

## Insulin

Insulin is a hormone made naturally in the body by the pancreas. This hormone controls the level of sugar (glucose) in the blood. People who have [type 1 diabetes](#) need to have regular insulin injections.

In type 1 diabetes, the body stops making insulin and the blood sugar level goes very high. Some people who have [type 2 diabetes](#) may also need to have insulin injections to help control blood sugar levels. Insulin is usually injected under the skin between 2–4 times a day.

There are different types of insulin available which are classified according to how quickly and for how long they work. Your doctor or diabetes nurse will discuss the various preparations and devices available and help you choose a regimen that is right for you. Treatment with insulin is usually lifelong.

### What is insulin?

Insulin is a hormone that is made by cells called beta cells. These are part of little islands of cells (islets) within the pancreas. Hormones are chemicals that are released into the bloodstream and work on various parts of the body. Insulin helps to control the levels of sugar (glucose) in your blood.

### How does insulin work?

After you eat, various foods are broken down in your gut into sugars. The main sugar is called glucose and it passes through your gut wall into your bloodstream. However, to remain healthy, your blood sugar level should not go too high or too low.

So, when your blood sugar level begins to rise (after you eat), the level of insulin should also rise. Insulin works on the cells of your body and makes them take in glucose from the bloodstream. Some of the glucose is used by the cells for energy and some is converted into glycogen or fat (which are stores of energy). When the blood sugar level begins to fall (between meals), the level of insulin falls. Some glycogen or fat is then converted back into glucose which is released from the cells into the bloodstream.

## What is insulin used for?

Your doctor may prescribe insulin if you have a condition called diabetes. In this condition, your body does not make enough insulin to meet its needs, or if it does, does not use the insulin it makes effectively. People with diabetes need treatment to control the level of sugar (glucose) in their blood. There are two different types of diabetes:

### Type 1 diabetes

Type 1 diabetes is the type of diabetes that typically develops in children and young adults. In people with type 1 diabetes the body stops making insulin and the blood sugar level goes very high. Treatment to manage blood sugar levels is with insulin injections and a healthy diet.

Dose Adjustment for Normal Eating (DAFNE) is a way of managing type 1 diabetes and provides people with the skills necessary to estimate the carbohydrate in each meal and to inject the right dose of insulin. See references below.

### Type 2 diabetes

Type 2 diabetes is the type which occurs mostly in people aged over 40 years but is becoming more common in younger adults and in children. The first-line treatment is diet, weight control and physical activity. If the blood sugar level remains high despite these measures then tablets to reduce the blood sugar level are usually advised. Insulin injections are needed in some cases.

## How is insulin taken?

Insulin cannot be taken by mouth, as it is destroyed by the digestive juices in your digestive system. It is therefore given by an injection under the skin. Insulin may come:

- In a vial to be injected with a separate syringe.
  - In a cartridge to be used with an injection-based insulin pen.
  - In the form of an insulin pump, which gives you insulin regularly throughout the day and tries to mimic the natural delivery of insulin.
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## How to inject insulin

Your doctor or diabetes nurse will show you how to inject yourself with insulin. It is usually injected under the skin into your upper arms, thigh, buttocks or tummy (abdomen). Most people take 2-4 injections of insulin each day.

## How much insulin to take

The type and amount of insulin you need may also vary each day, depending on what you eat and the amount of exercise you do. Your doctor or nurse will tell you when to inject your doses, as different types of insulins are given at different times in relation to food. It is important that you inject your doses when you have been advised to and not miss out any of your doses of insulin.

It is important to remember that insulin doses are referred to in terms of units. Make sure you know how much to use – ask your doctor or nurse if you are unsure. Before you start treatment your doctor or diabetes nurse will give a lot of advice and instruction on how and when to take the insulin.

## What types of insulins are available?

**Insulins** are made to closely resemble natural human insulin. They can also be obtained from the pancreas of pigs or cows but this is rarely used nowadays. There are a large number of insulins available in the UK and they come in various brand names.

There are different types of insulin available which are classified according to how quickly and for how long they work. Short-acting or soluble insulin works quickly and is usually injected just before meals. Intermediate- and long-acting insulins take longer to work and the effects last longer. Biphasic insulin products contain both a short-acting and an intermediate- or long-acting insulin. The six main types of insulin are:

### Rapid-acting analogue insulin

This can be injected just before, with or after food. It tends to last between 2 and 5 hours and only lasts long enough for the meal at which it is taken.

### **Short-acting insulin**

This should be injected 15–30 minutes before a meal, to cover the rise in blood-glucose levels that occurs after eating. It has a peak action of 2–6 hours and can last for up to eight hours.

### **Medium-acting and long-acting insulin**

These are taken once or twice a day to provide background insulin or in combination with short-acting insulins/rapid-acting analogues. Their peak activity is between 4 and 12 hours and can last up to 30 hours.

### **Long-acting analogue insulin**

This is usually injected once a day to provide background insulin lasting approximately 24 hours

### **Mixed insulin**

This is a combination of medium-acting and short-acting insulin.

### **Mixed analogue**

This is a combination of medium-acting insulin and rapid-acting analogue.

### **Which is best for you?**

The type of insulin or device that you are prescribed will be tailored to your needs. It may consist of one or more types of insulin and the amounts you use will be carefully chosen to suit you. It is very important that you use the same product each time unless your doctor or diabetes nurse tells you otherwise. Your doctor or nurse will discuss the various insulin types and devices with you and help you choose a treatment regimen that suits you.

A short-acting insulin can also be given continuously by a small portable pump. This pump injects a continuous amount of background insulin into the body. At meal times you can increase the dose. An insulin pump may be suitable for people who have lots of 'hypos' (blood sugar becomes very low) or very high blood sugar in the morning, even when on a suitable insulin regimen.

# What is hypoglycaemia?

Hypoglycaemia, which is often called a 'hypo', occurs when the level of blood sugar (glucose) becomes too low, usually under 4 mmol/L. People with diabetes who take insulin are at risk of having a hypo. A hypo may occur if you have taken too much insulin, delayed or missed a meal or snack, or have taken part in unplanned exercise or physical activity.

Symptoms of hypoglycaemia include:

- Trembling
- Sweating
- [Anxiety](#)
- Blurred vision
- Tingling lips
- Paleness
- Mood change
- Vagueness
- Confusion

To treat hypoglycaemia you should take a sugary drink or some sweets. Then eat a starchy snack such as a sandwich.

## Do I need any special monitoring or tests?

You will usually need to monitor your blood sugar (glucose) levels at home. You will also need to have a special blood test called HbA1c every few months.

### Blood sugar monitoring

It is likely you will need to monitor your blood sugar levels by using a monitor at home. This is to make sure that your insulin is working. Your doctor or diabetes clinic will provide you with a blood sugar monitor, test strips and a lancing device. A lancing device makes a very small cut in the skin so you can place a small drop of blood on the test strip. If you check your blood glucose level, ideally you should aim to keep the level between 4 and 7 mmol/L before meals, and less than 9 mmol/L two hours after meals. It may be best to measure your blood glucose level at the following times:

- At different times in the day.
- After a meal.
- During and after vigorous sport or exercise.
- If you think you are having a hypo (an episode of hypoglycaemia).
- If you are unwell with another illness (for example, a cold or infection).

## **HbA1c**

This test measures a part of the red blood cells. Sugar in the blood attaches to part of the red blood cells. This part can be measured and gives a good indication of your blood sugar control over the previous 1–3 months. This test is usually done regularly by your doctor or nurse. Ideally, the aim is to maintain your HbA1c to less than 48 mmol/mol (6.5%). However, this may not always be possible to achieve and the target level of HbA1c should be agreed on an individual basis between you and your doctor.

[See the separate leaflet called Tests for Blood Sugar \(Glucose\) and HbA1c for more details.](#)

## **What are the side-effects of insulin?**

Apart from hypos (episodes of [hypoglycaemia](#)), insulin has very few side-effects. Lumpiness at the site of the injection (lipodystrophy) has been reported. To help avoid this happening, try varying the places you inject.

## Can I drive if I have diabetes?

You can still drive if you have diabetes and are taking insulin. But if you have a lot of hypos (episodes of hypoglycaemia) or you are unable to tell when you are going to have a hypo then you are not allowed to drive. You will need to inform the Driver and Vehicle Licensing Agency (DVLA) that you have diabetes and are taking insulin. You will also need to be very careful to avoid hypos; this can be done by:

- Checking your blood sugar (glucose) before you drive and every two hours if you are on a long journey.
- Always having a supply of sugar in the car (where you can reach it).
- Avoiding driving if your meal is delayed.

If you have a hypo or have any warning signs when you are driving, you should:

- Stop the car in a safe place.
- Switch the engine off.
- Eat or drink some sugar.
- Wait until you are completely better before continuing your journey – waiting may take 15 minutes or longer.

## How long do I have to take insulin for?

To stay well and healthy you will need insulin injections for the rest of your life.

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## Can I buy insulin?

Yes – you can buy most insulins from any pharmacy. However, most people with diabetes have their insulin prescribed by their doctor.

## How to use the Yellow Card Scheme

If you think you have had a side-effect to one of your medicines you can report this on the Yellow Card Scheme. You can do this online at [www.mhra.gov.uk/yellowcard](http://www.mhra.gov.uk/yellowcard). The Yellow Card Scheme is used to make pharmacists, doctors and nurses aware of any new side-effects that medicines or any other healthcare products may have caused. If you wish to report a side-effect, you will need to provide basic information about:

- The side-effect.
- The name of the medicine which you think caused it.
- The person who had the side-effect.
- Your contact details as the reporter of the side-effect.

It is helpful if you have your medication - and/or the leaflet that came with it - with you while you fill out the report.

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## Further reading

- [Continuous subcutaneous insulin infusion for the treatment of diabetes mellitus](#); NICE Technology appraisal guidance, July 2008
- [Management of diabetes](#); Scottish Intercollegiate Guidelines Network - SIGN (March 2010 - updated November 2017)
- [British National Formulary \(BNF\)](#); NICE Evidence Services (UK access only)
- [Type 1 diabetes in adults: diagnosis and management](#); NICE Guidelines (August 2015 - last updated August 2022)
- [Diabetes \(type 1 and type 2\) in children and young people: diagnosis and management](#); NICE Guidelines (Aug 2015 - updated May 2023)
- [Type 2 diabetes in adults: management](#); NICE Guidance (December 2015 - last updated June 2022)
- [Dose Adjustment For Normal Eating](#); (DAFNE)

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