when cooked because they absorb water.
- You can choose to carb count your portion either as uncooked (Dried) or after it is cooked.
- Preference usually depends on the practicalities: it is easier to carb count a cooked value if you are cooking in bulk but easier to count a dried value if you are cooking for only you.
- If you are using a food label to carb count then you need to check whether the values per 100g are for a cooked or dried weight.

If you carb count your cooked portion using a dry value then you will over estimate your carb value and may end up dosing too much insulin.

Or if you carb count your dried portion using a cooked value then you will under estimate your carb value and not dose enough insulin.

Carbohydrate counting potatoes

Potatoes, will lose water during the cooking process. The amount of carbohydrate in the potato will not change but the weight will usually decrease. It is therefore important to make sure you use the carbohydrate information for cooked weight and carbohydrate information for uncooked weight separately and decide whether you will weigh your potato before or after cooking it.

For potatoes if you used an uncooked carb value for a cooked carb value, you will underestimate the carb value because per 100g of uncooked weight you have less carbs and more water compared to 100g of cooked weight.

It is useful to practice weighing these foods dry and cooked to get an idea of how much carbohydrate is in your individually preferred portion size. Use your reference tables and food labels to work this out. You can use the same measure cup/spoon to dish up your usual portion. Then when you are confident with your carb count for your portion, you can rely on picture books to help you when out and about. Using more than one resource may help make your carb count more accurate.

Potatoes lose weight when cooking but this is 'water weight' therefore the carbohydrate value remains the same.

Carb counting potato methods:

- Weigh your potato + nutritional table from food label/supermarket website / reference table.
- Compare your portion to Carbs and Cals picture portions in book or phone app.
- Use handy measures (egg sized potato = 10g).
- Use household measures (scoop / cup) + weigh portion + nutritional labels to calculate carbs in your household measure.

Carbohydrate counting meals and recipes

Method 1: Use visual portion resource e.g. carbs and cals app / book



Compare your portion to the option of visual portions on the app and click on the image closest to your portion size.



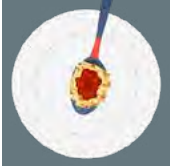
Read the carb value on the Green tab. Use this value, or add or subtract if you think your portion is more or less than the chosen image.

Method 2: Use the weight of the portion and carbs and cals portion weight to calculate the carb value



CHO value = $51\text{g} / 355 \times \text{portion weight}$
 CHO value = $51\text{g} / 355 \times 369 = 53\text{g}$
CHO value = 53g

Step 1: Put your plate on the scales and zero the weight.
Step 2: Serve the portion you would like to eat.
Step 3: Search for your meal on Carbs and Cals.
Step 4: Click on the portion picture.
Step 5: Divide the displayed CHO value by the displayed portion weight then multiply by your portion weight.
Step 6: The result is your carb value.





You can also weigh one serving spoon portion and calculate the CHO value for 1 spoonful, make note of the value so that the next time you can just count how many spoonfuls you serve yourself and multiply the CHO value by how many spoonfuls you served.

Example: CHO value for one serving spoonful of pasta bake = 51g

$$51\text{g} / 335\text{g} \times 111\text{g} = 16\text{g}$$

CHO value = 16g

Carbohydrate counting recipes



Follow the steps below to guide you with carbohydrate counting recipe.

Use this example to practice and find the total carbs in the recipe, record your values within the table and the total value below.

Tuna and Tomato Pasta Bake - Makes 4-6 portions

Ingredients

500g uncooked pasta = approx.1000g cooked pasta
1 tin of tuna (145g)
1 large onion (chopped)
500ml of milk
4tbsp of flour
150g of mature cheddar (grated)
1/2 tsp mustard powder
1 tin of sweetcorn (200g)
1/2 tin of chopped tomatoes (200g)



Step 1: Identify the ingredients containing carbohydrate.

Step 2: Use reference tables / food labels to calculate the grams of carbohydrate for each ingredient identified.

Step 3: Calculate the total grams of carbohydrate for the entire recipe.

Food Item	CHO (g)
Total Carbohydrate in recipe (g) =	

Step 4: Divide this by 4 or 6, depending how many people you are serving, to find the gram CHO for 1 portion.

Step 5: Write this down for future reference in your recipe book.

How to calculate your carbohydrate portion from the carbohydrate value of the whole recipe:

Step 1: Weigh the empty dish (1213g).

Step 2: Weigh the dish and pasta bake (3641g).

Step 3: Subtract the empty dish from the full dish (3641 - 1213 = 2428g).

Step 4: Weight of the pasta bake = 2428g

Step 5: Calculate the total CHO from the recipe (514g, as calculated previously).

Step 6: Find the weight of the portion or a handy measurement and calculate the CHO using the calculation:

$$\frac{\text{Total CHO}}{\text{Total weight}} \times \text{Portion weight (g)} = \text{CHO per portion}$$

$$\frac{514}{2428} \times \text{Portion weight (g)} = \text{CHO per portion}$$



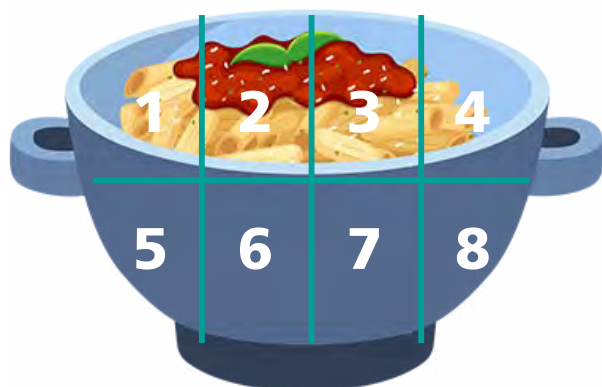
Calculate your carbohydrate portion from the Carbohydrate Value of 1 serving spoonful

$$\frac{1 \text{ spoonful CHO}}{\text{Total weight}} \times \text{Portion weight (g)} = \text{CHO per portion}$$

$$\frac{514}{2428} \times 111\text{g} = \mathbf{24\text{g}}$$

The difference between carb values calculated this way for 1 spoonful and using Carbs and Cals has a difference of 8g. There will be inaccuracies with both methods, just choose the method you feel most comfortable with.

Calculate your carbohydrate portion from equal segments of the whole dish



Step 1: Use the CHO value from the recipe for the whole dish.

Step 2: Divide the dish into equal segments (more for smaller portions and less for larger portions).

Step 3: Divide the total CHO value for the whole meal by the number of equally segmented portions.

$$\frac{\text{Total CHO}}{\text{Number of equal portions}} = \text{CHO per portion}$$

Pause the presentation and access the '**Carb counting recipes**' tutorial video in the K.A.R.E.N. course play list.

Homework: Carbohydrate counting recipes: Baking cakes



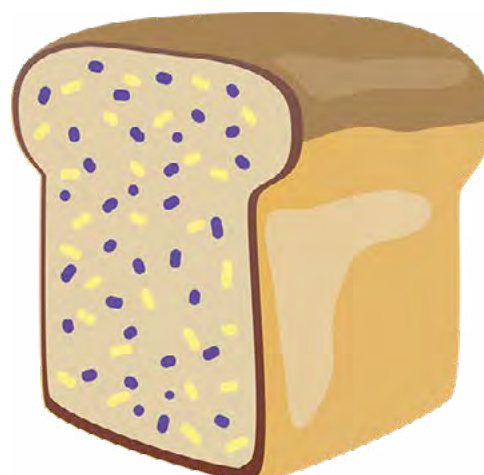
Follow the steps below to guide you with carbohydrate counting recipe.

Use this example to practice and find the total carbs in the recipe, record your values within the table and the total value on the next page.

Blueberry and Banana Oat Loaf (500g) - Serves 8

Ingredients

200g of self-raising flour
1 x 5ml spoon of baking powder
50g of caster sugar
100g of oats
1 large orange
3 medium bananas (ripe)
2 eggs
6 x 15ml spoons of sunflower oil
1 x 5ml spoon of vanilla extract
1 - 2 x 15ml spoons of semi-skimmed milk
175g blueberries



Step 1: Identify the ingredients containing carbohydrate.

Step 2: Use reference tables/food labels / picture books to calculate the grams of carbohydrate for each food portion identified.

Step 3: Calculate the total carbohydrate (CHO) content of the entire recipe.

Food Item	CHO (g)
Total Carbohydrate in recipe (g) =	

Step 4: Once the loaf has been baked (follow steps on the recipe), weigh the whole loaf cooked.

Step 5: The total carbohydrate content of the loaf is the total CHO of the recipe.

Step 6: Cut your slice and weigh it.

Step 7: Calculate the CHO in your slice:

$$\frac{\text{Total CHO}}{\text{Total weight}} \times \text{Slice weight (g)} = \text{CHO per portion}$$

Over the next week practice weighing the following foods and work out the carbohydrate value for each:



Weigh the following foods and work out the carb value for each:

1. Baked potato	Weight _____	g/100 _____	CHO _____g
2. White rice (dried)	Weight _____	g/100 _____	CHO _____g
3. White rice (cooked)	Weight _____	g/100 _____	CHO _____g
4. Pasta (dried)	Weight _____	g/100 _____	CHO _____g
5. Pasta (cooked)	Weight _____	g/100 _____	CHO _____g
6. Breakfast cereal	Weight _____	g/100 _____	CHO _____g
7. Milk on your cereal	Weight _____	g/100 _____	CHO _____g

Module 7 Complete

Module 8: Glycaemic Index

Module aims and objectives:

Aim: To be able to carbohydrate count difficult to measure foods confidently.

Objectives: By the end of Module 8 you will:

- Understand glycaemic index and glycaemic load with reference to carbohydrate absorption and the effect on blood-glucose
- Confidently apply alternative strategies of insulin dosing for delayed glucose absorption
- Improve confidence and skills to carbohydrate count and adjust insulin in social situations and when away from home.

Glycaemic Index

Remember that carbohydrate foods consist of chains of glucose molecules held together by chemical bonds – a bit like a bricks cemented together to make a wall. When we eat and drink carbohydrate, our digestive system breaks down the chains of glucose into their single units which are then absorbed across into the blood.

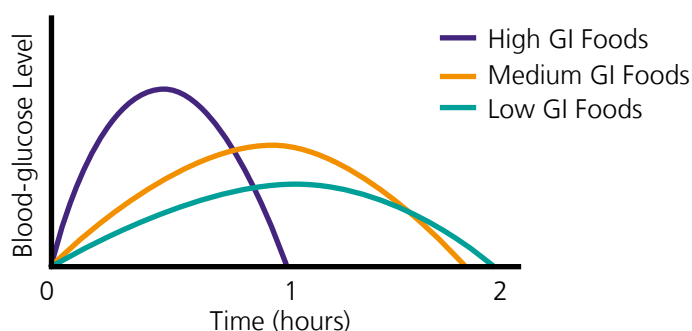
Carbohydrate food does not all break down in digestion at the same rate. The rate at which carbohydrate foods release glucose into the blood and cause the blood-glucose to rise after consumption can be ranked on a scale. This scale is called the Glycaemic index (GI). The scale runs from 1 to 100 with glucose as the reference with a score of 100.

Carbohydrate foods that are broken down quickly in digestion release their glucose units quicker into the blood and therefore raise the blood-glucose level more rapidly. These foods have a higher GI value (usually GI value greater than 70).

Carbohydrate foods that are digested much slower will release glucose into the blood more gradually and blood-glucose levels rise at a slower rate. These are given a low GI value (usually less than 55).

Examples

- Low GI - Oats, granary bread, sweet potato, beans and lentils.
- Medium GI - Weetabix, Shredded wheat, new potato, wholemeal bread, Special K.
- High GI - cornflakes, white bread, chips, sweets, rice krispies, coco pops.



Not all low GI foods are healthy choices. Chocolate and other fatty foods may have a lower GI.

Benefits of low GI foods

- Avoid rapid rise in glucose levels after eating
- Digest slowly so fill you up for longer – useful to control your appetite
- Slower absorbed carbohydrate can help keep blood-glucose level steady between meals – potentially helping to prevent hypos
- Higher fibre options are cholesterol lowering agents.

Aim to include more low GI foods in your diet but you can still include high GI options too.

There are many factors which effect the digestion time of carbohydrate foods and the blood-glucose absorption rate (GI):

- **Fibre**

Wholegrains and high fibre foods create a barrier in the gut which slows digestion down and gives fibrous foods a lower GI value. Wholemeal is not the same because although the whole of the grain has been included, it has been ground down already therefore wholemeal bread would have a higher GI value than slowly digested granary wholegrain bread.

- **Fat and protein**

Foods containing more fat and protein will have a lower GI value. This is because both nutrients slow digestion and take much longer to be broken down and absorbed. Carbohydrate digestion in high fat and protein foods can cause blood-glucose levels to rise very slowly and continue to rise for 3-5 hours after eating and sometimes longer if large portions are consumed. Combining a carbohydrate food with a high fat, protein or fibre food can slow down glucose absorption and lower the GI value of the meal.

- **Ripeness**

As fruits ripen their starches breakdown naturally and the sugar content increases which increases the GI value.

- **Processing**

Any processing of foods before eating will increase the GI value. Blending fruits and vegetables into smoothies breaks down the fibre and quickens absorption, mashing a potato will have a similar effect on increasing GI value and white bread is made from processed ground down flour and has a higher GI value.

- **Cooking Method**

Boiling will break down starch increase simple sugar, increasing the GI value. The longer duration food is cooked, the more processing involved and the higher the GI value. Pasta cooked 'al dente' will have a lower GI value than pasta cooked for a longer time.

Glycaemic Load (GL)

The total portion of carbohydrate you eat combined with the food's GI value determines how your blood-glucose will rise. Glycaemic Load considers the carbohydrate portion AND the GI value of the food.

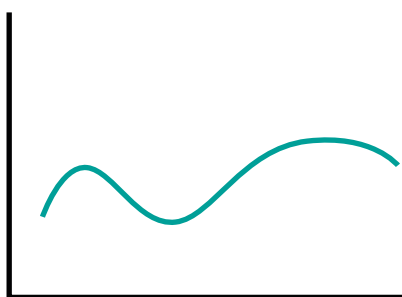
Example: eating a small portion of a high GI food will have a lesser effect on blood-glucose level when compared to a larger portion of a medium GI food.

Food absorption rates and your Insulin bolus

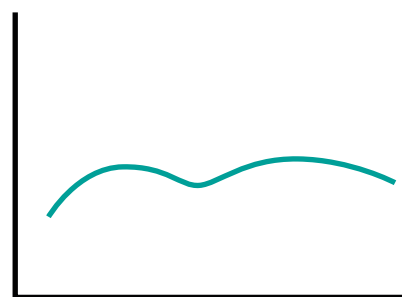
We now know that not all foods cause blood-glucose levels to rise at the same rate. When working out how many units to bolus with your food you need to consider:

- The amount of carbohydrate in the portion.
- The digestion rate of the carbohydrate consumed.

When Carbohydrate is digested slowly, a single bolus of insulin may initially reduce your blood-glucose and cause a hypo because the total amount of insulin acts at a quicker rate than the glucose being absorbed. Blood- Glucose levels can then rise later on as the remainder of the carbohydrate is digested and absorbed into the blood stream – after the action of insulin has started to wear off.



Single insulin dose with high fat/high CHO meal



2 split boluses with a high fat/high CHO meal

Two ways to alter how you administer your bolus can help avoid these fluctuations in blood-glucose level:

- Delay giving your bolus until after the meal
- Split the bolus into two injections – give one at the beginning of the meal and one shortly after e.g. if the meal requires 10 units of insulin, give 50% (5 units) before the meal and 50% (5 units) shortly after the meal.

Look at the following food

Consider:

- What are the rate of digestion and glucose absorption rate?
- What nutrients do they contain which may affect absorption?
- How would you amend your insulin bolus for each of these foods?



Carb counting meals out, takeaways, holidays and other special occasions

Having diabetes should not stop you from enjoying special occasions e.g. birthday parties or having a meal out. The uncertainties you face in these situations may cause you some concern about managing diabetes, however if you plan ahead and develop practical strategies to use, then life becomes a little easier and you can relax and enjoy yourself.

What difficulties can you think of when it comes to eating out when you have type 1 diabetes?



- Timing of insulin injection delayed.
- Unfamiliar food choices (when on holiday or visiting a new restaurant).
- Unknown portion sizes (you can't carb count until after seeing the meal in front of you).
- Unpredictable timings between ordering and your meal being served.
- Multiple courses consumed (when do I inject?).
- Social anxieties of injecting insulin in a public setting.
- Limited methods of accurately carb counting.
- Language or understanding barriers (when on holiday).
- Unknown ingredients in the food (it is difficult to predict the carb count and absorption rate if the fat content is higher).

Strategies to help you manage your diabetes on special occasions

Eating out

- Look at the menu on the website before you go to plan what you will eat.
- Is the nutritional information available on the website? If so, you can count your carbs before you go.
- Wait until you can see the meal and portion size before estimating your carbs.
- The Carbs and Cals app is a quick and useful method to carb count on the go.
- Try and dose insulin before eating, but if you are having multiple courses you can delay it occasionally.
- Make a note of your carb count for next time you eat there.
- Restaurant meals may often be higher in fat or have large CHO values. This will delay glucose absorption. Consider splitting your insulin dose, taking half before and half after the meal.
- Multiple courses require multiple insulin injections, but consider stacking effects. Try injecting once for a starter and main course, and again when desert has arrived.
- Review post meal glucose. Make a note of what worked and what didn't for you. This will help you for future meals out.

Takeaways

- Look for nutritional information available on the website to carb count before ordering.
- If you don't know the portion size, wait until you have the meal in front of you before estimating your carbs.
- If you're at home you can weigh your portion on your scales and use the Carbs and Cals app or reference tables to estimate your carb value more accurately.
- Write your carb value onto the takeaway menu for next time.

Holidays

- Research unfamiliar cuisine ahead of time and make a note of the carbohydrate counts for any dishes you may like to try when you are away.
- Use the Carbs and Cals app or reference tables to help you estimate your carbs when you're out for a meal.
- Buffets require multiple injections, but also consider stacking effects and try to avoid 'grazing' throughout the buffet. Instead fill your plate and aim to eat in 2-3 courses instead. You can then dose for course 1 and 2 together and inject again for course 3 for example, to avoid insulin stacking.

Regular testing is important. Make a note of what has worked and what hasn't. This will help you for any future meals.

Module 8 Complete

Module 9: Alcohol consumption and Type 1 Diabetes

Module aims and objectives:

Aim: To understand the wider public health guidance on safe alcohol consumption and understand and manage the effects of alcohol on glycaemic control in type 1 diabetes.

Objectives: By the end of Module 9 you will:

- Be familiar with the government guidelines for safe alcohol consumption
- Be familiar with the health complications associated with excessive alcohol consumption
- Understand the effects of different alcoholic drinks on blood-glucose levels in type 1 diabetes
- Understand the hypoglycaemic effects of alcohol within the body
- Understand the strategies and practical tips to safely regulate blood-glucose before, during and after alcohol consumption.

Drinking alcohol and carbohydrate counting considerations

If you choose to consume alcoholic drinks then there are a few factors to consider when it comes to managing your diabetes. Whether you have diabetes or not, it is strongly recommended that you ensure you drink within the government guidelines. Visit www.drinkaware.co.uk for more information.

Recommended alcohol intake

- 14 units per week
- Two alcohol-free days a week

1 unit is found in:

- ½ pint beer, cider, larger (3-4% abv), remember strong beer and lager and vintage cider can contain twice the amount of alcohol
- 125 ml glass of wine (9% abv), most wines contain 12-14% alcohol and a glass of these provides 1½ units alcohol
- One pub measure (25mls) of spirit (40% abv)

If you regularly drink 14 units each week, spread your drinking evenly over 3 or more days. One or two heavy drinking episodes a week and regular drinking of alcohol increases the risk of developing health problems and death from alcohol related poor health and accidents.

(abv = alcohol by volume)



Drinking excessively over the 14 units a week recommendations over 10-20 years can cause chronic illness:

- Cancers of the mouth, throat, breast, liver, pancreas
- Stroke
- Heart disease
- Liver disease
- Brain damage
- Damage to the nervous system

Not to mention it is expensive and contains a lot of calories - potentially contributing to weight gain! You can check the calories in your drinks by following the link

www.drinkaware.co.uk/tools/unit-and-calorie-calculator

Alcohol intake and hypoglycaemia

The amount of carbohydrate in alcoholic drinks can vary greatly. Alcohol is made from the fermentation of either sugar or starch. Pure alcohol alone does not raise the blood-glucose but any remaining unfermented carbohydrate or extra sugar or fruit can have an effect. The effect of alcoholic drinks on blood-glucose levels will depend upon the amount and type of alcohol drunk.

Alcohol itself, in large amounts can increase the risk of hypoglycaemia.

This is because alcohol is processed by the liver and interferes with the normal process of glucose release by the liver if blood-glucose levels fall.

This effect of alcohol can last for up to twenty four hours.

The risk of a hypo can also increase if you are more active on occasions when drinking, e.g. after playing sport, dancing or sex.

Ways to prevent a hypo when drinking

- Don't drink on an empty stomach – eat something carbohydrate-based beforehand.
- Don't carb count for alcohol – only food that you eat.
- You may need to eat some starchy food during the evening to keep your blood-glucose levels up.
- Tell the people you are with that you have diabetes and carry a medical ID.
- Have hypo treatment with you at all times
- Alternate alcoholic drinks with sparkling water, sugar-free lime and soda or diet drinks.
- Stick to your recommended daily units of alcohol.
- Eat a starchy snack before going to bed and drink plenty of water. You don't need insulin with this starchy snack.
- Test BGL before drinking and if able, before bed.

The morning after

- Drinking a pint of water before you go to bed will help to keep you hydrated and may help to prevent a hangover.
- If you do wake up with a hangover, you'll need to drink plenty of water.
- If you are suffering the typical hangover symptoms of headache, nausea, shaking and sweating, check your blood-glucose level as you may actually be having a hypo.
- No matter how awful you feel, you need to treat a hypo straight away – don't ignore it. Stick to your usual medication. Always have some breakfast – it will help you keep control of your blood-glucose.
- If you can't face food, or if you have been sick, take as much fluid as you can, including some sugary (non-diet) drinks.

Alcohol scenario 1

You are at a wedding reception and drink the complimentary champagne before moving onto the complimentary wine with the meal. You polish off two large glasses of white wine throughout the duration of the three course meal consisting of prawn cocktail with a bread roll, chicken, vegetables and four new potatoes and five profiteroles. Later at the wedding reception you consume a further two glasses of white wine. You ensure you have something to eat which consists of a pork roll from the hog roast and a side of chips. You also have a slice of wedding cake but take this home to eat for a late supper.



1. Calculate the amount of carbohydrate within the 2 meals. _____
2. How much insulin would you give with your meals? _____
3. What would you do at supper? _____
4. What would you need to consider **before, during** and **after** this occasion?



Alcohol scenario 2

You finish work and go to the pub with friends. You order a meat pie chips and peas and two pints of beer. Shortly after the meal you then drink another two pints of beer.



1. Calculate the amount of carbohydrates within the meal _____
2. How much insulin would you give with your meal? _____
3. What effects do you think the beer will have on your blood-glucose levels?

4. What can you do to manage your blood-glucose levels during the night?



Homework: Additional scenarios to consider

Alcohol scenario 3

You go to an Italian restaurant for your birthday treat. You decide to drink two large glasses of red wine with your meal. You order Garlic bread for starter, spaghetti Bolognese for your main meal and follow up with a lemon cheesecake for dessert. You decide to have another large glass of red wine instead of coffee – its your birthday after all!



1. Estimate the carbohydrate count for the meal and consider your insulin dose you would give for this using your carb ratio. _____
2. What method of carbohydrate counting would you use when you are out to count for your food? _____
3. When would you give your insulin injection(s) for your food? _____
4. What would you need to consider **before, during** and **after** this occasion



Alcohol scenario 4

You are having a night out on the town. You usually give your long acting insulin at 11pm before bedtime but you plan to be out dancing all night and probably won't return home until 3am. You start the night with a light meal of a mozzarella and tomato Panini with salad, accompanied with a Mojito cocktail. You then hit the bars and consume two wkd alcopops and two vodka and cokes. You continue dancing until 2am when you decide to head home via the takeaway and order a portion of chips to soak up the alcohol!



1. Calculate the amount of carbohydrate within the evening meals. _____
2. How much insulin would you give with your meal? _____
3. What would you need to consider **before, during** and **after** this occasion?

4. Are there more suitable drinks you might choose?



Useful website links

Type 1 diabetes and drinking

www.diabetes.org.uk/guide-to-diabetes/young-adults/type-1-drinking

Alcohol and diabetes

www.diabetes.org.uk/guide-to-diabetes/enjoy-food/what-to-drink-with-diabetes/alcohol-and-diabetes

Alcohol facts, advice and support

www.drinkaware.co.uk

Useful video links

Before a night out: Type 1 and alcohol

youtu.be/w6OIPE3Fe5g

On a night out: Type 1 and alcohol

youtu.be/LmxOTbHDZys

After a night out: Type 1 and alcohol

youtu.be/h0pZ-RkFBu4

Carbs and Calories in alcohol: Essential guide

www.youtube.com/watch?v=QairmEXAtE8&feature=em-uploademail

Module 9 Complete

Module 10: Management of Diabetes during illness and 'Sick Day Rules'

Module aims and objectives:

Aim: Understand how to manage your diabetes when you are ill.

Objectives: By the end of Module 10 you will:

- Be able to define hyperglycaemia, understand the symptoms and causes.
- Be able to safely manage your diabetes when ill.
- Explain what 'sick day rules' are and when to apply them.
- Know when to test for ketones, understand the blood ketones results and what action to take.

Hyperglycaemia

Hyperglycaemia is the term used to describe high blood-glucose levels.

What happens to blood-glucose levels during illness?

Illness can affect your diabetes control by raising your blood-glucose levels. Even if you have a poor appetite and you are not eating or drinking.



Increased Stress hormones causes Insulin resistance, driving Blood-glucose higher because insulin cannot work properly to remove excess glucose from your blood.

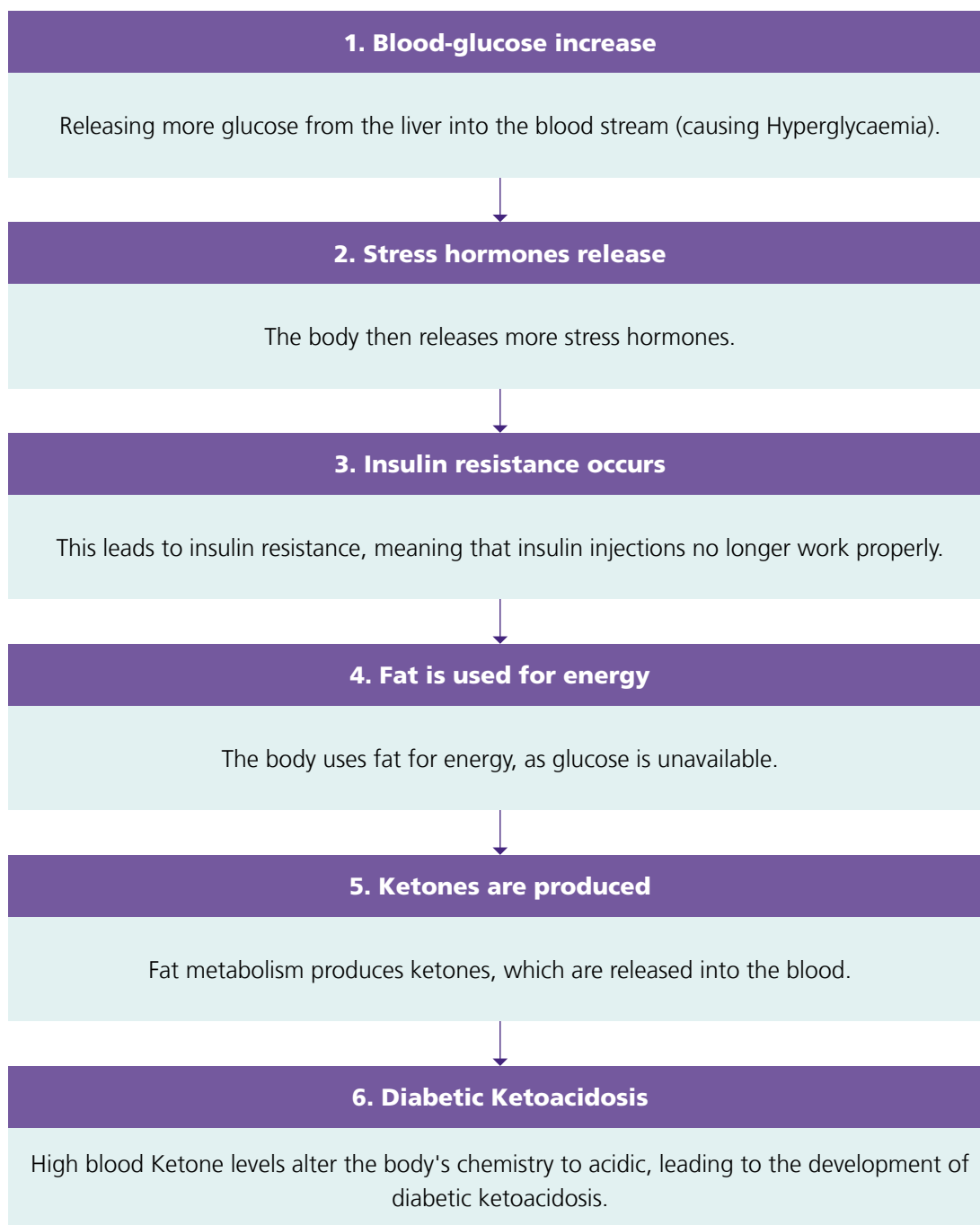


This leads to the body using fat as an energy source rather than glucose. Fat metabolism produces a substance called ketones which quickly upset the balance of the body's normal chemistry and pH thereby making the body chemistry acidic leading to the development of **diabetic ketoacidosis (DKA)**.



It is important to be aware of the signs and symptoms of ketosis, which may then reduce the risk of diabetic ketoacidosis developing. Equally important is being aware of the action to take if you develop/detect ketosis. This action is referred to by health care professionals as **'sick day rules'**.

What happens when you are unwell?



In someone without diabetes who is ill, the body compensates by releasing more insulin to deal with the higher blood-glucose levels and maintain the blood-glucose within a normal range. However in people with Type 1 diabetes the pancreas does not produce insulin this leads to the body using fat as an energy source rather than glucose. Fat metabolism produces a substance called ketones which quickly upset the balance of the body's normal chemistry and pH thereby making the body chemistry acidic leading to the development of diabetic ketoacidosis.

Diabetic Ketoacidosis

It is important to be aware of the signs and symptoms of ketosis, which may then reduce the risk of diabetic ketoacidosis developing. Equally important is being aware of the action to take if you develop/detect ketosis. This action is referred to by health care professionals as 'sick day rules'.

When am I at risk of diabetic ketoacidosis?

- When you are ill with infection, acute illness or stress.
- If you have forgotten to take your insulin.
- If you undertake exercise when you have ketosis.
- If your blood-glucose level is above 11mmols.
- If your insulin pump is not working.

What are the symptoms of diabetic ketoacidosis?

- | | |
|--|--|
| • High or normal blood-glucose levels. | • Abdominal pain. |
| • Ketones in the blood > 0.6mmols. | • Leg cramps. |
| • Passing lots of urine. | • Nausea and vomiting. |
| • Thirst. | • Finding it hard to breathe. |
| • Weakness. | • Pain in your stomach. |
| • Blurred vision. | • Breath that smells 'sweet' or of 'pear drops'. |

What are the possible causes?

- Any illness.
- Infection.
- Stress.
- Hormonal periods.
- Steroids.
- Insulin degradation (inadvertent freezing, out of date etc).

Implications of ketone levels

In the absence of sufficient insulin, the body's cells cannot use glucose for energy. The cells will switch to an alternative energy source and body fat will be broken down to supply the necessary energy

This rapid breakdown of fat can cause the build-up of substances known as ketones. Eventually ketones rise to levels that cause the blood to become acidic and this is known as diabetic ketoacidosis (DKA).

The only treatment for DKA is insulin and fluids.

Ketones are usually associated with high blood-glucose levels, however if you are unwell your blood-glucose levels may be within a normal range, or may even be low. This does not mean you do not have ketosis. Therefore you should always test for ketones if you are feeling/ or are unwell.

Testing ketone levels

There are two ways to test for ketones - ketones can be measured in urine by Ketostix or in blood by using a blood ketone meter.

It is advisable to check the expiry date on urine and blood strips before use as if they have not been used for a while they may be out of date. Urine Ketostix will remain in date to use 6 months from when they are first opened.

Blood testing for ketones is more accurate and reliable than urine ketone testing and this will be discussed on the course.

What is most important is that as a person with Type 1 diabetes you always have some method of being able to check your ketones levels.

Ketone checking equipment is an essential part of your 'Diabetes armoury kit'. Use this with caution in case of stacking of insulin correction doses.

As DKA can develop and progress quickly and makes you feel very unwell, the next section gives guidelines for you to follow if you are ill.

What action should I take if I am ill?

It is recommended that you test your blood for ketones if you are ill and always if your blood-glucose levels are over 14mmol/l.

What should I do if I have a ketone test > 0.6mmols/l?

- You should take some rapid acting insulin as soon as you can.
- Take double your correction dose.
- My doubled correction dose is: two units of rapid-acting insulin will lower blood-glucose by _____mmol.
- Drink plenty of water and sugar-free fluids.
- Test your blood-glucose and blood ketone every two hours and repeat the above correction dose until blood ketone is less than 0.6mmols.
- Try to identify cause of high blood-glucose level and seek treatment/medical advice if necessary.
- Contact diabetes team if high glucose and ketones levels persist despite applying the above actions.
- Contact your GP / Emergency Department if you are vomiting as dehydration may quickly occur.
- Continue with usual amount of background insulin / consider increasing the dose during the period of illness.

What should I do if I'm ill and my blood-glucose levels are high but I do not have ketones?

- You should continue to test for blood ketones every two hours if your blood-glucose levels remain above 11mmol/l.
- If you have a blood ketone >0.6mmols/l, treat as above with a double correction dose.
- If your blood ketone is <0.6mmols/l, but your blood-glucose levels remain above 11mmol/l, take your usual correction dose.
- My correction dose is: one unit of rapid-acting insulin will lower blood-glucose by _____mmols.
- Drink plenty of water and sugar-free fluids.
- Try to identify cause of high blood-glucose level and seek treatment / medical advice if necessary.
- Continue with usual amount of background insulin/consider increasing the dose during the period of illness.

Safety advice during periods of illness

- Always continue taking your basal insulin, even if you're not eating
- Use a correction dose if you are not eating but your blood-glucose / ketone level is elevated
- Test your blood ketone if your blood-glucose levels are above 11mmol/l
- Positive ketone tests always require treatment
- If you are unable to eat because you are ill, you can obtain carbohydrate from sources such as Lucozade, fizzy soft drinks, squashes and milky drinks
- Eat little and often, taking carbohydrate containing drinks as above, and snacks such as toast, biscuits, cereals
- Drink plenty of sugar free fluids
- Contact your GP, diabetes team or Emergency department if you are unsure what to do. Especially if you are vomiting or your blood-glucose and blood ketone levels are not reducing.

Blood ketone results interpretation

Blood Ketone Level	Advice
Less than 0.6mmol/L - Normal	Follow your healthcare professional's advice before making any changes to your medication program.
Between 0.6 and 1.5mmol/L - Medium	May indicate the development of DKA and require medical assistance. Follow your healthcare professional's instructions.
Above 1.5mmol/L - High	Contact your healthcare professional immediately for instructions and advice.

Module 10 Complete

Module 12: Healthy eating

Module aims and objectives:

Aim: Be familiar with key healthy eating guidance for the population and understand the context in relation to heart health and diabetes.

Objectives: By the end of Module 12 you will:

- Recognise the Eat Well Guide and identify the key food group and nutrients that make up a balanced diet.
- Be familiar with portion size recommendations for specific food groups
- Understand the link between dietary fat and blood lipid (cholesterol) levels
- Identify specific foods containing healthier fats within the diet and foods which are higher in unhealthier fats
- Understand the benefits of good hydration
- Be familiar with information found on food packaging and how to interpret it to make healthy choices
- Be familiar with risk factors associated with cardiovascular disease
- Be familiar with average energy requirements for men and women

Now I am counting carbohydrate can I eat what I want?

Now that you know how to carbohydrate count and adjust your insulin dose according to the carbohydrate values you are eating, you have more flexibility over your food choices whilst managing your type 1 diabetes everyday. It is still important to understand the principles of having a healthy diet and the wider benefits eating healthily can have on your general health and well-being.

This module provides you with the opportunity to test your knowledge of healthy eating and nutrition and offers you links to relevant resources to learn more. Whether you have diabetes or not, a healthy diet is important for the health of us all and we would encourage you to adopt some of the principles where you feel you can.

A sensible way to approach healthy eating is to follow the 80/20 rule:

Follow the healthy eating principles for 80% of the time or 80% of your whole diet but allow the remaining 20% for your treats and food that you may enjoy to make your eating habits sustainable.

Remember it is all about balance!



The eat-well guide

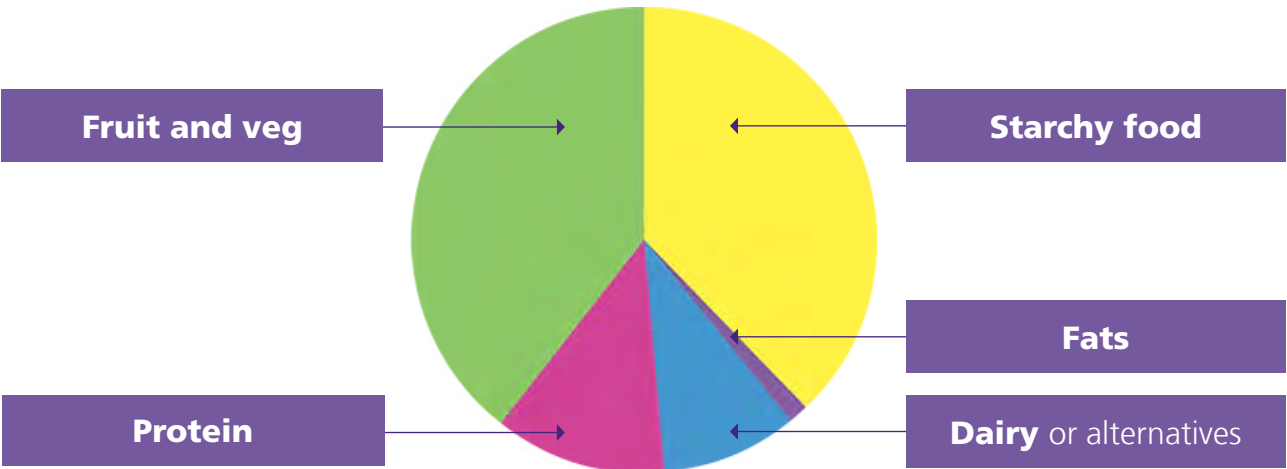
The eat-well guide translates government recommendations of healthy eating into simple messages to support us to make informed choices about our diet.

The guide separates the whole diet into five specific food groups of varying proportions. We should aim to eat foods from each of these food groups within the recommended proportions to obtain the balance of nutrients our bodies require for good health.

The key food groups:

- Starchy food
- Fruit and veg
- Protein
- Dairy
- Fats

A healthy diet consists of a regular meal pattern with a small starchy CHO portion with each meal. Food choices should be low in animal fats, high in fibre and low in sugar with plenty of fruit and vegetables. Cutting down on salt and eating more oily fish is also a healthy option.



Fruit and veg At least 5 portions of a variety of fruit and vegetables should be eaten every day.	Starchy food Choose wholegrain or high fibre and avoid added fat, sugar or salt for a healthier option.	Protein Eat more beans and pulses, and 2 portions of fish, and less processed or red meat.
Dairy or alternatives Lower fat and low sugar options should be chosen over full fat for a healthier diet.	Fats Unsalted oils and spreads are the best option, and should only be used in small amounts.	Snacks and sweets These items should be eaten less often and in small amounts to maintain a healthy diet.

What are the advantages of a healthy diet?

Eating healthily reduces the risk of weight gain, coronary heart disease, stroke and some cancers. Other risk factors such as high blood pressure and high cholesterol levels can also be reduced by healthy eating.

Food groups and suggestions

Fruit and vegetables

Current advice is to eat five portions of fruit and veg each day. One portion of fruit or vegetables is:

- 1 fist size apple, orange, pear, peach, nectarine
- 1 Small banana
- 2 plums, apricots, tangerines
- 1 dessert spoonful of dried fruit
- 1 small glass of fruit juice
- 1 handful of grapes, cherries or berries
- 2-3 tablespoons of vegetables, raw or cooked
- 1 large portion of salad (as a main course)

Try to choose your fruit and vegetable with a variety of colours. Any increase in the amount of fruit and veg you eat will help. If you're hungry between meals, fruit makes a good snack.

Dairy

Aim for three portions of dairy a day and choose low fat options where possible.

- 1 small pot (125ml) yoghurt
- 200ml glass of milk
- 40g (small matchbox size) cheese

Protein

Guidelines suggest we should have 2-3 portions of protein each day.

- Meat (pack of cards/palm of hand size)
- 2 Eggs
- 3-4 tbsp of baked beans
- White fish (cheque book or large mobile phone size)
- Oily fish (same as meat)

Fats

The Department of Health recommends that fat intake should not exceed 35% of our total daily energy intake from food. Fat has an important role to play in our bodies, however too much fat can lead to weight gain and high cholesterol levels.

Types of fat

Saturated fats: These are mainly found in animal products such as fat on meat, butter, lard, dripping, suet, full-fat dairy products, cheese, cream, coconut oil and palm oil.

Trans fats / hydrogenated fats: These are found in pastries, cakes, biscuits, crackers and hard margarines.

Monounsaturated fats: Olive oil, rapeseed oil, avocado and certain nuts (almonds and hazelnuts) are the main sources.

Polyunsaturated fats: These fats are found in sunflower oil, corn oil, soya oil, certain nuts (walnuts, pine nuts) and seeds (sunflower seeds and sesame seeds).

Omega-3-fatty acid: Is found in oily fish such as salmon, mackerel, sardines, pilchards, herring and fresh tuna. Non-fish sources include flaxseed and rapeseed oils. This polyunsaturated fat lowers your triglyceride levels. TGS is also a type of fatty substance in the blood. Omega-3-fatty acids also help prevent your blood from clotting and help regulate your heart rhythm. Eating oily fish at least twice a week can help reduce the risk of coronary heart disease.

Remember that all types of fat are high in calories, so try and limit the total amount of fat in the diet.

Which foods will affect my cholesterol levels?

Cholesterol is a waxy substance which is mainly made in the body and carried through blood by proteins. It plays an important role in how every cell works, however, too much cholesterol in the blood can increase your risk of getting coronary heart disease.

There are two different types of cholesterol, LDL (Low-density lipoprotein) and HDL (High-density lipoprotein). You should aim to have a higher HDL and lower LDL cholesterol.

This can be achieved by reducing the amount of saturated fat and trans-fats that you eat.

How can I cut down on the amount of saturated fat I eat?

- Try to grill, bake, microwave or casserole rather than fry foods.
- Choose the leanest meat and cut fat off before cooking. Substitute meat and meat products like pies, pasties, sausages and pate for fish, poultry without the skin.
- Choose semi-skimmed or skimmed milk.
- Use alternatives to cream such as low fat yogurt or fromage frais.
- Cheese is high in fat. Choose lower fat cheeses such as Edam, Mozzarella or half-fat hard cheese. Cottage cheese is low in fat.
- Substitute fruit for snacks like crisps, nuts, biscuits and chocolate.
- Use low fat spreads instead of butter. Choose a monounsaturated oil e.g. rapeseed or olive for cooking instead of lard or dripping.
- Choose low fat salad creams, mayonnaise and salad dressings.

How is blood pressure affected by what I eat?

A high salt intake can increase blood pressure in some people. If you are overweight, losing weight can help to reduce your blood pressure.

How can I reduce my salt intake?

The recommended salt intake per day is 6g, which is one heaped teaspoon salt. Tips to reduce salt intake:

- Use a minimal amount in cooking
- Avoid adding salt at the table
- Use herbs and spices to flavour food instead
- Select spices or seasonings that do not list sodium on their labels, i.e. choose garlic powder over garlic salt
- Commonplace foods high in salt are bacon, ham, crisps, salted nuts, cheese and processed foods. Cutting down on these foods will help reduce your salt intake.
- Use fresh, rather than packaged meats. Fresh cuts of beef, chicken or pork contain natural sodium, but the content is still much less than the hidden extra salt added during processing in products.
- When buying frozen vegetables, choose those that are labelled "fresh frozen" and do not contain added seasoning or sauces.
- Begin reading food labels as a matter of course. Salt content is always listed on the label. Sometimes the high sugar content in a product like apple pie can mask the high salt content so it's important to check every label for salt content.

Food labelling

What information can we get from food labels?

- Ingredients, allergens, health messages, portion size, weight, nutritional information.
- Traffic lights on the front of packaging.
- Use the 'per 100g' column on the nutritional information to assess if product is high in sugar, fat, salt.
- 'Of which sugar' includes added sugar (free sugar and natural occurring sugars in fruit / milk etc. To look closer for added sugar, check the ingredients list.
- Allergens in the ingredients list are written in bold.
- No added sugar or unsweetened doesn't mean the food doesn't contain any sugar. It only means that no further sugar was added to the food, therefore natural occurring sugars may still be present.
- 'Light' indicates that the product contains 30% less fat than the original product.
- 'Low fat' means that the product contains 3g or less fat/100g.
- A food high in salt has more than 1.5g per 100g of the product and a food equal to or less than 0.3g per 100g product is low in salt.
- Health claims on the label must be backed up by evidence in accordance with legislation 2007, e.g. healthy heart or helps aid digestion.
- Best before date is about quality, not safety. The flavour and texture might not be as good however it will still be safe to eat after this date.
- Use by date is about safety. You will see this on food that goes off quickly e.g. salads, yoghurts, and meat products. Foods can be eaten or frozen up until the use by date, but not later.

Homework: use module 12's video to help you with this activity.

Saturated fat vs unsaturated fat

Looking at the food items on the presentation slide, decide whether you think they are higher in saturated or unsaturated fats and record in the corresponding column below.



Saturated fats	Unsaturated fats

Nutritional requirements

About calories

The amount of energy in an item of food or drink is measured in calories (Kcal). When we eat and drink more calories than we use up in activity, our bodies store the excess as body fat. If this continues, over time weight may be gained.

Macronutrients in the diet provide us with calories. You can see below that fat is the most 'calorie dense' nutrient:

Macronutrient	Calories
Fat	9kcal per gram
Alcohol	7kcal per gram
Protein	4kcal per gram
Carbohydrate	4kcal per gram

Although not essential to calorie count, it is useful to have an insight into the calorie value of the foods you eat and a rough idea of the daily calorie requirements of an 'average adult' to consider your own requirements.

How can I keep my weight within the healthy range?

If you eat and drink more energy (calories) than you use you will gain weight. Weight gain or loss is determined by balancing food and physical activity. Less food and more physical activity aids weight loss.

Weight can be assessed using the body mass index (BMI). To calculate your BMI please use the NHS calculator which will let you know if your weight is in the healthy range.

How do I lose weight if I want to?

You can try to reduce the amount of energy-dense foods that you eat. Examples of these foods include those that are high in fat or sugar (biscuits, cakes, chocolate, savoury snacks, fried foods). Increasing the amount of fruit and vegetables you eat can help to fill you up.

Increasing your physical activity will help you to burn off more calories and lose weight more quickly.

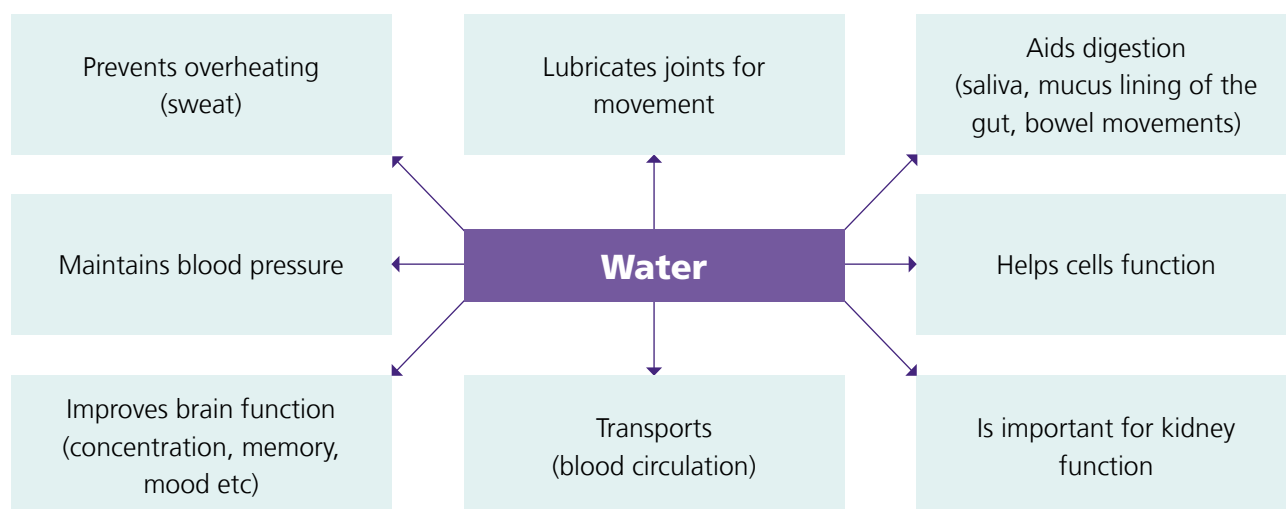
A safe and achievable target for a long-term healthier weight is to lose 1–2lbs (0.5–1kg) a week. To achieve this, you will need to consume about 600 fewer calories per day than your body needs to maintain weight. Beware of cutting calories too low, without medical supervision, as this can put your long-term health at risk.

If you feel you need more individual advice, contact your dietetics team for advice on **01623 622515 ext 6570**.

Hydration

Keeping hydrated is part of a healthy diet. Water, lower fat milk, and sugar-free drinks including tea and coffee all count towards the 6-8 recommended glasses a day. However, fruit juice and smoothies should be limited to a total of 150ml a day. We can also get more fluid from choosing foods with a higher water content, including fruit and veg, soups, stews and yoghurts.

The importance of staying hydrated



Useful website links

Eating with diabetes

www.diabetes.org.uk/guide-to-diabetes/enjoy-food/eating-with-diabetes

Eat well

www.nhs.uk/live-well/eat-well

Nutrition

www.nutrition.org.uk

The British Dietetic Association – UK Association of Dietitians

www.bda.uk.com

Let's get cooking recipes

www.bda.uk.com/food-health/lets-get-cooking/recipes.html

Cholesterol and healthy eating

www.heartuk.org.uk

British heart foundation

www.bhf.org.uk

BMI calculator

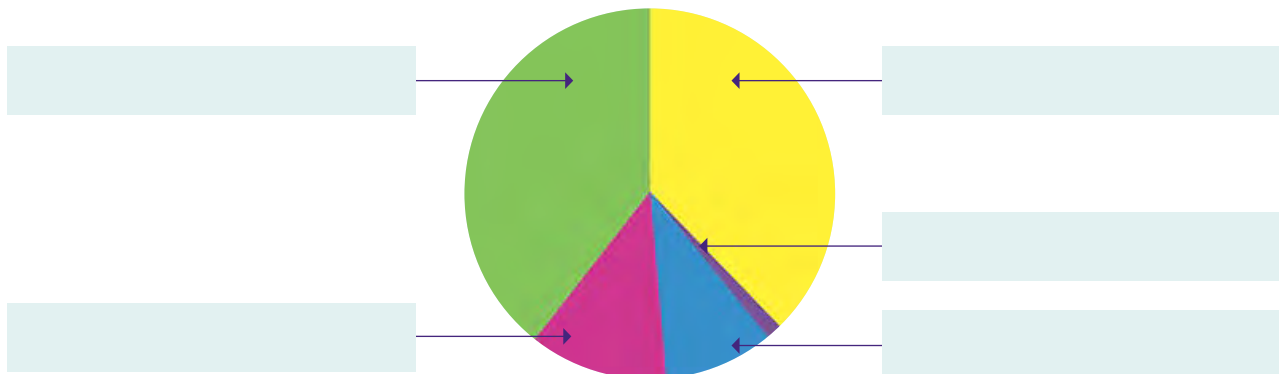
www.nhs.uk/live-well/healthy-weight/bmi-calculator

Module 12 Assessment

Healthy Eating



1. Can you name the 5 food groups that make up a healthy balanced diet?



2. What are the key nutrients we get from each food group?

3. How many portions of fruit and vegetable should we be aiming for each day?

- ☐ A. 2
- ☐ B. 4
- ☐ C. 5
- ☐ D. 6

4. Which fruits and vegetables count towards your daily target?

- ☐ A. Fresh
- ☐ B. Frozen
- ☐ C. Tinned
- ☐ D. Dried
- ☐ E. Juice
- ☐ F. All of above

5. Which of these doesn't count towards your recommended fruit and vegetable intake?

- ☐ A. Potatoes
- ☐ B. Sweet potatoes
- ☐ C. Parsnips
- ☐ D. Orange juice

6. Where does most of your Vitamin D come from?

- ☐ A. Sunlight
- ☐ B. Eggs
- ☐ C. Fortified cereal
- ☐ D. Oily fish

7. Adults require 3 portions of dairy foods each day to meet their calcium requirements which equates to approximately the calcium in 1 pint of milk. Which of these dairy foods count as 1 portion (a third) of your daily dairy requirements? (Circle all those that apply)

- ☐ A. 1 scoop of ice cream
- ☐ B. 1 small pot of yogurt
- ☐ C. 30g cheese (matchbox size)
- ☐ D. 200ml milk
- ☐ E. 1 teaspoon of butter

8. How many portions of fish should you aim to eat each week?

- ☐ A. 8
- ☐ B. 6
- ☐ C. 4
- ☐ D. 2

9. What information can you get from food packaging?

11. When reading food labels: food considered as 'low sugar' should contain how much sugar per 100g?

- ☐ A. No more than 5g per 100g for food and 2.5g
- ☐ B. No more than 7.5g per 100g for food and 5g
- ☐ C. No more than 10g per 100g for food and 7.5g
- ☐ D. No more than 12.5g per 100g for food and 10g

12. How many grams of salt is the recommended daily allowance for adults in the UK?

- ☐ A. 2g
- ☐ B. 6g
- ☐ C. 10g
- ☐ D. 20g

13. Match the correct calorie value per gram to the Macronutrient:

9kcal/1g

7kcal/1g

4kcal/1g

4kcal/1g

Macronutrient	Calories
Fat	
Alcohol	
Protein	
Carbohydrate	

Module 12 Complete

Module 14: Long-term effects of Diabetes

Module aims and objectives:

Aim: to understand the long-term effects of diabetes

Objectives: By the end of Module 14 you will:

- Understand the effects diabetes can have on the body
- Understand the treatment and management strategies available in relation to the long-term effects of diabetes
- Be aware of how to reduce the risk of developing the long-term effects of diabetes

Complications

The long-term effects of diabetes, often commonly referred to as complications, are associated with having high blood-glucose levels over a number of years. This can lead to changes and damage to certain blood vessels, capillaries and nerves throughout the body. Short periods of high blood-glucose levels will not seriously damage the body's tissues.

The areas most commonly affected by complications are:

- Eyes (retinopathy)
- Kidneys (nephropathy or renal disease)
- Blood vessels to the heart, brain, legs (cardiovascular disease)
- Nerve and nerve tissue (neuropathy)

Other risk factors for complications include high blood pressure and high cholesterol (a fat in the blood).

Will I definitely get complications?

This is a difficult question to answer. Medical studies have shown that, in most cases, the risk of developing complications can be minimized or reduced by controlling factors such as blood-glucose levels, blood pressure, lipid levels, smoking and weight control.



What can I do to reduce my risk?

Maintaining your blood-glucose levels as close as possible to the normal range should help to reduce your risk. Other risk factors like high blood pressure and cholesterol levels can be managed by either lifestyle or drug treatment.

Regular check-ups, often called your annual review allow your doctor or health care professional to screen for, and identify and treat any complications at an early stage.

What problems could I have with my eyes?

The main complication involving the eyes is called diabetic retinopathy.

This is damage to the tiny blood vessels in the membrane at the back of the eye (the retina). These changes, if left untreated, can lead to formation of new blood vessels. These blood vessels are more fragile and may bleed easily. Bleeding in the eye can lead to loss of sight.

National recommendations advise you to have your eyes checked by retinal screening every year as the treatment for diabetic retinopathy is very effective if treated early and promptly.

Retinopathy Grades; R grade, M grade and P grade.

Grades	Description
R0 No Retinopathy	No eye disease present - annual recall.
R1 Background Retinopathy	Minor changes to the retina e.g. tiny little bleeds referred to as micro aneurysms and small blot haemorrhages - annual recall.
R2 Pre-Proliferative	Intermediate changes to the retina e.g. R1 features + multiple deep blot haemorrhages, intra-retinal vascular abnormalities, venous Beading (sausage like appearance to the vessels) and reduplications (where a vessel loops around on itself forming a full loop). Digital surveillance clinics in eye screening are necessary with 3-6 monthly reviews or referral to Ophthalmology.
R3 active Proliferative Retinopathy	Advanced diabetes eye disease e.g. R1 and R2 features + new vessels at the optic disc, new vessels elsewhere on the retina, pre-retinal haemorrhage (bleeding within the layers of the retina), vitreous haemorrhage (bleeding into the jelly of the eye), retinal traction and Fibrosis and a detached retina. This will require an urgent referral to ophthalmology, to be seen within 2 weeks.
R3 stable Treated Proliferative Retinopathy	Evidence of pan retinal photocoagulation (Laser treatment) to treat the active features of R3, no new bleeds or new vessels present.
M0 No Maculopathy	No exudate (cholesterol leakage) within 1 disc diameter of the macula (the part of the eye responsible for focused vision). Referral dependent on R grade.
M1 Maculopathy	Exudate within 1DD of the Macula and/or dot or blot haemorrhages with a visual acuity of 6/12 or less. Routine referral to Ophthalmology or digital surveillance clinics depending on severity.
P0	No evidence of Pan Retinal Photocoagulation (PRP=laser treatment).
P1	Evidence of PRP

What are the common treatments for retinopathy?

Laser treatment is the commonest treatment for retinopathy and is highly effective. It consists of a number of tiny laser beams being shone through the pupil (the black part of the eye) directly onto the retina. This seals the blood vessel and reduces the risk of bleeding and of loss of sight. This treatment is often given in an outpatient clinic and is not normally painful, although it is described as a strange sensation.

In some cases of diabetic maculopathy injections of a medicine called anti-VEGF may be injected directly in to your eye to prevent new blood vessels forming, the main injections used are Lucentis and Eylea.

Does diabetes increase the risk of cataracts?

High blood-glucose levels increase the risk of frosting of the lens of the eye which is what causes cataracts. This will result in blurring of vision and haziness around bright lights. A cataract will also make eye screening difficult, as it will be difficult to see the retina. A different investigation may be required. If necessary, the lens can be extracted and replaced and this is usually performed under local anaesthetic.

What problems can I get with my kidneys?

The main complication involving the kidneys is diabetic nephropathy. This is damage to the blood vessels in the kidney which become thickened and cause irregular filtering of the blood. The first sign of nephropathy is leakage of very small amounts of protein (microalbuminuria) in the urine. Urine should be tested for the presence of albumin annually, this is called a Microalbumin screen. The result for microalbumin is reported as albumin:creatinine ratio (ACR).

The normal reference range for the ACR

- Male < 2.5mgs/ml
- Female <3.5mgs /ml

Your health care professional will also check a blood test to check how your kidneys are filtering, this is called estimated glomerular filtration rate (eGFR). The normal range for eGFR is above 90

What treatment is available for nephropathy?

Nephropathy is usually treated by a tablet called an ACE inhibitor and by good blood pressure control. Good control of your blood-glucose levels can also help to prevent any further deterioration in your kidney function.

What problems can I get with my feet?

Diabetes can affect the nerves and the blood supply to the feet. Over the years, the nerve endings to the feet can be affected by high blood sugars levels and duration of diabetes, this can affect the sensation in the feet. You may lose the ability to feel pressure, pain and heat in your feet. Pain helps alert us to danger. If you lose the sensation in your feet it becomes very easy to damage them and not be aware of it. This nerve damage is called Neuropathy.

People with diabetes are more at risk of developing narrowing of the blood vessels. This can happen throughout the body, but is particularly common in the legs. Wounds or ulcers may be slow to heal as a result. The risk of narrowed blood vessels is increased with long standing high blood sugars, if you have high blood pressure, high cholesterol or smoke.

Steps to take to healthy feet

- Have your annual foot check, where a healthcare professional will assess your circulation and sensation in your feet.
- Know your risk. At your annual review foot check you should be told if your feet are low, moderate or high risk of developing problems and referred to an appropriate health care professional if required.
- Look at your feet daily, if you are unable to ask someone to help. If you see any colour changes, swelling, cuts or bruises not improving, build-up of hard skin, pain or anything unusual discuss with your diabetes team.
- Keep your feet clean and dry, moisturise if needed.
- If you lose feeling in your feet, never go bare foot especially on hot sand or gravel, do not sit too close to hot radiator or heaters and take care with hot water bottles and hot water.
- Take extra care when cutting toe nails and if you are having problems with thick nails, not being able to reach to cut your nails, or you can't see very well ask for a referral to an NHS podiatrist.
- Do not use corn removing plasters or blades. If you have corns ask for a referral to a podiatrist to be treated.
- Always wear well-fitting shoes and clean socks.
- Maintain good blood-glucose control, this will help to reduce the risk of future problems.

Foot care is just good old fashioned common sense. You are given one pair look after them and they will look after you.

Healthy eating for a healthy lifestyle: Heart health and Diabetes

Having diabetes increases your risk of developing cardiovascular disease (CVD), but following a healthy diet can help reduce the risk. The link with diabetes and CVD is that having high blood-glucose levels over a prolonged time period can cause damage to the lining of blood vessels. Some describe it as having 'sticky blood vessels' which encourage fatty deposits to stick to the vessel wall and over time forms a plaque which accumulates, narrowing and may eventually block the vessel.

If blood flow is slowed and reduced, then less oxygen can be delivered to all organs and muscles. If the vessel is blocked completely then the neighbouring organ is starved of oxygen and stops functioning.

- If a narrowed vessel occurs in the heart then this causes Angina symptoms
- If a vessel in the heart is completely blocked then it causes a Myocardial infarction (heart attack)
- A narrowed or blocked vessel in the brain causes a stroke

Blood clots can also occur which may cause blockages when parts of the plaque breaks away and enters the blood circulation but can become trapped and block blood flow in any narrowing vessels throughout the body. This can again cause strokes, heart attacks, and also peripheral vascular issues in the legs – commonly known as a Deep Vein thrombosis (DVT).



Cardio-Vascular Disease (CVD)

People with diabetes are at an increased risk of cardiovascular disease.

The term CVD includes heart disease, stroke and all other diseases of the heart and circulation. The increase in cardiovascular disease arises due to the multiple risk factors associated with having diabetes. These risk factors include high blood pressure, high blood cholesterol, smoking, obesity, lack of physical activity, along with poor control of blood-glucose levels.

Your major blood vessels consist of arteries which carry blood away from your heart, and veins which return it. Damage to these vessels is referred to as **macrovascular disease**.

Capillaries are the tiny vessels where the exchange of oxygen and carbon dioxide takes place. When damage occurs to these vessels, this is referred to as **microvascular disease**.

When fatty materials such as cholesterol form deposits on the walls of the vessels (known as plaque), it furs up the artery and reduce the space for blood flow. This is described as **arteriosclerosis or atherosclerosis**.

If the plaque ruptures the artery walls, blood cells (called platelets) try to repair the damage, but this will cause a clot to form. Over time, the walls of the blood vessels lose their elasticity. This can contribute to the development of high blood pressure or hypertension, which can cause more damage to the blood vessels.

The force of blood being pumped from the heart can make the clot break away from the artery wall and travel through the system until it reaches a section too narrow to pass through. If this happens, the narrow section will become partially or completely blocked. Blockage of an artery leads to the part of the body it supplies being starved of oxygen and nutrients it needs. This is the cause of heart attacks or strokes (affecting the brain). Narrowing of the blood vessels can affect other parts of the body, such as the arms or legs. This is called peripheral vascular disease (PVD). This may produce intermittent claudication (pain in the calf muscle). If left untreated, amputation of the limb may eventually be necessary.

It is therefore important for people with diabetes to manage cardio vascular risk factors by making lifestyle changes such as eating a healthy diet, taking part in regular activity, reducing weight if you are overweight and stopping smoking.

Steps you can take to help prevent CVD

- If you smoke, ask for help to stop.
- Eat a healthy, balanced diet.
- Be more physically active.
- If you are overweight, try to get down to a healthy weight. Any weight loss will be beneficial.
- Take your medication as prescribed.
- Have your HbA1c checked at least annually.
- Have your blood pressure checked at least annually – the target for a person with Type 1 diabetes is: 135/85mmHg, if you have albuminuria: 130/80mmHg.
- Have your cholesterol/Lipid levels checked annually.

Neuropathy

The nervous system is like the body's electrical wiring. Nerves are specialised cells which carry tiny electrical currents from the brain, through the spinal cord and to every part of the body. There are many types of nerves. Sensory nerves convey sensation from all parts of the body up to the brain. Motor nerves carry impulses from the brain down to different parts of the body to control movement of muscles. So, if for example, you step on a pin, the sensory nerves for pain will carry a signal from your foot to your brain, which will make you feel the pain. A signal will then travel down the motor nerves to the muscle in your leg to make you lift the foot up and away from the pin. High glucose levels over many years can cause damage to the nerves. This is because glucose tends to slow down the electrical current through the nerve cells. This can eventually lead to:

- Damage to the nerves to the feet causing loss of sensation, numbness, tingling
- Damage to nerves controlling blood flow to the penis is one of the most common causes of erectile dysfunction in men with diabetes.
- Nerve damage to the gut can cause heartburn or constipation, diarrhoea, sickness - referred to as gastroparesis
- Nerve damage to the bladder can cause difficulty passing urine
- Nerve damage to sweat glands can cause excessive sweating - referred to as hyperhidrosis

Diabetic nerve damage (neuropathy) can be prevented by maintaining good control of your blood-glucose levels.

As yet there are no specific treatments to prevent or reverse nerve damage. There are several treatments which are effective at controlling the symptoms (such as Viagra for erectile dysfunction for heartburn). In many cases, achieving good blood-glucose control can lead to improvement in symptoms, but often the changes are permanent.

National recommendations advise an annual foot check to test sensation in the feet and check for any sign of nerve damage.

Annual review

Your annual review is a chance for you to discuss your diabetes management with your health care professional. This provides the opportunity to screen for any diabetes complications.

Information should be available to you about the results of your test and investigations you have had.

Diabetes UK list 15 health care essentials people with diabetes should receive:

- Your blood-glucose levels measured (HbA1c test)
- Your blood pressure measured and recorded
- Your blood fats checked (cholesterol/lipids)
- Your eyes screened for signs of retinopathy
- A foot assessment
- Your kidney function is checked
- Your weight checked and recorded
- If you smoke, support to help you stop
- A care planning review to discuss and agree goals between you and your health care team
- Access to a local education course
- If you are a child, care from Paediatric health care professionals
- Continuing high quality health care when you are in hospital
- If you are a woman who is planning to have a baby, high quality support from specialist healthcare professionals from pre conception through to postnatal care
- Help from specialist health care professionals to manage your diabetes
- Emotional and psychological support

Test	Target	Result	Comment
HbA1c	48mmols		
Blood pressure	Less than 130/85 mmHg		
Total Cholesterol	Less than 4 mmols/l		
HDL Cholesterol	Men above 1.0mmol/l Women above 1.2mmol/l		
LDL Cholesterol	Less than 2 mmols/l		
Triglycerides	Less than 1.7 mmol/l		

Module 14 Complete

Module 15: Diabetes technology

Module aims and objectives:

Aim: Understand the diabetes technologies available in diabetes.

Objectives: By the end of Module 15 you will:

- Have knowledge and be aware of the diabetes technologies available.
- Be able to understand and describe how the technologies work.
- Understand the criteria and funding arrangements required for the various diabetes technologies available.

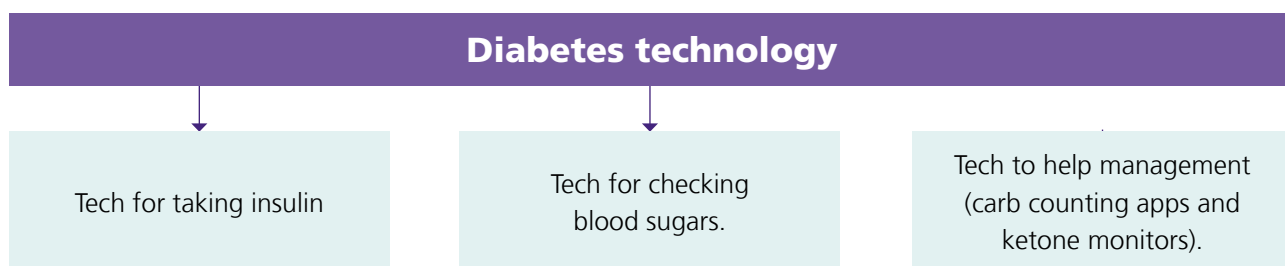
Technology and diabetes

Diabetes technology is the term used to describe the hardware, devices, and software that people with diabetes use to help manage blood-glucose levels, stave off diabetes complications, reduce the burden of living with diabetes, and improve quality of life.

For some people with diabetes, technology can be a really important part of how they manage their diabetes. But it's not right for everyone.

There are lots of different types of diabetes tech, like insulin pumps and continuous glucose monitors (CGM for short). When you hear your healthcare professional talking about diabetes technology, they'll usually be referring to tech that helps you take insulin or tech to check your blood-glucose levels.

So before you decide to use diabetes technology, it's important to think about whether it's the best choice for you. Diabetes tech doesn't necessarily make managing your diabetes easier and some people can find it overwhelming.



Technology for taking Insulin

Everyone with Type 1 diabetes will take insulin. The most common way for you to take insulin is with an insulin pen. But now there are more ways to deliver insulin, thanks to changes in technology.

Continuous Subcutaneous insulin infusion – Insulin pumps

What is an insulin pump?

- All insulin pumps now available on the NHS functions as a Hybrid Closed Loop (HCL) system, sometimes known as an 'artificial pancreas'.
- An insulin pump is a small electronic device that delivers a continuous supply of insulin throughout the day and night, according to your bodies needs' throughout the day and night.
- There are two types of insulin pump, a tethered pump and a patch pump.
- Both types of pumps are attached to your body by a tiny tube called a cannula, which goes just under your skin. You will need to learn how to change the cannula yourself.
- You need to change your cannula every two or three days and make sure you move to a different place every time you change it. This is really important because you can develop lipohypertrophy, which is where your body forms hard lumps that stop insulin working properly. You should also change sites to stop itching and rashes that form if you continue to use the same site for too long.

Tethered pumps

What is a tethered insulin pump?

- A tethered pump is attached to your body by another small tube that connects to your cannula.
- The pump itself usually has all the controls on it and can be carried on your belt, in a pocket, or in a body band. You can wear it under your clothes if you don't want it to be on show.
- Tethered pumps can vary in things like colour, screen size and some have extra features like Bluetooth remotes.
- A tethered pump attaches directly on to your body where you've chosen to place your cannula. People tend to put them on their legs, arms or stomach.
- Your healthcare team will talk with you about the pump they think will work best for you, or which one you can get on the NHS.

Patch pumps

What is a patch pump?

- A patch pump attaches directly on to your body where you've chosen to place your cannula. People tend to put them on their legs, arms or stomachs.
- Patch pumps have no extra tubing, which means the pump sits directly on your skin and it works by using a remote device, commonly called a handset.
- Unlike a tethered pump, patch pumps are disposable. You'll need to change the whole device when the pump alerts you, not just the infusion set.
- Your healthcare team will talk with you about the pump they think will work best for you, or which one you can get on the NHS.

What is a HCL systems?

A hybrid closed-loop systems work by linking insulin pumps and continuous glucose monitors (CGM) so they can “talk” to each other. This is done by a computer algorithm that can calculate the amount of insulin someone needs based on blood sugar readings so the pump can automatically give accurate and timely doses.

This allows the system to do some of the work to help manage blood sugar levels. Manual input is still needed to alert the system when eating or doing exercise.

There’s lots of evidence to show that the technology can help people with type 1 diabetes to improve their blood sugar levels, have less hypos and make self-managing the condition easier.

Different parts of a hybrid closed loop system

Not all types of continuous glucose monitors and insulin pumps can work together.

Continuous glucose monitor

A small sensor that sits under your skin. It continuously sends your blood sugar readings to a separate device like a mobile phone or direct to your insulin pump.

The algorithm

A computer programme that reads the blood sugar info and works out how much insulin is needed. The algorithm can be part of an app on a separate device like a mobile phone or may be part of the insulin pump itself.

An insulin pump

The pump automatically releases insulin into your body whenever you need it based on your blood sugar readings (except for mealtimes when the pump still needs info about carb amounts in your food). To work as a hybrid closed loop, it needs to be able to communicate with a CGM sensor, sometimes called a looping, sensor augmented, or an integrated pump.

NICE recommendations hybrid closed-loop Insulin Pumps

Under the new recommendations, hybrid closed-loop has been recommended for adults living with type 1 diabetes who have an HbA1c of 58 mmol/mol (7.5%) or higher, or have disabling hypoglycaemia, despite best possible management with at least one of the following:

- Continuous subcutaneous insulin infusion (CSII) (i.e. an insulin pump)
- Real-time continuous glucose monitoring (CGM)

Hybrid closed-loop has also been recommended for:

- Children and young people (under 18 years old) living with type 1 diabetes
- People living with type 1 diabetes who are pregnant or planning to become pregnant.

The guidance goes on to say that hybrid closed-loop systems should only be used with the support of a trained multidisciplinary team experienced in insulin pumps and continuous glucose monitoring in type 1 diabetes.

It also says that eligible people and their carers should be able to use them safely and either be offered an approved structured education programme or know how to manage insulin dosing and adjustments.

The pros and cons of Insulin pump therapy

Diabetes technology isn't right for everyone. Here we'll take you through the pros and cons of having an insulin pump, so you've got all the information you need to make your own decision.

Advantages of Insulin pumps	Disadvantages of Insulin pumps
- Blood-glucose levels more often in your target range. Most people often have fewer highs and lows. - You won't have to inject as often. - You can tailor your insulin more easily before, during and after exercise. - You'll have more flexibility in what, when and how much you eat. - Better accuracy when you're bringing down high sugar levels.	- You'll still need to inject sometimes. - You'll need to have your pump attached to you all the time. Only take it off for small breaks, like when you're swimming or showering. - The infusion set can sometimes get blocked, so you might need to change it at short notice. - You'll need to take a lot of time to learn about your pump. - There's always a small risk of infection from the cannula. - There is an increased risk of developing diabetic ketoacidosis.

Technology for blood-glucose monitoring

It's important that you try to achieve your blood-glucose target levels to avoid serious diabetes complications. Blood-glucose monitors have historically been the only way to check your blood-glucose levels and have been around for a long time.

Using diabetes tech can help you to keep a closer eye on your blood-glucose levels and help you to reach and maintain your target levels. These are known as Continual Glucose Monitors (CGM).

What is CGM?

CGM is a small sensor that you wear just under your skin. It records your glucose (sugar) levels continuously throughout the day and night. You can find out your glucose levels by opening the app whenever you want to.

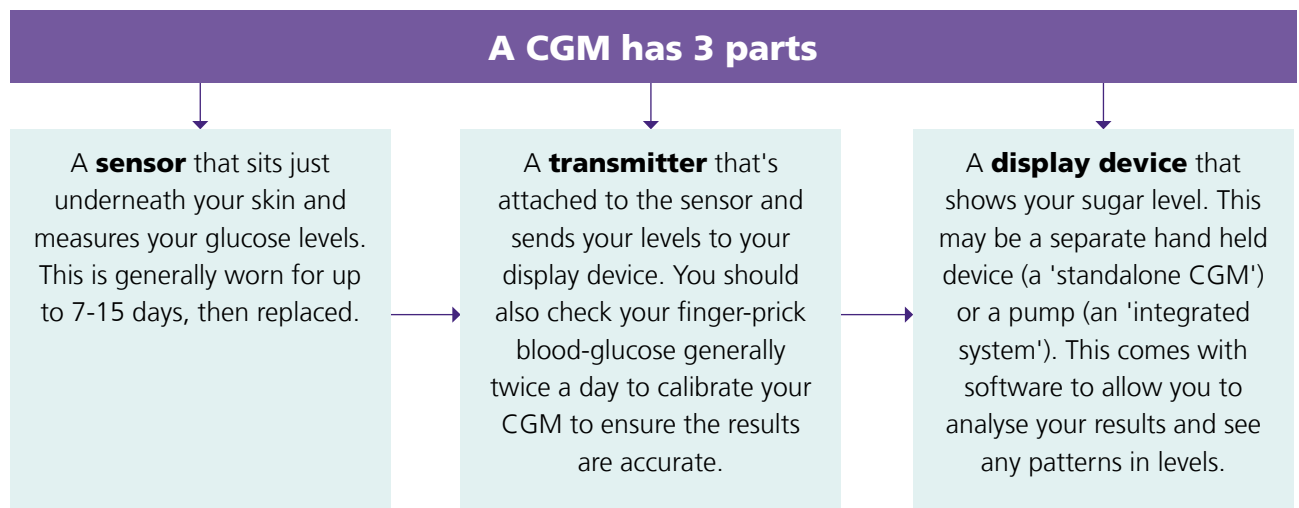
The sensor doesn't actually measure your blood glucose level, it measures the amount of glucose in the fluid that surrounds your body cells – called interstitial fluid. There is a small-time delay when checking this fluid, especially after eating or if you're exercising.

Your CGM result isn't always exactly the same as your finger-prick result. A finger prick is a more accurate result. This means you'll still need to do a finger-prick check if your blood-glucose does not match how you are feeling or if you're treating a hypo.

A CGM has two parts:

1. A sensor that you wear under your skin which measures your blood-glucose levels.
2. This will link via Bluetooth to an app on your SMART phone. If you can check on the company's websites which phones are compatible, but if you do not have a compatible phone, then a reader or receiver can be used.
 - CGM also comes with software so you can analyse your results and see patterns in your glucose levels.
 - On both the app and the software you will be able to see your time in range (3.9-10), a time in range of 70% can equate to an HbA1c of 58mmol/mol.
 - Sensor wear can range between 7 to 15 days depending on the make of sensor.

How does it work?



What does a Continuous Glucose Monitor do?

A CGM monitors your glucose levels continuously and sends data to your display device (a hand held monitor or pump). You can set alerts for high, low or rate of change.

Pros and cons of using CGM

Advantages of CGM	Disadvantages of CGM
- You can track your glucose levels through the day and night. - You can see what your levels are at times when you wouldn't normally test, e.g. during the night. - You can see trends: when your glucose levels are starting to rise or drop, so you can take action earlier. - Generally, you don't need to do so many finger prick checks. - It can help improve your HbA1c level as you can tailor your insulin doses more carefully. - It can help reduce hypos as you can see a downward trend before you actually go hypo. - You can set it to alarm at high and low levels.	- You can get overloaded with data, which can confuse or worry you. - You will still need to do some finger prick checks. - You may find wearing the sensor irritating or unsightly. - You need to be motivated to use the data it gives you to get the best diabetes management.

Module 15 Complete

Further resources

Type 1 DM general information

www.diabetes.org.uk

www.bda.uk.com

www.t1resources.uk

Carbohydrate counting

www.bidec-e-learning.com

www.carbsandcals.com

shop.diabetes.org.uk/products/carbs-count-e-book

Exercise

www.runsweet.com

www.excarbs.com

Technology

www.inputdiabetes.org.uk

Travelling

www.voyagemd.com

Apps

Carbs & Cals

Nutracheck

MyFitnessPal

Peer Support

Various Social Media Platforms

Notes