CARBS COUNT

An introduction to carbohydrate counting and insulin dose adjustment

DIABETES UK
CARE. CONNECT. CAMPAIGN.

Contents

This book is aimed at adults with Type 1 diabetes

Introduction: Carbohydrate counting and insulin dose adjustment

Carbohydrate counting is a method of matching your insulin requirements with the amount of carbohydrate you eat and drink.

For many people with Type 1 diabetes, it is an effective way of managing the condition, which, once mastered, will lead to better blood glucose control and greater flexibility and freedom of lifestyle.

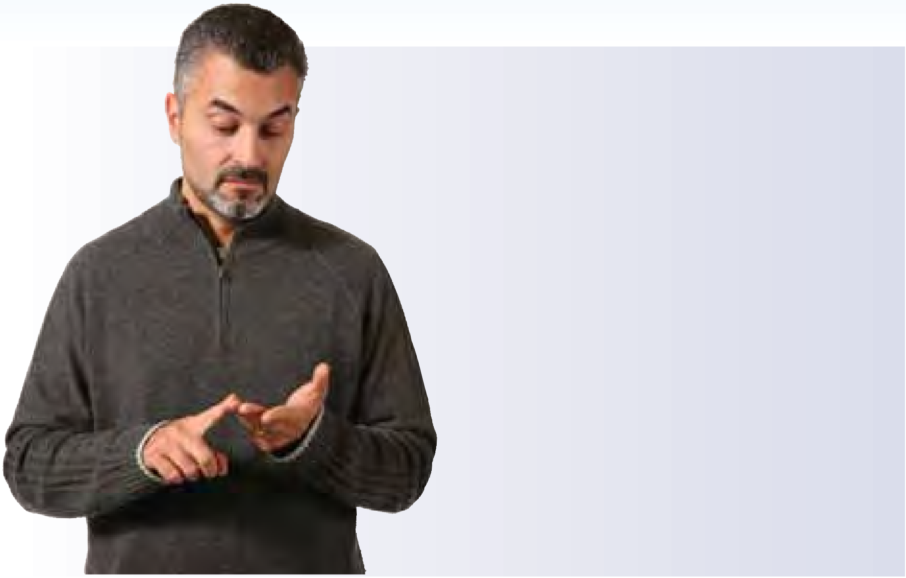
It is an approach that requires a great deal of time and effort. To do it successfully you will need to learn all about carbohydrates, learn how to adjust your insulin and be dedicated to monitoring your blood glucose levels frequently. You will also need the support of professionals either in the form of your diabetes healthcare team or one of the structured diabetes education courses available (see Chapter 10).

This book aims to support and increase your understanding of this method of managing diabetes.

This book will help you to:

- identify those foods that contain carbohydrate
- calculate the amount of carbohydrate these foods contain
- start looking at how much insulin to take for the amount of carbohydrate consumed.

We have also provided a pocket-sized book of carbohydrate values to use in your calculations.



The benefits

Learning to carbohydrate count and insulin dose adjust takes time, professional support, effort and practice. However, once you are confident you should be able to:

- vary the times you eat and the amount of carbohydrate you eat
- predict blood glucose responses to different foods
- enjoy a wider variety of foods.

Is this book for you?

This book is for adults with Type 1 diabetes who manage their blood glucose levels with a basal bolus insulin regimen. A basal bolus regimen uses a long-acting (basal) insulin to keep glucose produced by your liver under control, with additional short or rapid-acting (bolus) insulin to cover carbohydrate containing food and drink.

The general principles of carbohydrate counting are the same for people on insulin pump therapy as those on multiple daily injections. If you are considering starting on an insulin pump, it is important to understand and be able to follow the principles of carbohydrate counting beforehand.

What can you learn from this book and is it enough to start carbohydrate counting?

This book has been produced as an introductory guide to carbohydrate counting and insulin dose adjustment. It provides background information on carbohydrates and how to carbohydrate count. It also provides information on the different types of insulin, how they work and how each one should be adjusted according to what you eat and drink and the amount of physical activity you do. There are examples to follow and to do yourself to help you become familiar with this method of diabetes management.

By working with your healthcare team, you can use this book to start carbohydrate counting.

It can also be used as a refresher or reference guide after completing a diabetes structured education course (see Chapter 10).

IMPORTANT: The information in this book can be used in addition to the advice of trained healthcare professionals and recognised diabetes education courses **but it should not be used as a complete replacement for either of these.**

Chapter 1:
Understanding diabetes

To get to grips with how and why carbohydrate counting works, you'll need to have a good understanding of diabetes.

In this chapter you will find out about the following:

- **What is Type 1 diabetes?**
- **Symptoms of high blood glucose levels**
- **Targets for good blood glucose control**

What is Type 1 diabetes?

Having Type 1 diabetes means that your body does not produce any insulin.

Insulin is a hormone which is produced by the beta cells in the pancreas. Insulin acts like a key to unlock cells. It allows glucose in the blood stream to enter the cells. Type 1 diabetes is always treated with insulin.

Glucose is used by the body's cells for energy. Glucose comes mostly from the digestion of carbohydrate containing food and drink as well as from stores in the liver (see Chapter 2).

When insulin is not present, glucose cannot enter the cells and it builds up in the blood.

Type 1 diabetes develops when the insulin-producing cells (beta cells) in the pancreas have been destroyed. Nobody knows for sure why these cells are destroyed but the most likely cause is the body's immune system developing an abnormal reaction to the cells (autoimmune). This may be triggered by a virus, other infection, or environmental factors.

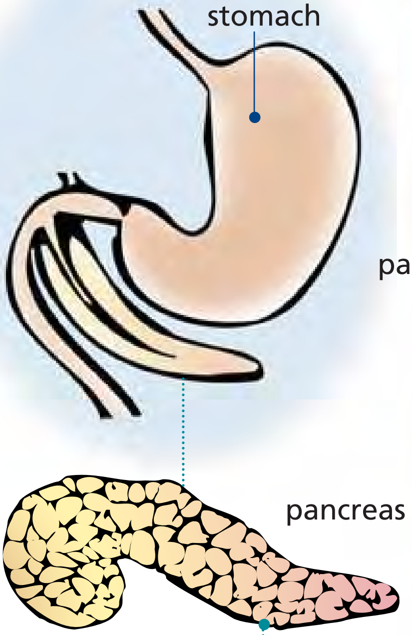
Insulin secretion and glucose regulation in the body is a fine balancing act. In people without diabetes, the amount of insulin increases and decreases automatically to keep blood glucose levels steady. Insulin is released continually over the course of the day, with extra insulin released when carbohydrate is eaten or drank. However, if you have Type 1 diabetes, this balance needs to be maintained by taking insulin throughout the day to stop your blood glucose levels from becoming too high.

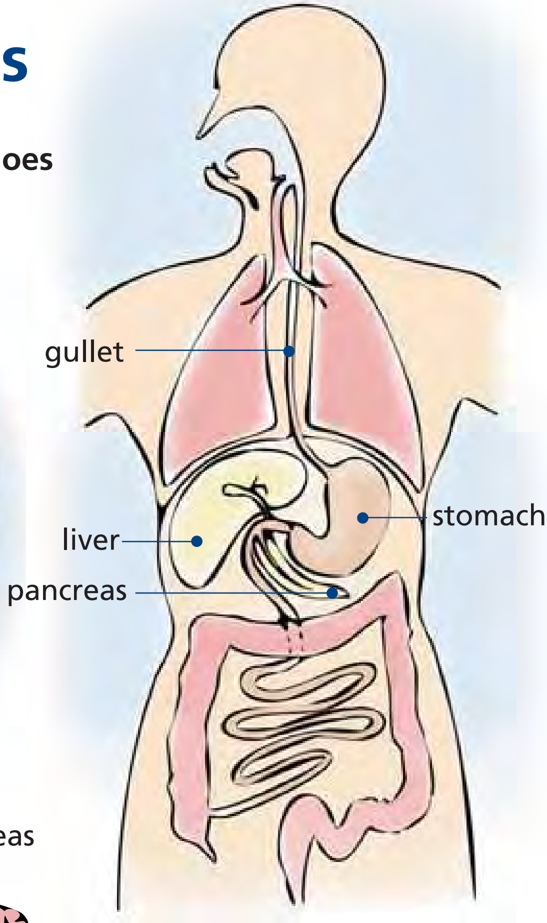
Type 1 diabetes is different from Type 2 diabetes in the following ways:

	Type 1	Type 2
At diagnosis	• Quick onset of symptoms • Generally below the age of 40 years old • Experience unexplained weight loss • Ketones present	• Slow onset of symptoms • Possibly no symptoms • Generally above the age of 40 years old (or above 25 years old if black or South Asian)
Physiology	• Autoimmune response • No insulin produced	• Insulin resistance • Some insulin produced
Treatment	• Insulin	• Lifestyle changes (food and physical activity) • Diabetes medication • Insulin

The pancreas

In people with Type 1 diabetes, the pancreas does not produce insulin.





microscopic appearance of pancreatic cells

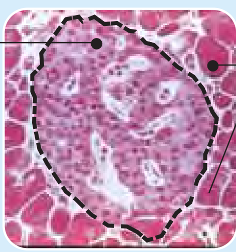


Illustration: Paul Grimes **Photography:** Blackwell Science Ltd.

Symptoms of high blood glucose levels

As blood glucose levels rise, you experience the symptoms of diabetes. You might have experienced some or all of the following symptoms before you were diagnosed with diabetes and may experience them now, when your blood glucose levels are running high.

- Passing lots of urine, especially at night – because your kidneys try to flush out the excess glucose.
- Increased thirst – to replace the increased fluid passed as urine.
- Tiredness – because the glucose cannot enter the cells to be used as energy.
- Unexplained weight loss – because your body's fat stores are broken down for energy, producing ketones.
- Genital itching or regular episodes of thrush – the excess glucose in your urine provides the ideal environment for bacteria to thrive.
- Slow healing of cuts and wounds.
- Blurred vision – molecules of glucose enters the lens (the front part) of the eye and affect your vision.

Good blood glucose control

Good blood glucose control means consistently keeping your blood glucose levels as near to normal as possible, mirroring those of someone without diabetes. For adults with Type 1 diabetes this is between 4–7 mmol/l before meals and less than 9 mmol/l two hours after meals. These targets can be difficult to achieve but evidence shows that once they are reached and maintained they can significantly reduce the risk of serious diabetic complications later on in life. For more information on diabetic complications such as cardiovascular disease (heart disease and stroke); retinopathy (eye disease); neuropathy (nerve disease) and nephropathy (kidney disease) see the glossary on page 115.

Evidence from the Diabetes Control and Complications Trial (DCCT) shows that achieving an HbA1c (see glossary) of less than 48 mmol/mol (6.5 per cent) reduced the risk of developing the long term complications of diabetes later on in life. This involved nearly 1,500 people with Type 1 diabetes throughout the USA and Canada. The trial was planned to be conducted over 10 years from 1983 to 1993 but the results were so clear that the study stopped a year ahead of schedule.

Hypoglycaemia

One of the other findings of the DCCT was that keeping tight blood glucose control can increase the risk of a hypo (low blood glucose level) although more recent research has shown that this does not have to be the case.[1, 2, 3]

Everyone with Type 1 diabetes is likely to have some hypos and, for some people, an increased risk of even mild hypos will be unacceptable. It is important to find a way of managing your diabetes, which is flexible enough to suit you but which also reduces your risk of developing future complications.

Please discuss your own personal blood glucose targets and any concerns regarding hypoglycaemia with your diabetes specialist.

Understanding what causes hypos and being able to recognise the signs, symptoms and how to best treat them, will help. For more information on hypos, see Chapter 9.

Summary

- Diabetes is a condition where the levels of glucose in the blood are not automatically controlled.
- Glucose comes from the digestion of carbohydrate containing foods and drinks and is also produced by the liver.
- Insulin is a hormone that acts like a key allowing glucose into the cells for energy.
- No-one knows for sure what causes Type 1 diabetes. It is thought to be linked to an autoimmune response.
- The symptoms of diabetes include: passing lots of urine; increased thirst; tiredness; unexplained weight loss; thrush or genital itching; slow healing of cuts wounds and blurred vision.
- Good blood glucose control reduces the risk of long term diabetes complications, such as heart disease, stroke, blindness, kidney disease and amputations.

Chapter 2: **Carbohydrates**

Before you start carbohydrate counting you'll need to have a good knowledge of carbohydrate, what it does and what food and drinks it is found in.

In this chapter you will find out about the following:

- **What is carbohydrate?**
- **Why carbohydrate is important in the diet**
- **Foods and drinks that contain carbohydrate**
- **Foods and drinks that you may not need to count.**

What is carbohydrate?

Carbohydrate is a nutrient that is an important source of energy in the diet. All carbohydrates are broken-down into glucose, which is used by the body's cells as fuel.

Carbohydrate can be classified in a number of different ways, but essentially there are two main types – starchy carbohydrates and sugars.

Starchy carbohydrates are foods like bread, pasta, chapattis, potatoes, yam, noodles, rice and cereals.

Sugars include table sugar such as caster and granulated (sucrose), and can also be found in fruit (fructose), and some dairy foods (lactose). It can often be identified on food labels as those ingredients ending with –ose.

Another type of food that can affect blood glucose levels are nutritive sweeteners, including polyols. If you are unsure what these are, they tend to end in –ol eg sorbitol, malitol, xylitol and mannitol.

The actual amount of carbohydrate that the body needs varies depending on your age, weight and activity levels, but it should make up about half of what you eat and drink. For good health, most of this should be from starchy carbohydrate, fruits and some dairy foods, with a small amount of your total carbohydrate to come from sucrose.

Why carbohydrate is important in the diet

Glucose from carbohydrate is essential to the body, especially the brain, as it is our body's primary source of fuel.

Some carbohydrates may help you to feel fuller for longer after eating. High fibre carbohydrates, such as wholegrain and fruit also play an important role in the health of the gut.

Food and drink that **contain carbohydrate**

Carbohydrate is digested at different rates by the body and can be divided into three main groups – fast, medium and slow acting (see table).

Food and drink that **do not contain carbohydrate**

Protein
- Meat, fish (white and oily), seafood, eggs
- Check food labels of sausages and burgers as they may contain carbohydrate

Fat
- Butter, lard, ghee, margarine, oils

Dairy
- Cheese

Vegetables
- Salad and most vegetables

Drinks
- Water, sugar free and diet drinks and squashes.
- Tea and coffee (without milk)

The three main carbohydrate groups

Fast acting carbohydrate – ideal for hypo-treatment



Food and drink

- glucose drinks and tablets
- ordinary soft drinks and squash
- chewy sweets, gums, jellies, mints.

How this fits in with carbohydrate counting

These foods and drinks cause a rapid rise in blood glucose levels and may be good first line hypo treatments (see Chapter 9). If they are not being used as a hypo treatment, these carbohydrates should be matched with fast-acting (bolus) insulin.

Medium and slow acting carbohydrate











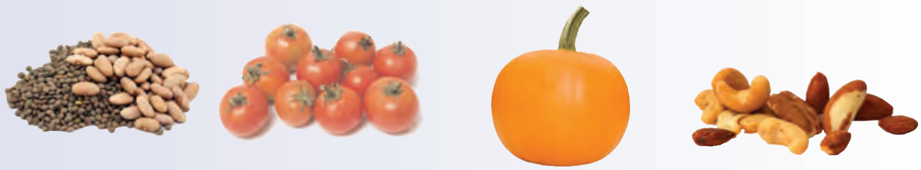
Food and drink

- bread, chapattis
- potatoes and sweet potatoes
- breakfast cereals and oats
- rice and pasta
- flour
- most fruit
- milk, yogurt and ice cream
- potato products e.g. chips and crisps
- products made from flour, eg biscuits, cakes, Yorkshire puddings, pancakes, pastry
- breaded products e.g. breaded fish and scotch egg
- chocolate
- honey, jam and other conserves
- sugar.

How this fits in with carbohydrate counting

By working out the amount of carbohydrate in these foods you will be able to control your blood glucose levels by matching it with the right amount of fast-acting (bolus) insulin.

Slow acting carbohydrate



Food and drink

- pearl barley
- peas, beans and lentils
- some vegetables, including sweetcorn, squash/pumpkin and parsnips
- some fruit, including tomatoes, cherries, grapefruit, lemon and lime
- nuts, Quorn, tofu, soya.

How this fits in with carbohydrate counting

Although these foods do contain some carbohydrate, they are absorbed very slowly and may not need to be matched with insulin, unless eaten in large quantities.

Summary

- There are two main types of carbohydrate, starchy carbohydrates and sugars.
- The vast majority of carbohydrate you eat should be made up of starchy carbohydrate, fruits and milk; with a small amount of your total carbohydrate to come from sucrose.
- Different foods and drinks contain different amounts of carbohydrate that are absorbed at varying rates.
- Some foods and drinks do not contain any carbohydrate at all.
- Carbohydrate is essential and should not be excluded from the diet.

Chapter 3:
Insulin

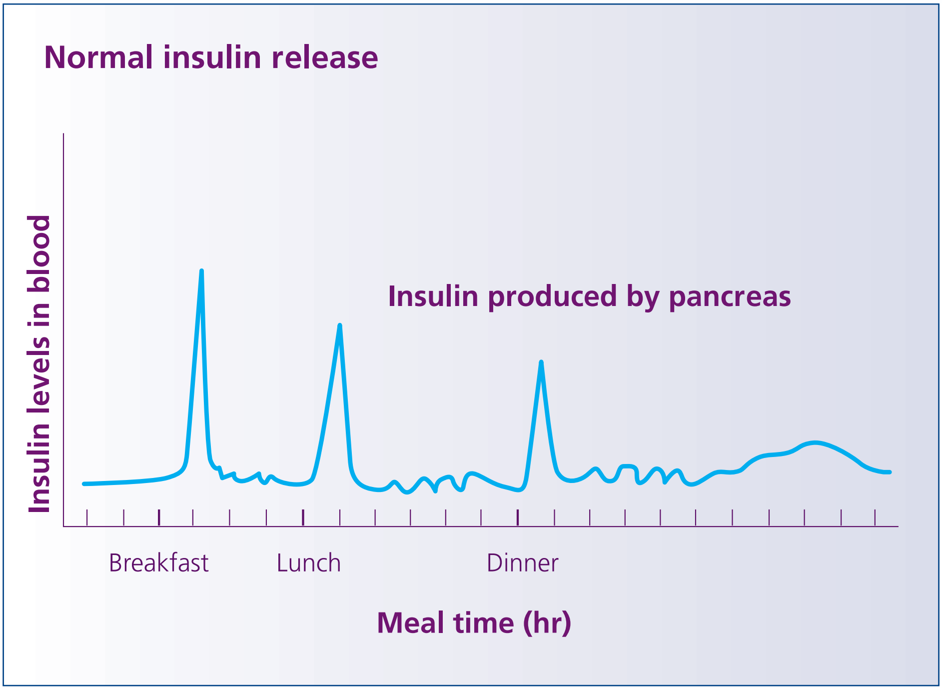
Being able to understand how insulin works is one of the cornerstones of managing diabetes.

In this chapter you will find out about the following:

- **The normal workings of the pancreas**
- **Basal insulin**
- **Adjusting basal insulin, including examples**
- **Bolus insulin**
- **Calculating bolus insulin doses**
- **Adjusting bolus insulin, including examples**
- **Correction doses**

The normal workings of the pancreas

In people without diabetes, blood glucose levels are automatically controlled by the release of insulin from the pancreas. The picture on page 20 shows that small amounts of insulin are released slowly over the whole day, with larger amounts released to deal with the glucose absorbed at mealtimes from food and drink.



In Type 1 diabetes, no insulin is released from the pancreas at all, and so the aim of insulin treatment is to mimic normal insulin production as in someone without diabetes.

There are two main groups of insulin:

- **Basal insulin**
- **Bolus insulin**

These may be human (actually made from bacteria), animal or analogue (genetically engineered).

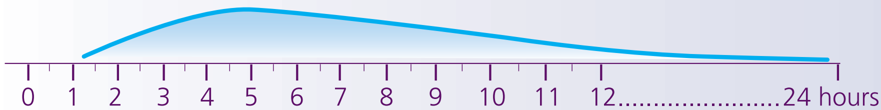
Basal insulin

Basal insulin (long-acting insulin) deals with the glucose produced by your liver. If you skip a meal or eat a carbohydrate-free meal, your basal insulin alone would be able to keep your blood glucose levels stable.

The majority of people would use one of two types of basal insulin

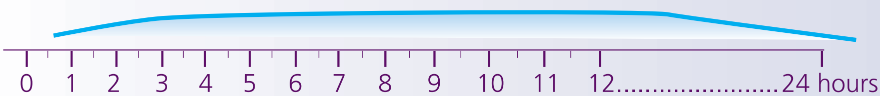
- Isophane or
- Long-acting analogue insulin.

Isophane insulin



Isophane insulin, eg Humulin I, Insulatard or Insuman Basal, works to keep your blood glucose levels under control between meals and overnight. It usually works hardest between four and twelve hours after injecting and generally lasts from eight to 24 hours. Isophane insulin is usually given twice a day when carbohydrate counting.

Long acting analogue insulin



Long-acting analogue insulin, eg Lantus or Levemir, is injected once or twice daily at the same time each day, and may work evenly up to 20–24 hours, without peaking.

How much basal insulin do I need?

Speak to your healthcare team who can help you work out a starting dose of basal insulin that will match needs.

How do I know I have the right amount of basal insulin?

A good way to check if your basal insulin dose is correct is to monitor your blood glucose levels before bed and when you wake up. If your bed-time blood glucose level is between 6–8 mmol/l and your waking glucose levels are within the target range of 4–6 mmol/l, you are likely to be having the correct dose of basal insulin. However, your pre bed-time blood glucose level may also be affected by the amount of insulin injected with your evening meal.

Some healthcare professionals also recommend having a carbohydrate free and bolus free lunch as a way of checking if the basal insulin dose is correct. If the pre-evening meal blood glucose level is in target then this would indicate you are taking the right amount of basal insulin.

Adjusting basal insulin

If your blood glucose levels are lower or higher than the target range before bed and/or before breakfast on three consecutive days, your insulin dose may need adjusting. You should always make only small adjustments and monitor their effect. Your diabetes team will be able to advise you on adjusting your basal insulin dose. If your blood glucose levels are above the ideal range it is likely you will need to increase your basal insulin dose to compensate. Conversely, if your blood glucose levels are below the desirable level, you are likely to need to reduce the amount of basal insulin. While establishing your insulin regimen, it is a good idea to try testing your blood glucose levels in the middle of the night, around 2am to 3am, to

ensure you are not having a night-time hypo before making any adjustments to your basal insulin.

You should concentrate on getting your basal dose correct before adjusting bolus insulin doses. Make sure you wait at least four days after making an adjustment to your basal insulin before making any further changes. You should, however, make an exception to this rule if you are having night time hypos and adjust immediately.

Example 1

Name: Jane

Jane has her basal insulin once a day in the evening. Looking at Jane's diary, how do you think her basal insulin should be adjusted? Does she need more or less basal insulin?

	Blood glucose level (mmol/l)				
Date	Before breakfast	Before lunch	Before evening meal	Before bed	During the night
16/11	10.9			10	
17/11	9.3			10	9
18/11	9.7			11	
19/11	10.5			12	
20/11	12.3			11	

Answer:

You can see if Jane's basal insulin dose is correct by looking at her blood glucose levels before breakfast and before bed. We can see that Jane has blood glucose levels above the target of 4 –6 mmol/l before breakfast and higher than 8 mmol/l before bedtime. This shows that Jane needs more basal insulin to bring those levels into the target ranges. Subsequently, Jane has made a small increase to her basal insulin (long-acting insulin) and continues regular blood glucose monitoring over the next few days to see what difference this makes.

Example 2

Name: Bob

Bob has his basal insulin twice a day. Looking at Bob's diary, how do you think his basal insulin should be adjusted? Does he need more or less basal insulin?

	Blood glucose level (mmol/l)				
Date	Before breakfast	Before lunch	Before evening meal	Before bed	During the night
9/5	3.1			6.2	3.8
10/5	3.6			7.5	
11/5	4.1			6.9	
12/5	2.9			7.2	

Answer:

Although Bob is going to bed with blood glucose levels between 6 –8 mmol/l, he is still waking up with levels below 4 mmol/l. To prevent him from having low blood glucose levels, Bob needs to reduce his dose of basal (long-acting) insulin. Bob decides to make a small reduction in his basal insulin tomorrow evening and continue monitoring his blood glucose levels closely over the next few days to see how this affects his diabetes control. Remember that Bob doesn't have to wait another four days to make further insulin adjustments if he is still experiencing hypos. More information about hypos can be found in Chapter 9.

Example 3

Name: Shazia

Shazia has her basal insulin twice a day. Looking at Shazia's diary, how do you think her basal insulin should be adjusted? Does she need more or less basal insulin?

	Blood glucose level (mmol/l)				
Date	Before breakfast	Before lunch	Before evening meal	Before bed	During the night
26/3	6.0			7.2	
27/3	5.5			6.5	6.4
28/3	5.6			7.5	
29/3	4.9			7.8	

Answer:

Shazia is going to bed with blood glucose levels in the target level of between 6–8 mmol/l, her blood glucose levels remain in target overnight, not changing significantly and are within the range of 4–6 mmol/l in the morning so she does not need to adjust her basal (long-acting) insulin.

Example 4

Name: Albert

Albert has his basal insulin once a day in the evening. Looking at Albert's diary, how do you think his basal insulin should be adjusted? Does he need more or less insulin?

	Blood glucose level (mmol/l)				
Date	Before breakfast	Before lunch	Before evening meal	Before bed	During the night
25/10	10.5			6.2	
26/10	12.6			6.4	
27/10	11.6			8	3.5
28/10	15.0			7.4	3.2

Answer:

Albert is waking up with high blood glucose levels despite going to bed with blood glucose levels within the recommended 6–8 mmol/l. Albert is having too much basal (long-acting) insulin, which is causing him to have night time hypos, which in turn appear to be rebounding (when the liver releases stored glucose into the blood stream), giving high blood glucose levels on waking. Albert decides to reduce his basal insulin dose by a small amount. Albert continues to monitor his blood glucose levels closely over the next few days to see what effect this has. More information on hypoglycaemia can be found in Chapter 9.

Bolus insulin

While basal insulin influences your blood glucose levels in between meals, it is the bolus (fast-acting) insulin that deals with the carbohydrate consumed from your food and drink.

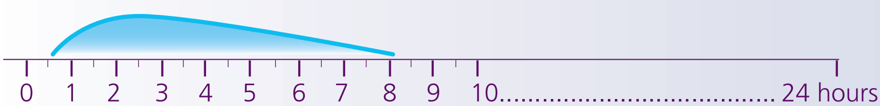
There are two main types of bolus insulin

- Rapid acting analogue insulin
- Short acting or soluble insulin

Rapid acting analogue insulin

Rapid acting analogue insulin, eg Apidra, Humalog, or Novarapid, has been developed to try to mimic what your body would normally do following a meal and works quickly to lower your blood glucose levels. This insulin can be given just before, with or just after food. It has its peak action within one to two hours and can last up to five hours.

Short acting or soluble insulin



Short acting or soluble insulin, eg. Actrapid, Humulin S or Insuman Rapid, is usually given 15 to 30 minutes before a meal to cover the rise in blood glucose levels that occurs after a meal. It has its peak action within two to six hours and it can last for up to eight hours.

Calculating bolus insulin doses

How much bolus insulin do I need?

Bolus insulin is usually taken before, during or sometimes just after you have eaten. To work out how much bolus insulin you need, you will need to know:

1. Your own 'insulin to carbohydrate ratio'. (This is the amount of insulin you need to inject for a certain amount of carbohydrate).
2. How much carbohydrate you are eating and drinking.

In a nutshell, the more carbohydrate you eat and drink the more bolus insulin you will need and the less carbohydrate you eat and drink, the less bolus insulin you need. Similarly if you have a carbohydrate free meal, you will not need any bolus insulin at all.

This section deals with 'insulin to carbohydrate ratios'. You will find out how to calculate the amount of carbohydrate in different food and drink in the next chapter.

Your insulin to carbohydrate ratio

Insulin to carbohydrate ratios vary from person to person, so you will have your own personal ratio. Eventually, you may even have a different insulin to carbohydrate ratio for each meal.

Carbohydrates can be counted in two ways, in grams or as carbohydrate portions. One carbohydrate portion (CP) is usually equal to 10g of carbohydrate. Some diabetes centres use CPs, while others work in grams of carbohydrate. It is important that you find the method that works best for you. This book illustrates all of the examples in both CPs and grams – see Chapter 4. Please note that there may be differences between the amount of insulin stated in the two different methods – this is not a mistake. No matter which method you use, with time, you will be able to adjust your insulin to carbohydrate ratios to take this into account.

Most adults tend to start with a ratio of around 1 unit of insulin for every 10g of carbohydrate or 1 unit of insulin for every CP. This is written as:

1 unit insulin : 10g carbohydrate
1 unit insulin : 1CP or

To work out the most suitable starting ratio for you, it is important to talk to your diabetes team.

Adjusting bolus insulin

If the ratio is correct and you have estimated the amount of carbohydrate correctly, you would expect to see your blood glucose levels before the next meal to be within the target range of 4–6 mmol/l. Some people like to test their blood glucose levels two hours after meals to see whether their levels are returning to the target range.

It is important not to make changes to your insulin regimen based on one blood glucose reading or experience alone. If you can see an obvious trend, where your blood glucose levels are generally lower or higher than the target range, you can make small changes to your bolus insulin ratio.

The tables opposite shows you how to adjust your ratio up and down. You might want to make one change at a time, focusing in on one particular mealtime.

The tables and following examples give you an indication of potential changes but you should discuss your own results with your diabetes team.

If you regularly experience hypos shortly after your meals, you may want to consider reducing the ratio for those meals the next day. That is, reducing the amount of insulin per 10g of carbohydrate or CP, depending on the system you are using. If you are regularly experiencing hypos at any other times of the day, it might be because your basal insulin dose is too high. You could have a carbohydrate-free and bolus insulin free meal to test if you are taking the correct basal dose during the day. Speak to your diabetes team for more information on how and when to do this.

Insulin to carbohydrate ratios in grams

Units of insulin	Grams of carbohydrate
1u	15g
1u	12.5g
1u	10g
1u	7.5g
1u	5g
1u	4g
1u	3g

Insulin to carbohydrate ratios in CPs

Units of Insulin	CPs
0.5u	1 CP
1u	1 CP
1.5u	1 CP
2u	1 CP
2.5u	1 CP
3u	1 cP

Example 5: Working in grams of carbohydrate

Name: Bob

Bob takes 1unit of bolus insulin for every 10g of carbohydrate at each mealtime. This means that if Bob has 60g of carbohydrate, he gives himself 6 units of bolus insulin. Looking at Bob's diary, how do you think his ratio should be adjusted? Which meal ratio needs adjusting?

	Blood glucose level (mmol/l)				
Date	Before breakfast	Before lunch	Before evening meal	Before bed	During the night
18/4	5.4	4.3	12.3	8	
19/4	5.1	5.2	13.6	8.5	
20/4	4.6	6	11.9	8.7	
21/4	4	5.9	11.6	7.5	
22/4	4.3	4.2	12.4	10	

Answer: Bob's blood glucose results are within target at breakfast and lunchtime, but they are above the target of 4 – 6 mmol/l before his evening meal. As Bob knows that it is his lunchtime insulin that af fects these results, he decides to increase his insulin to carbohydrate ratio at this time to 1u : 5g of carbohydrate, to help lower his blood glucose levels befor e his evening meal. So now if Bob has 60g of carbohydrate, he will give himself 12 units of bolus insulin.

$$\frac{60}{5} = \textbf{12 units of insulin}$$

He monitors his blood glucose levels closely over the next few days to see what affect this adjustment has had.

Example 6: Working in CPs

Name: Jane

Jane's ratio is worked out so that she takes 1 unit of bolus insulin for each CP at each mealtime. This means that if Jane has 6 CPs, she will need 6 units of bolus insulin. Looking at Jane's diary, how do you think her insulin to carbohydrate ratio should be adjusted? Which meal ratio needs adjusting?

	Blood glucose level (mmol/l)				
Date	Before breakfast	Before lunch	Before evening meal	Before bed	During the night
12/12	4.2	12.5	6.0		
13/12	5.9	15.1	5.8	6.7	
14/12	6.0	11.6	4.6		
15/12	4.7	10.9	5.7	7.8	
16/12	5.0	13.8	4.9		

Answer: Jane's blood glucose results are within target before breakfast, but they have risen to well above target by lunch time. Once she has given herself a correction dose (see page 32) her blood glucose levels are all within target. Jane works out that she needs to increase her insulin to carbohydrate ratio at breakfast to 1.5u : 1 CP tomorrow, as this is the ratio that effects her blood glucose levels before lunchtime. So now, if Jane eats 6 CPs at breakfast, she will give herself 9 units of insulin

6 x 1.5 = 9 units insulin

She will monitor her blood glucose levels closely over the next couple of days to see what affect this adjustment has had.

Correction doses

What is a correction dose?

A correction dose is an additional amount of bolus insulin to bring down a one-off high blood glucose level into the target range.

When should I use and give a correction dose?

These are the typical times when you might want to use a correction dose:

- following a snack earlier in the day that wasn't matched with any insulin at the time
- if you underestimated the amount of carbohydrate consumed or underestimated the amount of insulin to be taken at a previous meal or snack
- in times of stress as this can increase blood glucose levels.

Correction doses should always be given with caution and generally should only be given before a meal.

Giving a correction dose after a meal can be difficult to judge. If you give a correction dose too soon, the bolus insulin that you have already given may not have finished working, therefore increasing the risk of a hypo.

When should I **not** use a correction dose?

It is **not advised** to give a correction dose after drinking alcohol, and it should only be given with extreme caution following physical activity, due to the increased risk of a hypo at these times.

How do I work out my correction dose?

Correction doses differ from person to person and can vary by the time of day. Your diabetes team can help you work out your personal correction dose formula. The formula will tell you by how many mmols your blood glucose levels will fall for each unit of bolus insulin given. The only time when this may not apply is when your blood glucose levels are above 14 mmol/l, for example during illness, when you may need more insulin as you may be more insulin resistant.

Most people will have a formula of 1 unit of bolus insulin to reduce blood glucose levels by 2–3 mmol/l.

Correction doses are added to the calculated amount to match your carbohydrate intake at a meal, so you only need to have the one injection. See example 7 for how this works.

If you frequently need correction doses, you may need to look at your overall insulin regimen.

Example 7: Correction doses

Shazia is aiming for a blood glucose level of 4–6 mmol/l before her meals. When she tests before lunch, she finds that her blood glucose level is 10 mmol/l.

To get her blood glucose levels in the target range of 4–6 mmol/l, she needs to reduce her blood glucose levels by 4–6 mmol/l.

Shazia's diabetes team helped her work out that 1 unit of bolus insulin lowers her blood glucose levels by 2.5 mmol/l.

2 units would therefore reduce her blood glucose levels by 5 mmol/l.

Shazia decides to add this extra insulin to her mealtime insulin dose so she only has to inject once.

Summary

- In people without diabetes, insulin is released automatically in response to increasing blood glucose levels.
- In Type 1 diabetes, insulin treatment is used to mimic normal insulin release as closely as possible.
- There are two main types of insulin, basal and bolus insulin. Different insulins vary in how quickly they start working, when they peak, and how long they work for.
- Basal insulin is taken once or twice a day.
- Basal insulin can be adjusted to effect blood glucose levels before bed and on waking.
- It is important to concentrate on getting basal insulin doses correct before adjusting bolus insulin doses.
- Bolus insulin is taken either before, during or just after eating carbohydrate.
- Start by asking your diabetes team to help you calculate your basal dose of insulin and your insulin to carbohydrate ratio.
- Insulin to carbohydrate ratios can be expressed as:

  units of insulin : grams of carbohydrate

  or

  units of insulin : CPs.
- Insulin to carbohydrate ratios vary from person to person and you may have a different ratio for each meal. You will need to adjust your insulin to carbohydrate ratio depending on your blood glucose patterns.
- Correction doses are used with caution for 'one-off' high blood glucose levels.

Chapter 4:
How to estimate the carbohydrate content of food and drink

Estimating the amount of carbohydrate you eat and drink allows you to adjust your insulin to manage your blood glucose levels more effectively.

This chapter helps you to develop your own set of tools, which will allow you to estimate the amount of carbohydrate you eat and drink.

In this chapter you will find out about the following:

- **The carbohydrate content of food**
- **How to calculate the carbohydrate content of food using**
  - **carbohydrate reference lists**
  - **food labels**
  - **recipes.**

The carbohydrate content of food

Different foods contain different amounts of carbohydrate. Regardless of the type or amount of cooking, the carbohydrate content of a food stays the same. So, for example, a portion of raw (uncooked) spaghetti may contain about 50g of carbohydrate. When this is boiled and served, it will still contain 50g of carbohydrate, even though it will weigh more as it has absorbed water during cooking.

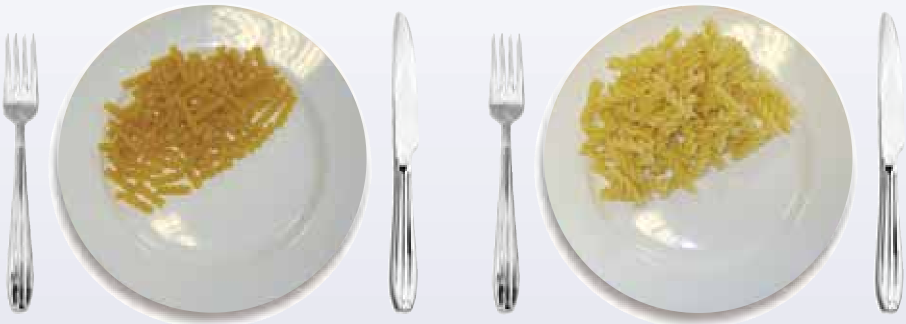
Although cooking does not affect the carbohydrate content of the food, different cooking methods will affect the weight and volume of the food depending on how much water it has lost or gained. So, for example, if a raw potato weighs 200g, after it has been baked it will weigh less because water has been lost in the cooking process. However, if that same potato were boiled it would weigh more because it will have absorbed water during the cooking process.

It is important to be aware of this because otherwise it would be very easy to over or underestimate the carbohydrate content of a food, which could mean giving too much or too little bolus insulin.

So, where possible, count the amount of carbohydrate in raw food rather than cooked.

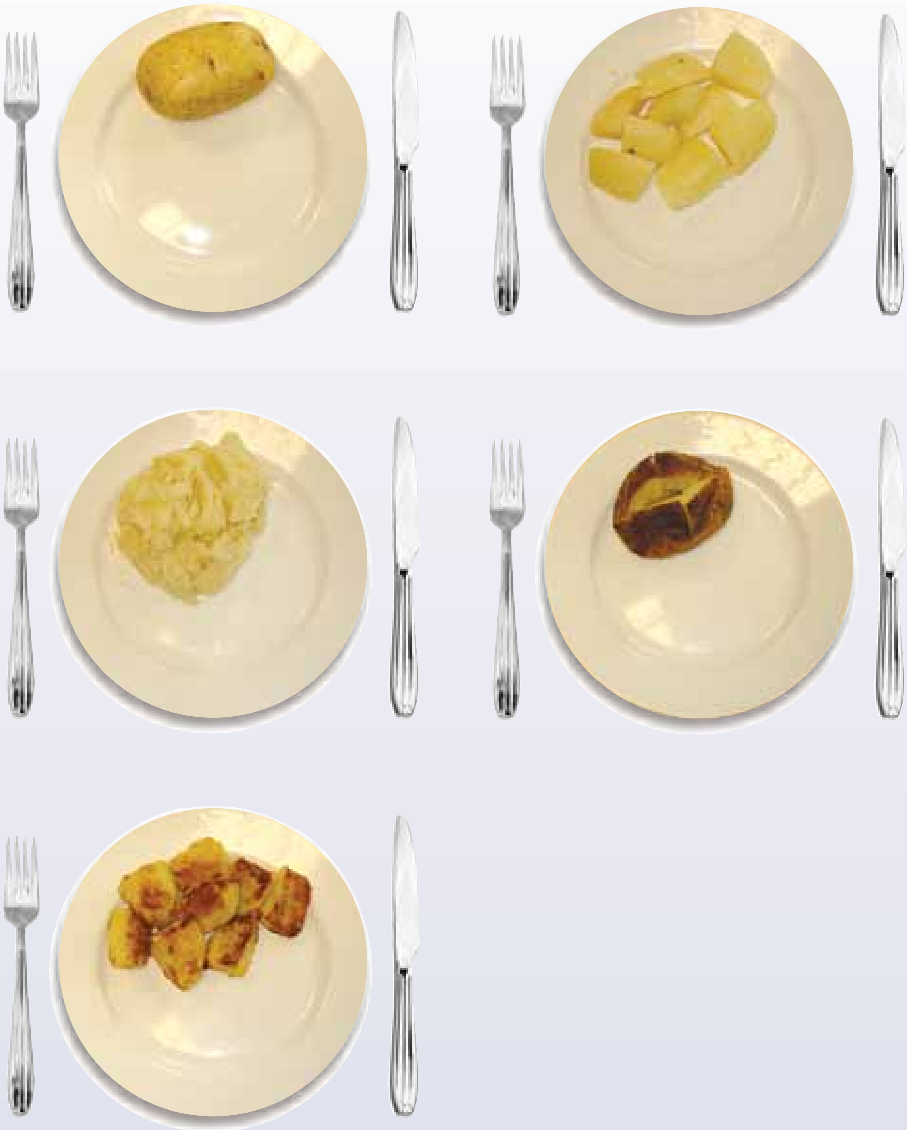
The following examples illustrate the effect that cooking has on pasta, potatoes and rice.

Example 1: Pasta



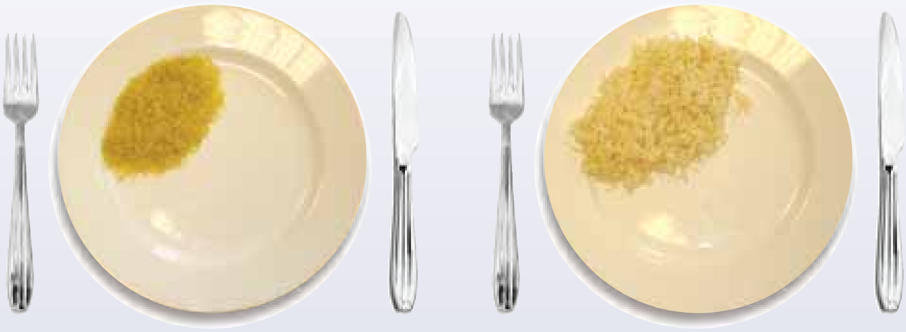
Each of these plates of pasta contains the same amount of carbohydrate (55g). The difference in the volume of pasta on each plate is due to the amount of water absorbed during the cooking process.

Example 2: Potatoes



Each of these plates of potatoes contains the same amount of carbohydrate (55 grams). The difference in the volume of potato on each plate is due to the amount of water absorbed or lost during the cooking pr ocess.

Example 3: Rice



Each of these plates of rice contains the same amount of carbohydrate (40g). The difference in the volume of rice on each plate is due to the amount of water absorbed during the cooking process.

How do I start to calculate the amount of carbohydrate in a food?

Carbohydrates can be counted in two ways, in grams or as carbohydrate portions. One carbohydrate portion (written as CP) is equal to 10g of carbohydrate.

There are various tools that can help you work out how much carbohydrate you are eating – these are:

1. Carbohydrate reference lists (provided with this book).
2. Food labels.
3. Scales, cups and spoons – it is worthwhile investing in a good set of scales that are flat based, digital and that can be zeroed. It is also important that your scales are accurate to within 5g. There are some scales available that can help you to work out the carbohydrate content of foods. These are fine to use but make sure they specifically use British food.
4. Reference books, eg calorie counters.
5. Restaurant websites.
6. Food photographs.

7. Further information provided by your healthcare team.

To start with, weighing food and using household measuring cups or measuring spoons will help you to get an idea of your own typical serving sizes. As time passes and your experience grows you will become more familiar with the amount of carbohydrate in the food and meals you typically eat – and even those you eat out. Some people find it helpful to make a note or list of their usual meals for future reference. You can add these to the space provided at the back of your carbohydrate reference list.

Rounding up and down

After measuring the carbohydrate accurately, sometimes you will need to round the figure up or down. Make sure you only round your calculations once you have worked out the total amount of carbohydrate for the whole meal.

If you round each individual food it will not be as accurate. Most of the time, deciding if the figure should be rounded up or down will be relatively straight forward. Sometimes it might be more difficult to know what to do, so use the table below to help you decide whether to round up or down.

Using carbohydrate reference lists

The carbohydrate reference list provided with this book gives you some of the most commonly eaten carbohydrate-containing food and drink, along with their carbohydrate content in both grams and CPs. Each food is listed in a number of handy measures, such as, a slice of bread, a piece of cake or a cup of cereal, but it is important to realise that everyone's typical serving can vary, so you need to ensure that you consider this when estimating how much carbohydrate you are eating.

				Grams				
0.1	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
Round down					**Round up**			
Round down		Round to ½ CP					**Round up**	
0.1	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
				CPs				

IMPORTANT: Rounding up and down. In the following examples you may find that, when working out how many units of insulin to give, we have given the option to round **both up and down** when the value is 0.5 of a unit, eg rounding 8.5 down to 8 or up to 9. This is because, when working out how much insulin to give, you need to consider a few things such as, what your current blood glucose levels are, whether you have been or are planning to be physically active that day or whether you are or will be drinking alcohol. Thinking about these things will help you decide how many units of insulin to give yourself.

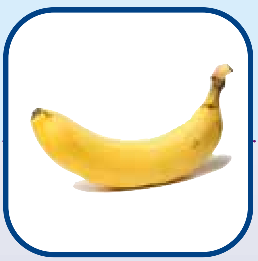
IMPORTANT: Which method are you using?

Method 1 works in carbohydrate portions (CPs). Follow the **green boxes**

Method 2 works in grams of carbohydrate (g). Follow the **blue boxes**

Example 4: Using a carbohydrate reference list

Jane has chosen to have a bagel with jam, and a medium banana, with a large mug of tea with milk for her breakfast.



Method 1: Carbohydrate portions

Jane works out, using the carbohydrate reference list, that she will be eating 8.5 CPs. She came to this conclusion because:

Bagel	= 4 CP
2 heaped teaspoons of jam	= 2 CP
Medium banana	= 2.5 CP
Milk in tea has a negligible amount of carbohydrate	= 0 CP
Total	**= 8.5 CP**
Jane has an insulin to carbohydrate ratio of 1 unit of insulin for each CP.	**8.5 x 1 = 8.5 units**
This is **rounded** to the nearest whole number.	**= 8 or 9 units**

Jane works out that she will need to give herself 8 or 9 units of bolus insulin.

Method 2: Carbohydrate in grams

Jane works out using the carbohydrate reference list that she will be eating 85g of carbohydrate. She came to this conclusion because:

Bagel	= 40g
2 heaped teaspoons of jam	= 22g
Medium banana	= 23g
Milk in tea has a negligible amount of carbohydrate	= 0g
Total	**= 85 g**
Jane has insulin to carbohydrate ratio of 1 unit of insulin for every 10g of carbohydrate.	$\mathbf{\frac{85}{10} = 8.5}$ **units**
This is **rounded** to the nearest whole number.	**= 8 or 9 units**

Jane works out that she will need to give herself 8 or 9 units of bolus insulin.

IMPORTANT: Different methods may give different results. Different methods of carbohydrate counting can give different units of insulin. Make sure you stick with one method and **do not** alternate between the two.

Example 5: Using a carbohydrate reference list

Osa has a 30g serving of Crunchy nut cornflakes with 100ml milk.

Method 1: Carbohydrate portions

Using the carbohydrate reference list, Osa works out that he will be eating 3 CPs. He came to this conclusion because:

30g Crunchy nut cornflakes	= 2.5 CP
100ml milk	= 0.5 CP
Total	**= 3 CP**
Osa has an insulin to carbohydrate ratio of 1.5 units of insulin for each CP.	**3 x 1.5 = 4.5 units**
This is **rounded** to the nearest whole number.	**= 4 or 5 units**

Osa works out that he will need to give himself 4 or 5 units of bolus insulin.

Method 2: Carbohydrate in grams

Using the carbohydrate reference list, Osa works out that he will be eating 43g of carbohydrate. He came to this conclusion because:

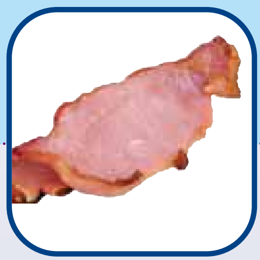
30g Crunchy nut cornflakes	= 24g
100ml of milk	= 5g
Total	**= 29g**
Osa has an insulin to carbohydrate ratio of 1 unit of insulin to every 7.5g of carbohydrate.	$\frac{29}{7.5}$ **= 3.9 units**
This is **rounded** to the nearest whole number.	**= 4 units**

Osa works out that he will need to give himself 4 units of bolus insulin.

Example 6: Using a carbohydrate reference list

Bob gets a traditional cooked breakfast with a strong black coffee at his local café on his way in to work. He has a fried egg, 1 rasher of bacon, a grilled tomato, mushrooms and a slice of black pudding.






Working out the carbohydrate content

By looking at his plate, Bob works out which foods contain carbohydrate.

Eggs	x
Bacon	x
Tomato	✓
Mushrooms	x
Black pudding	x
Coffee	x

By referring to Chapter 2, Bob discovers that although tomatoes contain some carbohydrate, it is a slowly absorbed carbohydrate and does not need to be matched to any insulin.

Bob does not inject any insulin for this meal.

Example 7: Using a carbohydrate reference list

Shazia has chosen to fast for Ramadan. She gets up very early to have breakfast before sunrise. She has leftovers from last nights meal, 1 large chapatti, with a heaped teaspoon of mango chutney and a pot of low fat natural yogurt. She also has a cup of chai made with half a cup of milk.

Method 1: Carbohydrate portions

Using the carbohydrate reference list, Shazia works out that she will be having 6CPs. She came to this conclusion because:

1 large chapatti	= 3.5 CP
1 heaped teaspoon mango chutney	= 1 CP
1 pot low fat natural yogurt	= 1 CP
100ml milk	= 0.5 CP
Total	**= 6 CP**
Shazia has an insulin to carbohydrate ratio of 2 units of insulin for every CP.	**6 x 2 = 12 units**

Shazia works out that she will need to give herself 12 units of bolus insulin.

Method 2: Carbohydrate in grams

Using the carbohydrate reference list, Shazia works out that she will be having 56g carbohydrate. She came to this conclusion because:

1 large chapatti	= 33g
1 heaped teaspoon mango chutney	= 9g
1 pot low fat natural yogurt	= 9g
100ml of milk	= 5g
Total =	**56g**
Shazia has an insulin to carbohydrate ratio of 1 unit for every 5g of carbohydrate. This is **rounded** to the nearest whole number.	$\frac{56}{5}$ **= 11.2 units** **= 11 units**

Shazia works out that she will need to give herself 11 units of bolus insulin.

Now you try 1

Albert has his porridge with a heaped dessert spoon of honey every morning after having bought his daily newspaper.

His porridge comprises of half a cup of raw oats, 100ml of milk and a dessert spoon of honey, with a 200ml glass of orange juice.

Method 1: Carbohydrate portions

Looking at the carbohydrate reference list, calculate the number of CPs Albert is having.

Half a cup (45g) of raw oats	= CP
100ml of milk	= CP
1 dessert spoon of honey	= CP
200ml orange juice	= CP
Total =	**CP**
Albert has an insulin to carbohydrate ratio of 1 unit of insulin for each CP.	
How much bolus insulin does he need?	= **units**

Answers on page 80

Now you try 1 (continued)

Method 2: Carbohydrate in grams

Looking at the carbohydrate reference list, calculate the amount of carbohydrate Albert is having in grams.	
Half a cup (45g) of raw oats	= g
100ml of milk	= g
1 dessert spoon of honey	= g
200ml orange juice	= g
Total =	**g**
Albert has an insulin to carbohydrate ratio of 1 unit of insulin for every 10g of carbohydrate.	
How much bolus insulin does he need?	= **units**

Answers on page 80

Using food labels

Using food labels is another good way of finding out the carbohydrate content of food and drink.

Over the years food labels have become a lot more comprehensive and clear. Most food labels include nutrition information like energy, fat, protein, carbohydrate and salt or sodium.

Food labels contain information to help you work out the amount of carbohydrate you are planning to eat and drink. You need to:

- Find the serving size and the grams of total carbohydrate per serving size.
- Decide how many servings you are having.
- Work out the number of servings you are eating multiplied (x) by grams of carbohydrate per serving. This is the total amount of carbohydrate you will be eating.

Or

- Calculate how much you will be eating by weighing the food or drink.

- Using the per 100g value for carbohydrate calculate the amount of carbohydrate you will have. For example, if you know the food contains 20g carbohydrate per 100g and you plan to eat 50g

$$20 \times \frac{50}{100} = \textbf{10g carbohydrate}$$

If you work in CP's, you will need to convert the number of grams of carbohydrate by dividing by 10. Only do this after adding together all the amount of carbohydrate in each food you are eating, so that you keep the figures as accurate as possible.

For example, if you convert both 27g of carbohydrate and 32g of carbohydrate into CPs **before** adding them together, you would get:

$$\frac{27}{10} = 2.7 \text{ rounded down to } \textbf{2.5 CP}$$

$$\frac{32}{10} = 3.2 \text{ rounded down to } \textbf{3 CP}$$

Whereas, if you convert them in to CPs **after** adding them together and then round up or down, you will get a more accurate figure for example:

$$\frac{59}{10} = 5.9 \text{ rounded up to } \textbf{6 CP}$$

27g + 32g = 59g.

There are some additional points to consider when using food labels to work out the amount of carbohydrate you are eating and drinking:

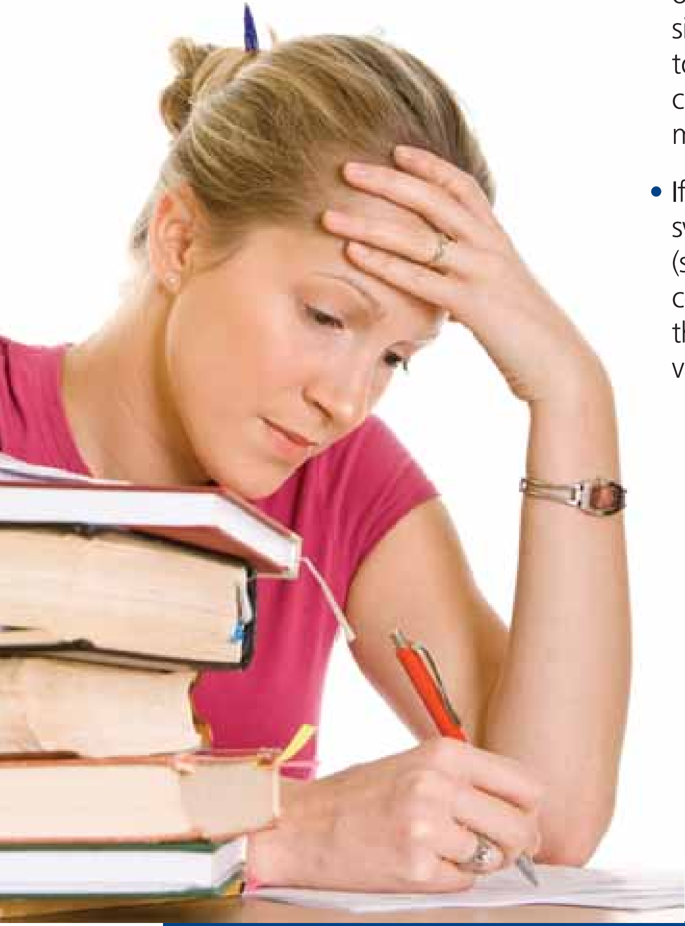
- The amount of carbohydrate you should count is the 'Total carbohydrate' rather than the

Crunchy nut cornflakes (Example of a food label)

Nutritional Information		
Typical values	**Per 100g**	**Per 56g serving**
Energy Kcal/KJ	397/ 1681	222/ 941
Protein (g)	6	3
Carbohydrate (g)	82	46
of which sugars (g)	35	20
Fat (g)	5	2.8
of which saturates (g)	0.9	0.5
Fibre (g)	2.5	1.4
Sodium (g)	0.45	0.25

‘of which sugars’ (see label).

- It is often useful to note whether the label shows the amount of carbohydrate in the raw or cooked product, especially with foods containing pasta or rice. If both are specified, the raw figures tend to be the most accurate.
- Check that you agree with the amount of carbohydrate stated on the label. Occasionally errors can be made so a visual cross reference is usually a good idea.
- Consider what ingredients make up the product you are looking at. Is it a food that contains a lot of very slowly digested carbohydrates, such as beans or tomatoes? Ordinarily you would not consider these foods for carbohydrate counting as they are absorbed very slowly into the blood stream, but the label will count them. You can get a sense for how much of these ingredients are in the product by looking at the ingredients list. The ingredients are listed from most to least. So if tomatoes or pulses are listed towards the top of the list, it may mean that the product contains a large amount of these ingredients. In these situations use your own experiences to judge what proportion of the carbohydrate on the label you match to bolus insulin.



- If the product contains a nutritive sweetener, like a polyol, (see Chapter 2) you may need to counta smaller amount of carbohydrate than stated on the label. This will vary from person to person.

Example 8: Using food labels

Jane goes out from work to buy a pasta salad and yogurt from the shop around the corner.

Chicken pasta salad

Nutritional Information		
Typical values	**Per 100g**	**Per half pack**
Energy Kcal	271/1085	190/760
Protein (g)	15.8	11.1
Carbohydrate (g)	20.4	28.6
of which sugars (g)	7	4.9
Fat (g)	5	3.5
of which saturates (g)	0.6	0.42
Fibre (g)	5.1	3.6
Sodium (g)	0.4	0.28

Working out the carbohydrate content

The label tells Jane that half a pack contains 28.6g of carbohydrate. Jane eats a whole pack. To calculate the amount of carbohydrate she has eaten, she multiplies **28.6g by 2 = 57.2g.**

Creamy raspberry yogurt (125g)

Nutritional Information		
Typical values	**Per 100g**	**Per pot**
Energy Kcal	106/424	133/530
Protein (g)	3.9	4.9
Carbohydrate (g)	16.4	20.5
of which sugars (g)	14.6	18.3
Fat (g)	2.7	3.4
of which saturates (g)	1.9	2.4
Fibre (g)	0.6	0.75
Sodium (g)	0.07	0.09

Working out the carbohydrate content

The label tells Jane that for each pot of yogurt, she is eating **20.5g** of carbohydrate.

Method 1: Carbohydrate portions

To find out the total amount of carbohydrate in her meal, she needs to add up the amount of carbohydrate fr om each item.

Chicken pasta salad Creamy raspberry yogurt	= 57.2g = 20.5g
Total amount of carbohydrate	**= 77.7g rounded to 78g**
Now it is time to convert into CPs. To work out how many CPs, divide by 10.	$\frac{78}{10}$ **= 7.8 CP** **rounded to 8CP**
Jane has an insulin to carbohydrate ratio of 1 unit of insulin for each CP.	**8 x 1 = 8 units**

Jane works out that she needs to give herself 8 units of bolus insulin.

Method 2: Carbohydrate in grams

To find out the total amount of carbohydrate in her meal, she needs to add up the amount of carbohydrate fr om each item.

Vegetable pasta salad Creamy raspberry yogurt	= 57.2g = 20.5g
Total amount of carbohydrate	**= 77.7g rounded to 78g**
Jane has an insulin to carbohydrate ratio of 1 unit of insulin for every 10g of carbohydrate. This is **rounded** to the nearest whole number.	$\frac{78}{10}$ **= 7.8 units** **= 8 units**
This means that Jane needs to give herself 8 units of bolus insulin.	

Example 9: Using food labels

Osa goes back to his halls of residence for a mini pizza, a packet of microwave chips and a 200g tin of spaghetti hoops, with a can of diet coke.

Mini pizza (170g)

Nutritional Information		
Typical values	**Per 100g**	**Per pizza**
Energy Kcal	267 / 1068	45 / 1816
Protein (g)	11	18.7
Carbohydrate (g)	30.2	51.3
of which sugars (g)	2.7	4.6
Fat (g)	11.3	19.2
of which saturates (g)	5.3	9
Fibre (g)	1.5	2.6
Sodium (g)	0.5	0.9

Working out the carbohydrate content

The label tells Osa that each mini pizza contains **51.3g** of carbohydrate.

Microwave chips (105g)

Nutritional Information		
Typical values	**Per 100g**	**Per pack**
Energy Kcal/KJ	156/656	164/689
Protein (g)	2.3	2.4
Carbohydrate (g)	26.4	27.7
of which sugars (g)	0.5	0.5
Fat (g)	4.5	4.7
of which saturates (g)	0.5	0.5
Fibre (g)	2	2
Sodium (g)	0.08	0.08

Working out the carbohydrate content

The label tells Osa that each pack of micr ochips contains **27.7g** of carbohydrate.

Tinned spaghetti hoops (200g)

Nutritional Information		
Typical values	**Per 100g**	**Per serving**
Energy Kcal/KJ	64/273	128/546
Protein (g)	1.9	3.8
Carbohydrate (g)	14.1	28.2
of which sugars (g)	5.5	11
Fat (g)	0.4	0.8
of which saturates (g)	0.1	0.2
Fibre (g)	0.7	1.4
Sodium (g)	0.42	0.84

Working out the carbohydrate content

The label tells Osa there is **28.2g** of carbohydrate in the tinned spaghetti hoops.

Diet coke (330ml can)

Nutritional Information		
Typical values	**Per 100g**	**Per can**
Energy Kcal	0.4/1.6	1.3/5.3
Protein (g)	0	0
Carbohydrate (g)	0	0
of which sugars (g)	0	0
Fat (g)	0	0
of which saturates (g)	0	0
Fibre (g)	0	0.13
Sodium (g)	0.04	

Working out the carbohydrate content

The label tells Osa that his diet Cola contains no carbohydrate and so will not need to be matched to any insulin.

Method 1: Carbohydrate portions

To find out the total amount of carbohydrate in his meal, he needs to add up the amount of carbohydrate from each item.

Mini pizza Microwave chips Spaghetti hoops Diet coke	= 51.3g = 27.7g = 28.2g = 0g
Total amount of carbohydrate	**= 107.2g rounded to 107g**
Now it is time to convert into CPs. To work out how many CPs, divide by 10. This is **rounded** to the nearest 1/2 CP whole number.	**$\frac{107}{10}$ = 10.7 CP** **10.5 CP**
Osa has an insulin to carbohydrate ratio of 1.5 units of insulin for each CP.	**10.5 x 1.5 = 16 units**

Osa works out that he needs to give himself 16 units of bolus insulin.

Method 2: Carbohydrate in grams

To find out the total amount of carbohydrate in his meal, he needs to add up the amount of carbohydrate from each item.

Mini pizza Microwave chips Spaghetti hoops Diet coke	= 51.3g = 27.2g = 28.2g = 0g
Total amount of carbohydrate	**= 107.2g rounded to 107g**
Osa has an insulin to carbohydrate ratio of 1 unit of insulin for every 7.5g of carbohydrate. This is **rounded** to the nearest whole number.	**$\frac{107}{7.5}$ =14.3 units** **= 14 units**

Osa works out that he needs to give himself 14 units of bolus insulin.

Example 10: Using food labels

Bob has managed to find time to pick up a large cornish pasty and a danish pastry all washed down with a carton of orange juice.

Cornish pasty (260g)

Nutritional Information	
Typical values	**Per 100g**
Energy Kcal/KJ	255/ 1066
Protein (g)	6.2
Carbohydrate (g)	21.6
of which sugars (g)	1.3
Fat (g)	15.5
of which saturates (g)	7.5
Fibre (g)	1.9
Sodium (g)	0.5

Working out the carbohydrate content

The label above tells Bob that the pasty contains **56g** of carbohydrate.

$21.6 \times \frac{260}{100} = \mathbf{56g}$

Danish pastry (71g)

Nutritional Information		
Typical values	**Per 100g**	**Per pastry**
Energy Kcal/KJ	368/ 1540	263/ 1100
Protein (g)	5.3	3.8
Carbohydrate (g)	47.5	33.4
of which sugars (g)	27.3	19.5
Fat (g)	18.3	13.1
of which saturates (g)	4.9	3.5
Fibre (g)	1.8	1.3
Sodium (g)	0.35	0.25

Working out the carbohydrate content

The label above tells Bob that the pastry contains **33.4g** of carbohydrate.

Orange juice (200ml carton)

Nutritional Information		
Typical values	**Per 100g**	**Per 200ml carton**
Energy Kcal/KJ	36/ 153	72/ 306
Protein (g)	0.5	1
Carbohydrate (g)	8.8	17.6
of which sugars (g)	8.8	17.6
Fat (g)	0.1	0.2
of which saturates (g)	0	0
Fibre (g)	0.1	0.2
Sodium (g)	0.01	0.02

Working out the carbohydrate content

The label above tells Bob that a carton of orange juice contains **17.6g** of carbohydrate.

Method 1: Carbohydrate portions

To find out the total amount of carbohydrate in his meal, he needs to add up the amount of carbohydrate fr om each item.

Cornish pasty Danish pastry Fruit Juice	= 56g = 33.4g = 17.6g
Total amount of carbohydrate	**= 107g**
Now it is time to convert into CPs. To work out how many CPs, divide by 10.	$\frac{107}{10}$ = **10.5 CP**
This is **rounded** to the nearest whole number. Bob has a an insulin to carbohydrate of 2 units of insulin for each CP.	**10.5** **10.5 x 2 = 21 units**

Bob works out that he needs to give himself 21 units of bolus insulin.

Method 2: Carbohydrate in grams

To find out the total amount of carbohydrate in his meal, he needs to add up the amount of carbohydrate fr om each item.

Cornish pasty Danish pastry Fruit juice	= 56g = 33.4g = 17.6g
Total amount of carbohydrate	**= 107g**
Osa has an insulin to carbohydrate ratio of 1 unit of insulin for every 5g of carbohydrate. This is **rounded** to the nearest whole number.	$\frac{107}{5}$ **= 21.4 units** **= 21 units**
Bob works out that he needs to give himself 21 units of bolus insulin.	

Example 11: Missing lunch

Shazia is fasting for Ramadan and is not eating during daylight hours.

As Shazia has not eaten anything for lunch, she does not need to give herself any bolus insulin.

Now you try 2

Albert has got back from walking his Westie dog, and has warmed up a tin of whole oxtail soup and buttered a wholegrain roll followed by an Eccles cake and a black coffee.

Firstly, find out how much carbohydrate is in each part of Albert's meal

Oxtail soup (400g)

Nutritional Information	
Typical values	**Per 100g**
Energy Kcal/KJ	1.6/ 158
Protein (g)	1.6g
Carbohydrate (g)	6.6g
of which sugars (g)	1.7g
Fat (g)	0.5g
of which saturates (g)	0.2g
Fibre (g)	0.3g
Sodium (g)	0.3g
Salt (g)	0.7

Working out the carbohydrate content

Wholegrain roll (56g)

Nutritional Information		
Typical values	**Per 100g**	**Per 56g roll**
Energy Kcal/KJ	235/ 999	132/ 559
Protein (g)	9.3	5.2
Carbohydrate (g)	46.3	25.9
of which sugars (g)	2.2	1.2
Fat (g)	2.7	1.5
of which saturates (g)	0.5	0.28
Fibre (g)	4.3	2.4
Sodium (g)	0.58	0.32

Working out the carbohydrate content

Now you try 2 (continued)

Eccles cake (45g)

Nutritional Information		
Typical values	**Per 100g**	**Per serving**
Energy Kcal/KJ	365/ 1535	382/ 1381
Protein (g)	2.8	2.5
Carbohydrate (g)	51.6	23.2
of which sugars (g)	34	30
Fat (g)	16.6	15
of which saturates (g)	6.1	5.5
Fibre (g)	1.6	1.44
Sodium (g)	0.3	0.27

Working out the carbohydrate content

Now work out how much bolus insulin Albert needs to give himself.

Method 1: Carbohydrate portions

1 tin oxtail soup	=	g
1 wholegrain roll	=	g
Eccles cake	=	g
Black coffee	=	g
Total =		**g**
Convert into CPs	**=**	**CP**
Albert has an insulin to carbohydrate ratio of 1.5 units of insulin for each CP.		
How much bolus insulin will Albert need?	**=**	**units**

Method 2: Carbohydrate in grams

1 tin oxtail soup	=	g
1 wholegrain roll	=	g
Eccles cake	=	g
Black coffee	=	g
Total =		**g**
Albert has an insulin to carbohydrate of 1 unit of insulin for every 7.5g of carbohydrate.		
How much bolus insulin does he need?	**=**	**units**

Answers on page 81

Using a combination of food labels and carbohydrate lists

Sometimes, you will need to use a combination of methods to work out the amount of carbohydrate you are eating and drinking.

Example 12: Using carbohydrate reference lists and food labels

Jane has got home from work late and wants to make something quick for dinner. She decides to make a stir fry with steak and a black bean sauce, with a jacket potato.

When working out her carbohydrate portions, she divides the foods into those that are counted and those that are not.

Foods counted: Baked potato, black bean sauce
Foods not counted: Vegetables, steak

Method 1: Carbohydrate portions

Jane weighs her raw potato. It weighs 237g. Using the carbohydrate reference list, Jane can see that 100g contains 1.5CP. Jane works out how many CPs are in 1g of potato

$$\frac{1.5\ \text{CP}}{100} = 0.015\ \text{CP}$$

Her potato weighs 237g, so she multiplies this by 237.
0.015 x 237 = 3.55 CP rounded to **3.5 CP**

Method 2: Carbohydrate in grams

Jane weighs her raw potato. It weighs 237g. Using the carbohydrate reference list, Jane can see that 100g contains 17g of carbohydrate. Jane works out how much carbohydrate is in 1g of potato $\frac{17}{100} = 0.17\text{g}$

Her potato weighs 237g, so she multiplies this by 237. **0.17 x 237 = 40.3g**

Black bean sauce (120g)

Nutritional Information		
Typical values	**Per 100g**	**Per 60g serving**
Energy Kcal/KJ	89/373	53.4/224
Protein (g)	2.8	1.7
Carbohydrate (g)	14.8	8.9
of which sugars (g)	14.6	8.9
Fat (g)	2.0	1.2
of which saturates (g)	0.5	0.3
Fibre (g)	1.5	0.9
Sodium (g)	1.8	1.1

Working out the carbohydrate content

Jane looks at the label on the bottle of black bean sauce which shows that there is **8.9g** of carbohydrate in half the jar.

Method 1: Carbohydrate portions

Now add up the total number of CPs.	
Black bean sauce Now convert into CPs Rounded to the nearest whole number	= 8.9g $\frac{8.9}{10}$ **= 0.89 CPs** = 1 CP
Potato	= 3.5 CP
Total amount of carbohydrate	**= 4.5 CP**
Jane has an insulin to carbohydrate ratio of 1 unit of insulin for each CP.	**4.5 x1 = 4.5 units**
Jane works out that she needs to give herself 4 or 5 units of bolus insulin.	

Method 2: Carbohydrate in grams

Now add up the total amount of carbohydrate.	
Potato Black bean sauce	= 40.3g = 8.9g
Total amount of carbohydrate	**= 49.2g rounded to 49g**
Jane has an insulin to carbohydrate ratio of 1unit of insulin for every 10g of carbohydrate. This is **rounded** to the nearest whole number.	$\frac{49}{10}$ **= 4.9 units** **= 5 units**
Jane works out that she needs to give herself 5 units of bolus insulin.	

Example 13: Using food labels and the carbohydrate reference list

Bob has taken a ready meal out of the freezer. He has a shepherd's pie and heats up a large tin of baked beans and serves it with some instant gravy.

When calculating his carbohydrate portions, Bob identifies those foods that are counted for carbohydrate counting and those that are not.

Foods counted: Ready made Shepherd's pie, baked beans
Foods not counted: Gravy

Shepherd's pie (400g)

Nutritional Information		
Typical values	**Per 100g**	**Per 400g serving**
Energy Kcal/KJ	85/357	340/1428
Protein (g)	4.5	18
Carbohydrate (g)	11.5	46
of which sugars (g)	1.7	6.8
Fat (g)	2.3	9.2
of which saturates (g)	1	4
Fibre (g)	1.2	4.8
Sodium (g)	0.2	0.8

Working out the carbohydrate content

The label tells Bob that there is **46g** of carbohydrate in his ready meal.

Baked beans (large tin)

Method 1: Carbohydrate portions

Using the carbohydrate reference list, Bob works out that a large tin of baked beans has **3 CPs.**

Method 2: Carbohydrate in grams

Using the carbohydrate reference list, Bob works out that a large tin of baked beans has **29g** of carbohydrate.

Method 1:Carbohydrate portions

To find out the total amount of carbohydrate in his meal, Bob needs to add up the amount of carbohydrate from each item.

Shepherds pie Now convert this into CP	= 46g $\frac{46}{10}$ = 4.6 CP
Round to the nearest 1/2 CP	= 4.5 CP
Baked beans **Total amount of carbohydrate**	= 3 CP **= 7.5 CP**
Bob has an insulin to carbohydrate ratio of 2 units of insulin for each CP.	**7.5 x 2 = 15 units**

Bob works out that he needs to give himself 15 units of bolus insulin.

Method 2: Carbohydrate in grams

To find out the total amount of carbohydrate in his meal, Bob needs to add up the amount of carbohydrate in each item.

Shepherds pie Baked beans	= 46g = 29g
Total amount of carbohydrate	**= 75g**
Jane has an insulin to carbohydrate ratio of 1 unit of insulin for every 5g of carbohydrate.	**$\frac{75}{5}$ =15 units**

Bob works out that he needs to give himself 15 units of bolus insulin.

Note: When comparing the amount of carbohydrate in baked beans from the carbohydrate reference list and the amount stated on the food label, you may notice that the figur es are quite different. This is because baked beans and other pulses ar e slow acting carbohydrates and so are absorbed very slowly. This means that they may not need to be matched with insulin. This has been taken into account in the carbohydrate reference list, whereas the food label will give the amount including the beans.

Example 14: Using recipes, food labels and the carbohydrate reference list

Shazia has Iftari (Sunset meal). She has 4 dates and water to br eak the fast. Afterwards she has a meal of a r oti, dhal, lamb curry and a shop bought samosa.

Dates (375g)

Nutritional Information	
Typical values	**Per 100g**
Energy Kcal/KJ	305/1293
Protein (g)	2.1
Carbohydrate (g)	71.8
of which sugars (g)	71.8
Fat (g)	1.0
of which saturates (g)	0.4
Fibre (g)	8.2
Sodium (g)	< 0.1

Shazia weighs her 4 dates and now knows they weigh 60g.

Working out the carbohydrate content

The label tells Shazia that 100g of dried dates has 71.8g of carbohydrate. Shazia works out how much carbohydrate is in 1g.

$$\frac{71.8}{100} = 0.718\text{g}$$

She eats 60g of dates, so she multiplies by 60

0.718 x 60 = 43g

To make 6 Roti, Shazia's mum uses:

- 425g chappati flour
- 1 cup water at room temperature
- ghee for brushing the bread

Shazia highlights those ingredients that contain carbohydrate.

Foods counted: Chappati flour
Foods not counted: Water and ghee

Chapatti flour (1kg)

Nutritional Information

Typical values	Per 100g
Energy Kcal/KJ	335/1426
Protein (g)	9.8
Carbohydrate (g)	77.6
of which sugars (g)	2.1
Fat (g)	0.5
of which saturates (g)	0.1
Fibre (g)	0
Sodium (g)	0.15

Working out the carbohydrate content

The label tells Shazia that 100g of flour provides 77.6g of carbohydrate. From this Shazia works out how much carbohydrate is in 1g

$$\frac{77.6}{100} = 0.776\text{g}$$

To find out how much is in 425g she multiplies by 425.

0.776 x 425 = 330g

This recipe makes 6 Roti's of which Shazia has only one.

$$\frac{330\text{g}}{6} = 55\text{g}$$

To make the dhal, Shazia's mum uses a recipe which serves four people:

Dahl recipe for four

400g/14oz canned Puy lentils, drained
1/2 tsp turmeric
1/2 tsp mixed spice
1/2 tsp cumin seeds
1/2 tsp coriander seeds
1/2 tsp curry powder
30g/1oz fresh mint, chopped
30g/1oz fresh coriander, chopped
salt and freshly ground black pepper
Juice of 1 lemon
140g/5oz Greek yogurt

Shazia highlights the ingredients she needs to count.

Foods counted: Greek yogurt
Foods not counted: Puy lentils, turmeric, mixed spice, cumin seeds, coriander seeds, curry powder, fresh mint, fresh coriander, black pepper and lemon.

Greek yogurt (450g)

Nutritional Information		
Typical values	**Per 100g**	**Per 1/2 pot**
Energy Kcal/KJ	131/548	295/1233
Protein (g)	5.5	12.4
Carbohydrate (g)	4.6	10.4
of which sugars (g)	4.5	10.1
Fat (g)	10	23
of which saturates (g)	7.2	16.2
Fibre (g)	0.1	0.2
Sodium (g)	0.12	0.27

Working out the carbohydrate content

The label tells Shazia that 100g of Greek yogurt has 4.6g of carbohydrate. She works out how much carbohydrate is in 1g.

$$\frac{4.6}{100} = 0.046\text{g}$$

The recipe uses 140g, so she multiplies it by 140.

0.046 x 140 = 6.44g rounded to 6g

Shazia eats 1/4 of the dahl made.

$$\frac{6}{4} = 1.5\text{g}$$

This is such a small amount of carbohydrate that it **will not need to be matched by any insulin.**

To make the Lamb curry Shazia's mum uses the following ingredients to serve four people:

Lamb curry for four

600g lamb

garlic

ginger

2 tsp salt.

1 tsp haldi (turmeric)

3 tsp garam masala

2 tsp ground coriander

2 tsp ground cumin

1/2 pot low fat natural yogurt

1 tsp chilli powder

2 onions

3/4 tin plum tomatoes

Shazia highlights those ingredients she needs to count.

Foods counted: Natural yogurt
Foods not counted: Lamb, garlic, ginger, salt, haldi, garam masala, coriander, cumin, chilli powder, onions, plum tomatoes

Method 1: Carbohydrate portions

Using the carbohydrate reference list, Shazia works out that 1 pot of low fat natural yogurt contains 1CP.

Only half a pot of yogurt is used in this r ecipe, so Shazia knows that is will provide 0.5 CP.

Shazia eats 1/4 of the curry made.

$$\frac{0.5}{4} = 0.1 \text{ CP}$$

This is such a small amount of carbohydrate that it **will not need to be matched to any insulin.**

Method 2: Carbohydrate in grams

Using the carbohydrate reference list, Shazia works out that 1 pot of low fat natural yogurt contains 9g of carbohydrate.

Only half a pot of yogurt is used in this r ecipe, so Shazia knows that is will provide half of 4.5g.

$$\frac{9}{2} = 4.5\text{g}$$

Shazia eats 1/4 of the curry made.

$$\frac{4.5}{4} = 1.1 \text{ g}$$

This is such a small amount of carbohydrate that it **will not need to be matched to any insulin.**

Vegetable samosa (450g)

Nutritional Information

Typical values	Per 100g	Per samosa
Energy Kcal/KJ	222/ 930	112/ 468
Protein (g)	4	2
Carbohydrate (g)	23.5	11.8
of which sugars (g)	2	1
Fat (g)	12.5	6.3
of which saturates (g)	1.1	0.6
Fibre (g)	1.2	0.6
Sodium (g)	0.3	0.2

Working out the carbohydrate content

The label tells Shazia that each samosa has **11.8g** of carbohydrate.

Method 1: Carbohydrate portions

To find out the total amount of carbohydrate in her meal, Shazia needs to add up the amount of carbohydrate in each item.

Dates Roti Vegetable samosa	= 43g = 55g = 11.8g
Total amount of carbohydrate	**= 109.8 g rounded to 110g**
Now it is time to convert into CPs. To work out how many CPs, divide by 10.	$\frac{110}{10}$ **= 11 CP**
Shazia has an insulin to carbohydrate ratio of 2.5 units of insulin for each CP.	**11 x 2.5 = 27.5 units**

Shazia works out that she needs to give herself 27 or 28 units of bolus insulin.

Method 2: Carbohydrate in grams

To find out the total amount of carbohydrate in her meal Shazia adds up the amount of carbohydrate in each item of food.

Dates Roti Vegetable samosa	= 43g = 55g = 11.8g
Total amount of carbohydrate	**= 109.8g rounded to 110g**
Shazia has an insulin to carbohydrate ratio of 1 unit of insulin for every 4g of carbohydrate.	$\frac{110}{4}$ **= 27.5 units**

Shazia works out that she needs to give herself 27 or 28 units of bolus insulin.

Now you try 3

Using recipes, food labels and the carbohydrate reference list

Albert has taken some pork chops out of the freezer, which he will grill and serve with a jacket potato and mashed swede and carrot served with apple sauce. Albert is quite partial to a pudding a couple of times a week, so he has two pancakes with a tablespoon of honey.

For his main meal he uses:

Pork chops

1 pork chop
1 (360g raw) jacket potato
1 knob of margarine
1 carrot
1/4 small swede
1 tablespoon/ 15ml apple sauce
100ml gravy

Now you try 3

Apple sauce

Nutritional Information		
Typical values	**Per 100g**	**Per 15ml serving**
Energy Kcal/KJ	107/488	16/73
Protein (g)	0.2	Tr
Carbohydrate (g)	26.5	4
of which sugars (g)	25.5	3.8
Fat (g)	Tr	0
of which saturates (g)	Tr	0
Fibre (g)	1.3	0.2
Sodium (g)	0.1	Tr

For his pudding he uses the recipe below, which is enough to make six pancakes:

Pancakes for six
1/2 pint/ 285ml milk
2 tablespoons/ 60g flour
1 egg
Topped with 1 tablespoon / 15ml
of honey

Follow these steps:

1. Divide the foods into those that are counted and those that are not.

2. Calculate the carbohydrate content of each element that is counted.

3. Calculate the total amount of carbohydrate in Albert's meal.

4. Albert has a ratio of: 2 units of insulin for each CP or 1 unit of insulin for every 5g of carbohydrate. How many units of bolus insulin will Albert need to give himself?

Answers on page 82–87

Honey (250ml jar)

Nutritional Information		
Typical values	**Per 100g**	**Per 15ml serving**
Energy Kcal/KJ	359/ 1442	54/ 216
Protein (g)	0.1	<0.1
Carbohydrate (g)	84.7	12.7
of which sugars (g)	84.7	12.7
Fat (g)	Tr	0
of which saturates (g)	Tr	0
Fibre (g)	0.3	<0.1
Sodium (g)	Tr	0

Summary

- There are many ways of estimating carbohydrate, including carbohydrate reference lists, food labels and calculating recipes.
- The amount of carbohydrate in foods does not change during cooking.
- Work out the carbohydrate content of the whole meal before rounding figures up or down.
- Different methods of carbohydrate counting (using CPs or grams) can result in different units of insulin given. **Make sure you stick with one method and do not alter nate between the two.**

Answers

Now you try 1: pages 46–47

Method 1: Carbohydrate portions

To find out the total amount of carbohydrate in his meal, Albert needs to add up the amount of carbohydrate in each item.	
Half a cup (45g) of raw oats	= 3 CP
100ml of milk	= 0.5 CP
1 dessert spoon of honey	= 1.5 CP
200ml orange juice	= 2 CP
Total	**= 7 CP**
Albert has an insulin to carbohydrate ratio of 1 unit of insulin for each CP.	**7 x 1 = 7 units**
Albert works out that he needs to give himself 7 units of bolus insulin.	

Method 2: Carbohydrate in grams:

To find out the total amount of carbohydrate in his meal, Albert needs to add up the amount of carbohydrate in each item.	
Half a cup (45g) of raw oats	= 30g
100ml of milk	= 5g
1 dessert spoon of honey	= 14g
200ml orange juice	= 22g
Total	**= 71 g**
He has an insulin to carbohydrate ratio of 1 unit of insulin for every 10g of carbohydrate.	$\frac{71}{10}$ **= 7.1 units**
This is **rounded** to the nearest whole number.	**= 7 units**
Albert works out that he needs to give himself 7 units of bolus insulin.	

Answers

Now you try 2: pages 60–63

Method 1: Carbohydrate portions

To find out the total amount of carbohydrate in his meal, Albert needs to add up the amount of carbohydrate in each item.	
1 tin oxtail soup Wholegrain roll Eccles cake Black coffee	= 26.4g = 25.9g = 23.2g = 0g
Total amount of carbohydrate	**= 75.5g**
To work out how many CPs, divide by 10.	**$\frac{75.5}{10}$ = 7.55 CP** **rounded to 7.5 CP**
Albert has an insulin to carbohydrate ratio of 1.5 units of insulin for each CP. This is **rounded** to the nearest whole number.	**7.5 x 1.5 = 11.25 units** **= 11 units**
Albert works out that he needs to give himself 11 units of bolus insulin.	

Method 2: Carbohydrate in grams

To find out the total amount of carbohydrate in his meal, Albert needs to add up the amount of carbohydrate in each item.	
1 tin oxtail soup Wholegrain roll Eccles cake Black coffee	= 26.4g = 25.9g = 23.2g = 0g
Total amount of carbohydrate	**= 75.5g**
Albert has an insulin to carbohydrate ratio of 1unit of insulin for every 7.5g of carbohydrate. This is **rounded** to the nearest whole number.	**$\frac{75.5}{7.5}$ = 10.06 units** **= 10 units**
Albert works out that he needs to give himself 10 units of bolus insulin.	

Answers

Now you try 3: pages 77–79

1. *Divide the foods into those that are counted and those that are not.*

Foods counted: jacket potato, apple sauce, milk, flour, honey
Foods not counted: pork chop, margarine, carrot, swede, gravy, egg

2. *Calculate the carbohydrate content of each element that is counted.*

Jacket potato

Note: This is a good example of when it is important to be careful when working out the carbohydrate content of foods that change their weight significantly during the cooking process.

Method 1: Carbohydrate portions

Albert weighs his potato **once it has been cooked** and it weighs 180g.

By looking at the carbohydrate reference list he can see that this has **5.5 CPs.**

Albert could also have worked this out by finding out how much carbohydrate his **raw** potato contained, which weighed 360g. The carbohydrate reference list shows that 100g raw potato has 1.5 CP. He works out how much carbohydrate is in 1g.

$$\frac{1.5}{100} = 0.015 \text{ CP}$$

His potato weighed 360g so he multiplies by 360.

0.015 x 360 = 5.5 CPs

Method 2: Carbohydrate in grams

Albert weighs his potato **once it has been cooked** and it weighs 180g.

By looking at the carbohydrate reference list he can see that this has **57g carbohydrate.**

Albert could also have worked this out by finding out how much carbohydrate his **raw** potato contained, which weighed 360g. The carbohydrate reference list shows that 100g raw potato has 17g of carbohydrate.

He works out how much carbohydrate is in 1g $\frac{17}{100} = 0.17g$

His potato weighed 360g so he multiplies by 360.
0.17 x 360 = 61.2g

This figure is rounded to **61g**

Apple sauce (250ml jar)

Working out the carbohydrate content

The label tells Albert that a 15ml serving of apple sauce has **4g** of carbohydrate.

Milk

Method 1: Carbohydrate portions

The carbohydrate reference list shows that 100ml milk has 0.5 CP. This recipe uses 285ml of milk. Albert works out how much carbohydrate is in 1g.

$\frac{0.5}{100} = 0.005$ **CPs**

To find out how much is in 285ml, multiply by 285.
0.005 x 285 = 1.43 CP rounded to **1.5 CP**

Answers

Now you try 3 (continued): pages 77–79

Method 2: Carbohydrate in grams

The carbohydrate reference list shows that 100ml milk has 5g carbohydrate. Albert works out how much carbohydrate is in 1g.

$$\frac{5}{100} = 0.05g$$

This recipe uses 285ml milk.
So he multiplies by 285 **0.05 x 285 = 14.3g**

Flour

Method 1: Carbohydrate portions

The carbohydrate reference list shows that 1 tablespoon or 30g of flour is 2 CP. Therefore **2 tablespoons or 60g** of flour will have twice this amount **2 x 2 = 4CP**

Method 2: Carbohydrate in grams

The carbohydrate reference list shows that 1 tablespoon or 30g of flour has 20g of carbohydrate. Therefore **2 tablespoons or 60g** of flour will have twice this amount **20g x 2 =40g**

Method 1: Carbohydrate portions	
The total amount of carbohydrate in the pancake mix is as follows:	
Milk	= 1.45CP
Flour	= 4 CP
Total	**= 5.5 CP**
This recipe makes 6 pancakes. Albert eats 2 pancakes.	**$\frac{5.5}{3}$ = 1.83 CP**
Rounded to the nearest whole number.	**= 1.8 CP**

Method 2: Carbohydrate portions	
The total amount of carbohydrate in the pancake mix is as follows:	
Milk	= 14.3g
Flour	= 40g
Total =	**54.3g**
This recipe makes 6 pancakes. Albert eats 2 pancakes.	**$\frac{54.3}{3}$ = 18.1g**

Honey (250ml jar)

Working out the carbohydrate content
The label shows there is **12.7g** of carbohydrate in 15ml of honey.

Answers

Now you try 3 (continued): pages 77–79

3. *Calculate the total amount of carbohydrate in Albert's meal.*

Method 1: Carbohydrate portions	
To work out the total amount of carbohydrate in the whole of Albert' s meal, start by adding up the carbohydrate in grams.	
Apple sauce Honey	= 4g = 12.7g
Total amount of carbohydrate	**= 16.7g**
To work out how many CPs, divide by 10.	$\frac{16.7}{10}$ **= 1.67 CP** **rounded to 1.7 CP**
Now move on to adding up the CPs Jacket potato Pancakes Apple sauce and honey	 = 5.5 CP = 1.8 CP = 1.7 CP
Total = Albert has a carbohydrate to insulin ratio of 2 units of insulin for each CP.	**9 CP** **9 x 2 = 18 units**
This means that Albert needs to give himself 18 units of bolus insulin.	

Method 2: Carbohydrate in grams

The total amount of carbohydrate in Albert's meal is as follows:	
Jacket potato Apple sauce Pancakes Honey	= 61g = 4g = 18.1g = 12.7g
Total amount of carbohydrate	**= 95.8g rounded to 96g**
Albert has an insulin to carbohydrate ratio of 1unit of insulin for every 5g of carbohydrate.	$\frac{96}{5}$ **= 19.2 units**
This is **rounded** to the nearest whole number.	**= 19 units**
This means that Albert needs to give himself 19 units of bolus insulin.	

IMPORTANT: Different methods may give different results.
Different methods of carbohydrate counting can give different units of insulin. Make sure you stick with one method and **do not** alternate between the two.

Chapter 5:
Eating out, takeaways and snacks

When eating out it may be more difficult to judge how much carbohydrate you are going to eat at a particular meal.

This chapter covers the following:

- **Things to think about when you are eating out**
- **Insulin and snacks**

Things to think about when you are eating out

When going out to a restaurant, you may not be planning on having a pudding when you start, but sometimes they just look too good.

It is not just tempting puddings and extra carbohydrates at the end of a meal that can make it difficult to control your blood glucose levels when eating out. The following should be considered too:

- You won't have all the tools you use to accurately estimate the carbohydrate content of foods, especially if you need to weigh any of them.
  Carbohydrate reference lists and books will help. They list the amount of carbohydrate in handy measures, such as a bread roll or a scoop of mashed potato. And some contain pictures for comparing too. Remember, to keep your own notes on your typical portion sizes and carbohydrate values.

- You might not know exactly what ingredients were used to make up your meal. This makes it more difficult to know what parts of your meal you need to match with insulin. Roast dinner may be easy to calculate, but if you are trying something with lots of hidden ingredients, it may be more difficult.

  Ask restaurant staff to let you know what is in your meal. Many large chains and takeaway restaurants have websites that state the amount of carbohydrate in popular dishes. If you have a favourite restaurant or takeaway, you could also keep a note of your insulin doses and blood glucose levels with various dishes.

- You may drink alcohol when eating out and alcohol can affect your blood glucose levels.

  The effect of alcohol on blood glucose levels is discussed in Chapter 6 and the risk of hypos after alcohol should be carefully considered when working out how much insulin to give.

- You may choose foods that are higher in fat than usual. Fat slows down the absorption of carbohydrate. This can mean that when you give your bolus insulin, it might have finished working before all your carbohydrate has been absorbed.

  One way of dealing with this is to split your dose of insulin. For example, giving half of your insulin dose just before or with your meal and the other half 30 minutes after your meal, eg with a stuffed crust pizza. Experience and monitoring your blood glucose levels will help you to decide in which situations this is right for you.

- Eating out is often a leisurely event, which could last a few hours.

  This means that you will need to consider when to give your insulin – at the start of the meal, in the middle, at the end, or splitting your dose. These decisions should be made on a meal by meal basis, based on past experiences.

- Activity and exercise on a night out (eg going out dancing after dinner can lower blood glucose levels and so must be considered when calculating your insulin dose.)
  More detailed information on physical activity is in Chapter 7.
- Estimating carbohydrates at these times can be difficult.
  It is often best to underestimate the amount of carbohydrate you have eaten and therefore the amount of bolus insulin to avoid hypos, and then give a correction dose before your next meal to compensate if necessary.

Insulin and snacks

Insulin should generally be given with snacks that provide more than 10g of carbohydrate or 1 CP, however this may differ depending on your insulin to carbohydrate ratio.

When calculating how much insulin to give, use the insulin to carbohydrate ratio of the closest meal time.

Examples of snacks that do not need to be matched to insulin

The following are unlikely to be needed to be matched with insulin.

Beef jerky
Pork scratchings
Vegetable sticks
Berries/ Cherries (not strawberries)
Hummous
Cheese
Nuts
Pepperoni stick
Bombay mix
Seeds
Salad
Vegetable chips
Dips
Olives
Gherkins
Pickled onions
Some soups

Examples of snacks that contain more than 10g of carbohydrate or 1 CP or more. It is likely that these snacks will need to be matched with insulin.

Food	Portion size	Amount of carbohydrate	CP
Crisps	1 bag (25g)	13	1 1/2
Snack a jacks	1 bag	23	2 1/2
Yogurt	1 pot (200g)	15	1 1/2
Digestive biscuits	2 biscuits	19	2
Fruit	1 apple (medium)	12	1
Crunchie	1 standard bar	22	2
Rice cakes	2 cakes	15	1 1/2
Tortilla chips	1 bag (30g)	18	2
Choc ice	1 block	15	1 1/2
Crackers	3 water biscuits	15	1 1/2

Summary

- Blood glucose levels tend to be more difficult to control when eating out for many reasons.
- It may be useful to adopt various ways of giving bolus insulin to help control blood glucose levels.
- Generally only snacks with more than 10g of carbohydrate or 1 CP need to be counted when matching to insulin.
- When eating snacks that you need to cover with insulin, use the insulin to carbohydrate ratio of the closest meal.

Chapter 6: **Alcohol**

If you drink alcohol it is important to understand the effect this can have on your blood glucose levels and the precautions you should take to avoid having a hypo.

This chapter covers the following:

- **The effect of alcohol on blood glucose levels**
- **Alcoholic drinks that contain carbohydrate**
- **How to avoid alcohol related hypos**

The effect of alcohol on blood glucose levels

Alcohol can affect blood glucose levels in different ways. Depending on what they drink, some people find that initially their blood glucose levels will rise, whilst others find it falls. Even people who find their blood glucose levels rise initially, usually experience lower blood glucose levels for some hours after drinking alcohol.

Alcohol interferes with the normal release of stored glucose from the liver and so blood glucose levels can fall if no extra carbohydrate is eaten. This interference with the liver increases the risk of hypos during, and for sometime after, drinking. The liver processes one unit of alcohol each hour and while it is doing this, your body cannot automatically release glucagon to reverse a hypo (see Chapter 9). Even if you have just a few drinks in the evening, you could be at an increased risk of a hypo all night and possibly part of the next day too.

Different drinks contain different units of alcohol. Over the years the alcohol content of alcoholic drinks has continued to increase, so a drink may contain more units than you think. Below is a guide to the number of units for some typical drinks:

Amount	Drink	Alcoholic strength (approx) ABV	Units (approx) of alcohol
1 pint	Premium strength lager or cider	5	2.8
1 pint	Average strength lager	4	2.3
1 pint	Average strength cider	4.5	2.6
1 pint	Bitter	3.8	2.2
1 pint	Stout	4.2	2.4
Medium glass (175ml)	White, red or rose wine	12	2.1
Large glass (250ml)	White, red or rose wine	12	3.0
Single pub measure (25ml)	Spirits, eg vodka, gin, whisky	40	1

You can calculate how much alcohol is in your drink by using the following formula:

$$\frac{\text{ABV x amount of drink in mls}}{100} = \text{number of units}$$

Alcoholic drinks that contain carbohydrate

Some alcoholic drinks do contain carbohydrate, such as beers, cider and alcopops and therefore will make your blood glucose levels rise initially. Due to the risk of hypos, it is not usually necessary to count the carbohydrate content or give extra insulin.

Extreme caution must be taken when giving additional doses of insulin with alcohol. If you find that your blood glucose levels are consistently higher after drinking alcohol, ask your diabetes team how much additional insulin you need to give.

How can I avoid alcohol related hypos?

There are a few general rules to help prevent hypos when drinking alcohol:

- Avoid drinking on an empty stomach.
- Eat carbohydrate containing snacks especially before bed, without taking any extra bolus insulin.
- Have some extra carbohydrate the following morning or reduce bolus insulin.
- Monitor your blood glucose levels closely.
- Carry hypo treatment with you at all times.
- Take your diabetes identification out with you in case of a hypo.
- Make sure that the people you are with know that you have diabetes and how alcohol affects your blood glucose levels.

Summary

- Alcohol lowers blood glucose levels, making hypos more likely.
- Avoid alcohol related hypos by not missing meals, eating regular snacks and doing additional blood glucose monitoring.
- Although some alcoholic drinks contain carbohydrate, they should generally not be matched with insulin, because of the increased risk of a hypo unless otherwise advised by your diabetes team.

Chapter 7:
Physical activity

Physical activity is important for living a healthy life. For people with diabetes it is essential to understand the ef fect that any activity has on blood glucose levels and what steps can be taken to keep them under control.

This chapter covers the following:

- **What happens to the body during physical activity**
- **Physical activity and Type 1 diabetes**
- **Adjusting insulin doses and carbohydrate intake for physical activity**

What happens to the body during physical activity

During activity, the body needs additional oxygen and energy. To achieve this, the heart and lungs work harder and hormones are released. The heart is pumping faster, breathing is deeper and energy is released from the body stores, especially from the liver.

Initially, energy (glucose) is released from stores within the body's cells, but as the activity continues, the energy is taken from the blood stream. As this glucose in the blood stream is used up, the liver releases stored glucose to maintain blood glucose levels.

In people without diabetes, this balance of glucose released from the liver keeps blood glucose levels within a normal range. The glucose released from the liver is brought about by a sharp increase in certain hormones – glucagon, catecholamines (including adrenaline) and growth hormones and at the same time insulin levels are reduced.

Once these stores of glucose are used up, other energy sources become available, such as fat from fat stores.

Physical activity and Type 1 diabetes

In Type 1 diabetes there are difficulties with this balance of hormones. Giving too much insulin levels and lower adrenaline levels together can increase the likelihood of experiencing a hypo either during or up to 24 hours after activity.

To reduce the chances of a hypo happening, you need to plan ahead where possible and alter your carbohydrate intake and/or insulin doses, ie eat more carbohydrate or take less insulin. With planned activity you have this option. If you are trying to lose weight, it is probably best to reduce your insulin doses in advance. Speak to your diabetes team for guidance on how to do this. If you are doing unplanned activity, you will need to have more carbohydrate. See the table on page 98 for more guidance on this.

Recent research has shown that some people may find that during anaerobic exercise (see Glossary), for example sprinting, blood glucose levels actually increase as the activity is very intense[4]. If this applies, you may want to discuss this with your diabetes team.

High blood glucose levels before activity

Be careful when your glucose level is more than 14 mmol/l.[4] Activity, in this situation, can raise your blood glucose level even further rather than lower it. If this happens, it is because you may not have enough insulin circulating in the body. Consider injecting an extra dose of bolus insulin (correction dose) and always check for ketones. If ketones are present, you need to avoid doing any activity until your ketones have gone.

More information on ketones can be found in Chapter 8.

Checklist to avoid problems during or following physical activity

- Test your blood glucose levels more often, particularly before, during and hourly after activity. This will help you understand your body's response.
- If ketones are present with high blood glucose levels (more than14 mmol/l), delay exercise until you have got rid of the ketones, as this could lead to ketoacidosis (see Chapter 8).
- If blood glucose levels are below 7 mmol/l before the activity, take additional carbohydrate, without matching it to a dose of insulin.
- If you have blood glucose levels of less than 4 mmol/l, you are having a hypo. Make sure you treat this appropriately (see Chapter 9) and try to achieve a blood glucose levels of at least 7 mmol/l, before starting your activity.
- Be prepared to decrease your insulin, increase your carbohydrate intake or both.
- Be aware that absorption of insulin may be faster if you inject into a limb that will be used for activity, such as your leg if you are running.
- Always carry hypo treatment, (see Chapter 9) and medical ID.
- Make sure you drink plenty of fluids during prolonged activity.
- If your activity involves being on your own, make sure someone knows where you have gone.
- Teach those with you on how to recognise and treat hypos.

Unplanned activity

The table below is a guide to show how you might adjust your carbohydrate intake when taking part in unplanned physical activity.

Activity level
Short duration, low intensity

eg 30 minutes of yoga, walking or bicycling leisurely.

Blood glucose level before activity

Less than 5 mmol/l	5–10 mmol/l	10–14 mmol/l
Add 10–20g carbohydrate before activity.	No adjustment needed.	No adjustment needed.

Activity level
Moderate duration, moderate intensity

eg 30-60 minutes of walking vigorously, playing tennis, swimming or jogging.

Blood glucose level before activity

Less than 5 mmol/l	5–10 mmol/l	10–14 mmol/l
Add 10–20g carbohydrate before activity. Add 10–20g carbohydrate before activity.	Add 10–20g carbohydrate for a blood glucose level of 5–7 mmol/l. No adjustment needed for a blood glucose level of 7.1–10 mmol/l.	No adjustment needed.

Activity level
Moderate duration, high intensity

eg 30-60 minutes running, high impact aerobics or kick boxing.

Blood glucose level before activity

Less than 5 mmol/l	5–10 mmol/l	10–14 mmol/l
Add 20 – 30g carbohydrate before activity.	Add 10–20g carbohydrate before activity.	No adjustment needed.

Activity level
Long duration, moderate intensity

eg 60 minutes or more of playing team sports, golfing, cycling or swimming (retest your blood glucose level after each hour of activity and add carbohydrate according to that blood glucose level).

Blood glucose level before activity

Less than 5 mmol/l	5–10 mmol/l	10–14 mmol/l
Add 10-20g carbohydrate per hour of activity.	Add 1 –20g carbohydrate per hour of activity.	After first hour of activity, add 10–20g carbohydrate.

Example 1

Jane regularly enjoys a morning swim.

Before breakfast, she does 40 lengths of the local pool (1km), which takes her 30 minutes. Her blood glucose level when she wakes up is 4.8 mmol/l.

How does Jane need to adjust her carbohydrate intake?

Answer:

Jane does moderate duration, moderate intensity activity and her blood glucose level is less than 5 mmol/l before starting. She needs to have 10–20g of carbohydrate before swimming.

Example 2

Osa is going out on a Friday night to the students' union for a night of dancing/clubbing. He dances for 2 1/2 hours. Osa does not drink alcohol but always seems to have a hypo every Saturday morning.

How does Osa need to adjust his carbohydrate intake?

Answer:

Osa does long duration, moderate intensity activity. He needs to have an extra 10–20g of carbohydrate per hour of dancing.

Example 3

Bob likes to spend the evenings after work in the gym.

After work he spends 1 hour doing weights and cardio work. He goes before his evening meal and his blood glucose level before he starts is 5.2 mmol/l.

How does Bob need to adjust his carbohydrate intake?

Answer:

Bob does moderate duration, high intensity activity and his blood glucose level is in the range of 5 –10 mmol/l before starting. Bob will need to have 10–20g of carbohydrate before the gym.

Now you try 4

Albert regularly treats his Westie dog to a days' walking.

They walk a distance of 12 miles. His blood glucose level before he starts is 12 mmol/l

How does Albert need to adjust his carbohydrate intake?

Answers on page 102

Summary

- Different types of physical activity will affect blood glucose levels in different ways.
- The risk of a hypo is increased following physical activity, as energy stores are replenished.
- Adapting carbohydrate intake and insulin doses before, during and after physical activity can help to keep blood glucose levels within range.
- Measure for ketones if blood glucose levels are above 14 mmol/l. Do not exercise if ketones are present.

Important: This chapter is aimed at people doing moderate activity. People who are very active or training for an event will need to get individual expert advice from their diabetes team.

Answers

Now you try 4: page 101

Answer:

Albert does long duration, moderate intensity activity. Albert checks his blood glucose levels hourly and has an extra 10–20g of carbohydrate every hour.

Chapter 8: **Hyperglycaemia and diabetic ketoacidosis**

Hyperglycemia and diabetic ketoacidosis (DKA) are short term complications of diabetes. It is important for you to understand when and why these may occur and how to manage them.

In this chapter you will find out about the following:

- **How diabetic ketoacidosis (DKA) occurs**
- **How ketones effect people with Type 1 diabetes**
- **When DKA is most likely to occur**
- **Measuring ketones**
- **What to do if you have ketones**

What is hyperglycaemia?

Hyperglycaemia means high blood glucose levels above 10 mmol/l. In the short term, consistent hyperglycaemia can lead to a condition called diabetic ketoacidosis (DKA). DKA occurs when there is not enough insulin in the body to allow enough glucose to entering the cells. In response to the lack of glucose, the body begins to use stores of fat as an alternative for energy, which in turn produces by-products known as ketones which make the blood acidic.

How ketones affect people with Type 1 diabetes

Ketones are very harmful and the body will immediately try to get rid of them by excreting them in the urine and exhaling them in the breath. Consequently, when blood glucose levels are high and ketones are present, people often become increasingly thirsty as the body tries to flush the glucose and ketones out in the urine. If the level of ketones in the body continues to rise, ketoacidosis develops and nausea or vomiting may start. In addition, the skin may become dry, eyesight blurred and breathing both deep and rapid to exhale ketones in the breath.

Unfortunately, vomiting makes the body even more dehydrated and less efficient at flushing the ketones out, allowing levels to rise even faster. As the levels rise, it may be possible to smell the ketones on the breath – often described as smelling like pear drops or nail varnish. If untreated, DKA can cause death, so it needs to be treated urgently – in a matter of hours.

The good news is that DKA can be avoided by careful monitoring and adjusting of insulin, by following sick day rules, such as drinking plenty of fluid, injecting more bolus insulin and checking for ketones. DKA can be treated effectively in hospital with intravenous fluids, insulin and glucose.

When is DKA most likely to occur?

The high-risk time for developing ketoacidosis is when you are unwell or forget to take your insulin. Part of the body's response to illness and infection is to release more glucose (from the liver) and hormones into the bloodstream, which stop insulin working normally. This happens even if you lose your appetite or are off your food altogether. During periods of illness, even if you are not eating, insulin is still needed and should never be stopped.

Checking your blood glucose levels when you are ill is very important and should be done at least every four to six hours if there are no ketones present or every two hours if ketones are present. Diabetes UK recommends that you test at least four times a day and night (ie at least eight times over a 24 hour period). Ask your diabetes team for help if you are worried.

Measuring ketones

One way of finding out if you have enough insulin in your body is to check for ketones either in your urine or blood. As levels of ketones rise, the body tries to get rid of them in the urine. Ketones in the urine are easily detected by a simple urine test, although there is a delay between blood and urine levels.

People with diabetes should test their urine or blood for ketones if their blood glucose is persistently high (usually over 15 mmol/l)[7] or if they have any symptoms of ketoacidosis, such as thirst, going to the toilet a lot and tiredness.

What to do if you have ketones

If you get a positive result for ketones (greater than 1.5 mmol/l on a blood ketone meter, or small or more on a urine ketostick), you should do the following:

- Drink plenty of sugar-free fluids. Aim for at least 3 litres (5 pints) a day. This is about 100–200ml per hour.
- Keep taking your insulin. You are likely to need more insulin even if you are not eating anything – discuss how much with your diabetes team.
- Test your blood glucose and ketone levels closely.
- If you cannot keep to your normal meal pattern, replace meals with frequent carbohydrate containing snacks and drinks. Match this carbohydrate with bolus insulin as usual.

Summary

- Hyperglycaemia means high blood glucose levels.
- Ketones are produced when fat is broken down to be used as energy in the absence of sufficient insulin circulating in the blood stream.
- Ketones are poisonous to the body and are excreted in the urine and breath.
- High ketone levels can result in diabetic ketoacidosis (DKA) which can be fatal. Contact your diabetes team or GP (or A&E if your diabetes team or GP are not available) for additional information and support.
- DKA is most likely during times of illness and missed insulin.
- During illness follow the 'sick day rules' and measure for ketones if blood glucose levels are above 15 mmol/l [7].

Chapter 9:
Hypoglycaemia

Hypoglycemia is a short term complication of diabetes. By understanding when and why a hypo might happen, you can manage them more effectively.

In this chapter you will find out about the following:

- **What is hypoglycaemia?**
- **When is a hypo likely to happen?**
- **Symptoms of hypoglycaemia**
- **Treating hypos**
- **Hypos at night**

What is hypoglycaemia?

Hypoglycaemia, known as hypo, means low blood glucose level – that is less than 4 mmol/l. Hypos are often the one thing that people are most worried about.

In someone without diabetes, blood glucose levels are tightly controlled by both insulin (to lower blood glucose levels) and glucagon (to increase blood glucose levels). As glucose levels begin to fall the body shuts down the production of insulin and starts to produce glucagon instead. Glucagon encourages the liver to release stored glucose into the blood stream.

In people with diabetes, both of these mechanisms can be affected. Chapter 1 explains that people with Type 1 diabetes do not produce any of their own insulin, and so insulin treatment is given instead.

Once insulin has been given it will continue to work for the duration of its action, lowering the blood glucose levels no matter what they are.

The mechanism for producing glucagon is also not as effective in people with Type 1 diabetes. Blood glucose levels can continue to fall below 4 mmol/l and adrenaline is released, which in turn causes the symptoms of a hypo.

If a hypo isn't treated, then blood glucose levels will continue to drop, releasing more hormones (growth hormone and cortisol), which encourage the liver to release stored glucose.

Eventually, once your insulin has worn off and the liver has released enough stored glucose, your blood glucose levels will rise again.

When is a hypo likely to happen?

Hypos are an expected side effect of insulin treatment, but they should not be frequent, more than 1–3 per week is too frequent.
The cause of your hypo should also be easily identifiable.

Hypos can happen for many reasons including:

- mismatch of insulin to carbohydrate
- unplanned activity
- drinking alcohol
- overestimating a correction dose

Early symptoms, known as adrenergic symptoms

When blood glucose levels fall, the brain gives you warning signs by releasing adrenaline and other hormones that produce the symptoms you might be familiar with.

These include:

- feeling hungry
- trembling and shakiness
- sweating
- anxiety and irritability
- going pale
- pounding of the heart
- tingling of the lips
- blurred vision.

Later symptoms, known as neuroglycopenic symptoms

Later effects of hypos, happen when the storage of glucose causes disturbance in brain function. These include:

- difficulty in concentrating
- vagueness or confusion
- irritability or irrational behaviour.

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Symptoms of hypoglycaemia

Symptoms of a hypo can vary from person to person and, sometimes, each time you have a hypo.

Other people may notice these symptoms before you do.

Any hypo that you cannot treat yourself, whilst still conscious, is considered to be a severe hypo because, without treatment, it could progress to unconsciousness.

People with Type 1 diabetes can lose their hypo warning signs. If this has happened to you, discuss this with your diabetes team, who can advise you on how this can be helped.

Treating hypos

Once you start to notice your hypo warning signs, take action quickly. Although most of the time you will be able to deal with the hypo yourself, ask for help if you need it.

Take 10–20g of fast acting carbohydrate that is quickly absorbed. A list of possible first line treatments are listed in the table below.

Once you have recovered, follow this with a further 10–20g of slow-acting carbohydrate.

First line treatment

Take the simplest food or drink that contains about 10-20g of fast acting carbohydrate that is quickly absorbed, ideally glucose. This could be:

- a glass of original lucozade
- a glass of non-diet drink eg cola, lemonade, orangeade
- three or more glucose tablets
- five sweets, eg jelly babies or jelly beans
- a glass of unsweetened fruit juice
- Glucogel

The exact quantity will vary from person to person and will depend on circumstances. You may need to repeat this. You should always carry some hypo treatment with you.

Follow-on treatment

To prevent your blood glucose level dropping again, it is important to follow fast acting carbohydrate with a snack that contains slow acting carbohydrate or the next meal if it is due. This may not be necessary if you are using an insulin pump – check with your diabetes team.

These slow-acting carbohydrates include:

- a slice of bread or toast
- a piece of fruit
- a small bowl of cereal
- biscuits and milk
- the next meal if due

Severe hypos

If you do not treat a hypo, it will become much worse and you may become unconscious. Severe hypos will need to be treated by someone else.

If you have become confused and unable to treat your hypo, it is important that somebody else knows what to do and can step in to help.

IMPORTANT: Do not give anything by mouth if unable to swallow or unconscious.

Let friends, family and work colleagues know that if you become unconscious they must never try to give you food, drink or even Glucogel because it could cause you to choke. If possible they should place you in the recovery position (on your side with your head tilted back), so that your tongue does not block your throat, and call an ambulance.

Glucagon, the hormone that releases glucose from the liver, can be given by injection, if the person who is with you has been taught how to do this. It is a very effective way of reversing a hypo and will bring you round within five to ten minutes. Some people may feel nauseated immediately after an injection of glucagon. Once you are conscious, follow your normal hypo treatment.

You can get glucagon kits on prescription from your doctor, and your diabetes care team will show your carer how to give it to you. Your carer should feel confident and comfortable about administering glucagon, knowing where it should be stored and making sure that it has not gone past its expiry date. Your carer should not give it to you if they feel unsure – they should immediately call 999 for an ambulance.

If you become unconscious and do not treat a hypo, your body will slowly respond by naturally increasing blood glucose levels, and you will eventually become conscious again as the effect of your insulin wears off. On very rare occasions, having a hypo has been fatal and some deaths have occurred as a result of drinking large amounts of alcohol. This is because the alcohol slows down the release of glucose from the liver (see Chapter 6).

Hypos at night

Many people worry about having a hypo at night. Low blood glucose levels can happen during the night, but you may not notice them. Keep some hypo treatment by your bed just in case.

If you have a night time hypo that has not woken you up, you may wake up in the morning feeling very tired, perhaps with a headache or with a feeling like a hangover.

The best way of confirming that you are having night time hypos is to carry out an occasional blood glucose test between 2.00am and 4.00am when most night time hypos happen. Set an alarm for this. Blood glucose levels usually fall to their lowest level around this time. They start to rise again as the effect of the insulin you injected the day before, wears off and the liver releases stored glucose. This is why you may have a high blood glucose level the next morning even if your glucose level has gone low during the night.

If you do find that you have more than one hypo at night every month, contact your diabetes team – you may need to adjust the timing of your insulin injection, or the dose.

After a hypo

Following a hypo, some people can feel unwell, perhaps with a headache, as well as experience feelings of anger and /or embarrassment. This is quite natural and you may want to discuss some of these issues with the people around you or your diabetes team.

If, following a hypo, your blood glucose levels are high, do not correct them (see Chapter 3).

Summary

- Hypoglycaemia means low blood glucose levels, below 4 mmol/l.
- Normally when your blood glucose level falls too low, various hormones are released to increase it again.
- The release of these hormones cause the signs and symptoms of a hypo, including sweating, shaking and tingling of lips.
- A mild hypo should be treated immediately with a fast-acting carbohydrate, followed by a slow-acting carbohydrate.
- A severe hypo is defined as one you cannot treat yourself.
- A severe hypo may need to be treated with Glucogel or a glucagon injection, depending on whether you are conscious or not.
- Never put anything in an unconscious persons mouth as they may choke. **Call an ambulance.**
- Many people experience night time hypos. Confirm this by testing blood glucose levels at 2–4am. If you are having night time hypos, (see Chapter 3) discuss with your diabetes team.
- Please read the chapters on alcohol and physical activity.

Chapter 10: Structured education courses

Structured education courses

Once you have been diagnosed, living with diabetes becomes a lifelong learning process. To help with this learning process, the Department of Health guidelines currently recommend that all people with diabetes are offered **structured education courses**. A structured course will enable you to start effectively using carbohydrate counting and insulin dose adjustment as a method of controlling your diabetes.

There are lots of different education courses available for people with diabetes, which vary in length and content. These courses are often delivered as a group, as recommended by National Institute of Clinical Excellence (NICE)

Courses may include topics like

- What is diabetes?
- The symptoms of diabetes
- Healthy eating
- Physical activity
- Insulin actions
- Carbohydrate counting
- Hypoglycaemia (low blood glucose levels)
- Hyperglycaemia (high blood glucose levels), illness and ketoacidosis
- Blood glucose monitoring
- Long-term complications of diabetes
- Building your confidence for self-management
- Local services available

Family members, partners and friends should be included in the education process if possible.

It is important that the course that you attend meets the criteria that are set by the Department of Health[6].

The criteria are that the course should:

- have a patient centred philosophy
- have a structured, written curriculum
- have trained educators
- be quality assured
- be audited.

When choosing a course you should ask the following questions:

- Is the programme relevant to my type of diabetes?
- Can I commit enough time to complete the programme in full?
- Is the programme run by qualified trained healthcare professionals?
- Am I happy to take a more involved and proactive role in my diabetes care?

There is currently no formal accreditation scheme in the UK for national or local patient education programmes but there are now tools available for your diabetes team to assess whether their courses are meeting criteria set out by the Department of Health.

Education courses can be found at: **www.diabetes.nhs.uk/downloads/Type_1_Education_Network.pdf**

Or to find a DAFNE course visit: **www.dafne.uk.com**

There may be other education courses available in your area, you can find out about these by contacting your local diabetes service, although it is worth remembering that they may not yet meet the recommended criteria.

Diabetes services and people with diabetes are encouraged to share their experiences of education courses by using Diabetes UK's web-based shared practice database at **www.diabetes.org.uk/sharedpractice**

IMPORTANT: The information in this book can be used in addition to the advice of trained healthcare professionals and carbohydrate counting courses **but it should not be used as a complete replacement for either of these.**

Glossary and references

Glossary

Aerobic exercise. The word Aerobic means 'with oxygen', and the term Aerobic exercise refers to exercise that involves or improves oxygen consumption by the body, such as walking, jogging, swimming, cycling etc.

Anaerobic exercise describes a type of activity that does not need oxygen. These activities are of short duration, high intensity, such as weight lifting.

Cardiovascular disease can also be called 'heart and circulatory disease'. It means all diseases of the heart and circulation, including coronary heart disease (angina and heart attack), and stroke.

The Diabetes Education Network (DEN) is a group of over 200 diabetes healthcare professionals involved in structured education for people with diabetes.

The aim of the network is to support centres delivering/ planning to deliver structured education programmes for people with diabetes to work towards meeting the Department of Health criteria for structured education programmes.

It aims to achieve this by:

- Providing the opportunity to share best practice and learning
- Developing a common evaluation criteria to support quality assurance
- Supporting access to appropriate training
- Supporting centres to deliver high quality programmes

Diabetic ketoacidosis (DKA) is a dangerous condition that can occur as a result of hyperglycaemia and too little insulin. In the absence of insulin, glucose cannot be used for energy. Fat is used as an alternative energy source and acidic chemicals (ketones) are released into the blood as by products.

HbA1c is a blood test showing blood glucose control over the previous two to three months. It is expressed as a percentage.

Nephropathy is a long term complication of diabetes that causes damage to the small blood vessels in the kidneys. This damage can cause the vessels to become leaky or, in some cases, to stop working, making the kidneys work less efficiently. If the kidneys start to fail they cannot carry out their job so well which may result in the build up of waste products in the blood, which the body cannot get rid of.

Neuropathy is a long term complication of diabetes that causes damage to the nerves that transmit impulses to and from the brain and spinal cord, to the muscles, skin, blood vessels and other organs. This includes erectile dysfunction, damage to the nerves in the feet and stomach (gastroparesis).

Retinopathy is a long term complication of diabetes that affects the blood vessels supplying the retina – the seeing part of the eye. Blood vessels in the retina of the eye can become blocked, leaky or grow haphazardly. This damage gets in the way of the light passing through to the retina and if left untreated can damage vision.

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About Diabetes UK and membership

Diabetes UK is the leading UK charity that cares for, connects with and campaigns on behalf of all people affected by and at risk of diabetes.

- We help people manage their diabetes effectively by providing information, advice and support.
- We campaign with people with diabetes and with healthcare professionals to improve the quality of care across the UK's health services.
- We fund pioneering research into care, cure and prevention for all types of diabetes.
- We campaign to stem the rising tide of diabetes.

Did you know?

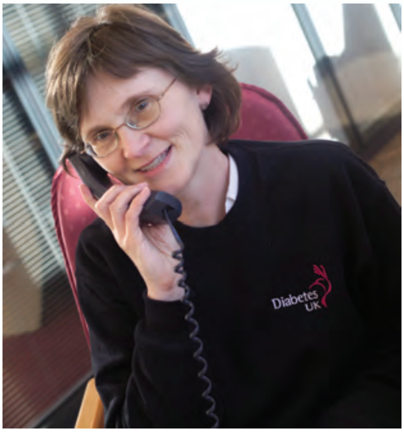
Diabetes is the biggest health challenge facing the UK today. This serious condition is on the rise and more than one in 20 people in the UK have diabetes (diagnosed or undiagnosed).There are currently 3.7 million people in the UK living with diabetes. 2.9 million cases are diagnosed and an estimated 850,000 cases are undiagnosed. As many as 7 million people are at high risk of developing Type 2 diabetes.

- Our website www.diabetes.org.uk has over 4,000 visitors a day.
- We have a network of offices throughout the UK.
- Diabetes UK Careline staff receives nearly 3,000 enquiries a month.
- We spend over £6 million a year on diabetes research.
- We produce a wide range of magazines, books and leaflets covering all aspect of diabetes.

For more information about the publications we produce visit **www.diabetes.org.uk/onlineshop** or call **0800 585 088** to request a free catalogue.

Diabetes UK Careline

The Diabetes UK Careline provides support and information to people with diabetes as well as friends, family and carers. We can provide information to help you learn more about the condition and how to manage it.



The Careline is staffed by trained counsellors who can provide a listening ear and the time to talk things through.

Call 0845 120 2960 Monday–Friday, 9am–5pm*
Email careline@diabetes.org.uk
Write to Diabetes UK Careline, Macleod House, 10 Parkway, London, NW1 7AA

*Depending on your phone package, calls to 0845 numbers may be free. Please check with your phone provider. Or call 020 7424 1000 and ask Reception to transfer your call to Careline.

How can you help?

You can be actively involved in the work that Diabetes UK does.

- Become a supporting member
  call free on 0800 138 5605
  www.diabetes.org.uk/join
- Diabetes Campaigners Network
  or details call 020 7424 1000
  Email dcn@diabetes.org.uk
  www.diabetes.org.uk/dcn
- Fundraising ideas and events
  call 020 7424 1000
  Email community@diabetes.org.uk
  www.diabetes.org.uk/fundraise
- Make a donation
  call 020 7424 1010
  www.diabetes.org.uk/donate

Become a Supporting Member of Diabetes UK

We are a growing community of 300,000 supporters nationwide: people with diabetes, their friends, family and volunteers.

Our members are at the heart of what we do. We support each other and share our experiences. The generosity of our members also enables us to fund essential care, services and research to help improve the lives of everyone affected by diabetes.

By standing with us, our members make us a far more powerful force as we campaign to ensure that diabetes care and research remain at the heart of the nation's conversation about health.

To ensure everyone understands the best ways to manage diabetes, we provide relevant and accurate information to people with the condition, as well as for families, carers and healthcare professionals.
Every two months, Diabetes UK members receive a copy of balance, our magazine designed to be the definitive resource for all things diabetes.

To become a Supporting Member of Diabetes UK, call 0845 123 2399 or email supporterservices@diabetes.org.uk or visit www.diabetes.org.uk/join.

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DIABETES UK
CARE. CONNECT. CAMPAIGN.

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