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Pre-diabetes (Impaired Glucose Tolerance)

If you have pre-diabetes (impaired glucose tolerance), your blood sugar (glucose) is raised beyond the normal range but it is not so high that you have diabetes. However, if you have pre-diabetes, you are at increased risk of developing diabetes. You are also at increased risk of developing conditions such as heart disease, peripheral arterial disease and stroke (cardiovascular diseases). If pre-diabetes is treated, it can help to prevent the development of diabetes and cardiovascular disease. The most effective treatment is lifestyle changes including eating a healthy balanced diet, losing weight if you are overweight, and doing regular physical activity.

Understanding blood glucose and insulin

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

So, when your blood glucose level begins to rise (after you eat), the level of a hormone called 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 stores of energy (glycogen or fat).

When the blood glucose 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.

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.

What is a normal blood glucose level?

Your blood glucose level literally refers to the amount of glucose in your blood. A normal blood glucose level ranges between about 4 and 8 millimoles per litre (mmol/L). Blood glucose levels may be at the higher end of the range after eating and at the lower end of the range first thing in the morning.

If your blood glucose is measured by a blood test when you have not been fasting, this is called a random blood glucose level. If your blood glucose is measured after you have been fasting, this is called a fasting blood glucose level. A normal fasting blood glucose level is less than 6 mmol/L.

Note: the terms blood sugar and blood glucose mean the same thing.

What is diabetes?

Diabetes mellitus (just called diabetes from now on) occurs when the level of glucose in the blood becomes higher than normal. There are two main types of diabetes - type 1 diabetes and type 2 diabetes. Type 2 diabetes is much more common than type 1 diabetes.

The World Health Organization (WHO) has said that someone may have diabetes if they have:

- A fasting blood glucose of 7 mmol/L or more; OR
- A blood glucose of 11.1 mmol/L or more after a two-hour oral glucose tolerance test (see below).

The WHO now recommends that a different blood test called glycated haemoglobin (HbA1c) can be used as an alternative to glucose blood tests to diagnose type 2 diabetes. HbA1c levels of 48 mmol/mol (6.5%) or above indicate that someone has type 2 diabetes. [See separate leaflet called Tests for Glucose \(Sugar\) and HbA1c for more details.](#)

Type 1 diabetes

In type 1 diabetes the beta cells in the pancreas stop making insulin. The illness and symptoms develop quickly (over days or weeks) because the level of insulin in the bloodstream becomes very low. Type 1 diabetes used to be known as juvenile, early-onset, or insulin-dependent diabetes. It usually first develops in children or in young adults. Type 1 diabetes is treated with insulin injections and diet. [See separate leaflet called Type 1 Diabetes for more details.](#)

Type 2 diabetes

With type 2 diabetes, the illness and symptoms tend to develop gradually (over weeks or months). This is because in type 2 diabetes you still make insulin (unlike in type 1 diabetes). However, you develop diabetes because:

- You do not make enough insulin for your body's needs; OR
- The cells in your body do not use insulin properly. This is called insulin resistance. The cells in your body become resistant to normal levels of insulin. This means that you need more insulin than you would normally make to keep the blood glucose level down; OR
- A combination of the above two reasons.

[See separate leaflet called Type 2 Diabetes for more details.](#)

What is pre-diabetes?

If you have pre-diabetes (impaired glucose tolerance), your blood sugar (glucose) is raised beyond the normal range but it is not so high that you have diabetes. However, if you have pre-diabetes you are at risk of developing type 2 diabetes.

Between 1 and 3 out of every 4 people with pre-diabetes will develop diabetes within ten years.

It is also thought that having pre-diabetes increases your risk of developing conditions such as heart disease, peripheral arterial disease and stroke (cardiovascular diseases). Also, people who have pre-diabetes are more likely also to have other risk factors for cardiovascular disease, including high blood pressure, raised cholesterol levels, being overweight, etc. [See separate leaflets called Preventing Cardiovascular Diseases and Cardiovascular Health Risk Assessment for more details.](#)

The WHO defines someone as having pre-diabetes if they have:

- A fasting blood glucose of less than 7 mmol/L; AND
- A blood glucose of 7.8 mmol/L or more but less than 11.1mmol/L after a two-hour oral glucose tolerance test (see below).

However, the glucose tolerance test is rarely used now. The most commonly used test to identify pre-diabetes is now the HbA1c blood test. The WHO has recommended that an HbA1c blood test level of 42–47 mmol/mol (6.0–6.5%) indicates a high risk of diabetes.

What is impaired fasting glycaemia?

The WHO has also said that someone has impaired fasting glycaemia if they have:

- A fasting blood glucose between 6.1 to 6.9 mmol/L; AND
- A blood glucose of less than 7.8 mmol/L after a two-hour oral glucose tolerance test (see below).

If you have impaired fasting glycaemia, you are also thought to have an increased risk of developing diabetes. Your risk of developing cardiovascular disease is also increased but this seems to be lower than if you have pre-diabetes (impaired glucose tolerance). The rest of this leaflet is about pre-diabetes.

How common is pre-diabetes?

Many people have pre-diabetes (impaired glucose tolerance) and because there are no symptoms, they do not know that they have it. Diabetes UK estimates that around seven million people in the UK have pre-diabetes.

What causes pre-diabetes and who develops it?

Pre-diabetes (impaired glucose tolerance) develops for the same reasons as type 2 diabetes (see above). There are various things that can increase your risk of developing pre-diabetes. They are the same risk factors as those for type 2 diabetes. They include:

- **Being overweight or obese** (most people with pre-diabetes are overweight or obese).
- Having a family history of diabetes. This refers to a close family member with diabetes - a mother, father, brother or sister.
- Doing little physical activity.
- Having other risk factors for cardiovascular disease such as **high blood pressure** or high **cholesterol** levels.
- If a woman has **polycystic ovary syndrome** and is also overweight.
- If you developed diabetes during pregnancy (called gestational diabetes).

What are the symptoms of pre-diabetes and how is it diagnosed?

People with pre-diabetes (impaired glucose tolerance) usually have no symptoms. You are often found to have pre-diabetes after blood tests taken for another reason show that you have a raised blood sugar (glucose) level. Sometimes, your doctor may suggest that a screening blood test should be taken to check your blood glucose because they are worried that you may have some risk factors for pre-diabetes or diabetes. For example, if you have high cholesterol levels, are overweight or have high blood pressure, or if you have had a heart attack or stroke, your doctor may suggest that you have a blood test to check your blood glucose.

Pre-diabetes is now most often diagnosed using a blood test called HbA1c. **See the separate leaflet called Tests for Glucose (Sugar) and HbA1c for more details.** An HbA1c value of 48 mmol/mol (6.5%) or above is recommended as the blood level for diagnosing diabetes. People with an HbA1c level of 42-47 mmol/mol (6.0-6.5%) are often said to have pre-diabetes because they are at increased risk of diabetes and cardiovascular disease.

Another test to diagnose pre-diabetes is the glucose tolerance but this is much less often used now. **See the separate leaflet called Glucose Tolerance Test for further details.**

How is pre-diabetes treated?

There is increasing evidence that if pre-diabetes (impaired glucose tolerance) is treated, the progression to diabetes can be prevented. Also, it may be possible to prevent cardiovascular disease from developing. So, it is important to know if you have pre-diabetes and to treat it in order to reduce your risk of developing diabetes and cardiovascular disease. Treatments that have been suggested include lifestyle changes and treatments with medicines.

It is also very important to have a regular blood test to recheck your blood sugar (glucose) level in case you develop diabetes. The frequency of the blood test will vary but you should discuss this with your doctor. A blood glucose test at least once each year is usually recommended.

Lifestyle changes

Lifestyle changes have been found to be the most effective way to stop pre-diabetes from developing into diabetes. Losing weight if you are overweight and increasing your levels of physical activity can help to reduce insulin resistance and therefore make the insulin that is produced more effective at controlling your blood glucose levels.

If you have pre-diabetes, you should:

- **Eat a healthy balanced diet.** Your practice nurse and/or a dietician will give details on how to eat a healthy diet. The diet is the same as recommended for everyone. The idea that you need special foods if you have pre-diabetes or diabetes is a myth. Basically, you should aim to eat a diet low in fat, high in fibre and with plenty of starchy foods, fruit and vegetables. [See separate leaflet called Healthy Eating.](#)
- **Lose weight if you are overweight.** Getting to a perfect weight is unrealistic for many people. However, if you are overweight or obese then losing some weight will help to reduce your blood glucose level (and have other health benefits too). [See separate leaflet called Weight Reduction - How to Lose Weight.](#)
- **Do some physical activity regularly.** If you are able, a minimum of 30 minutes' physical activity at least five times a week is advised. For example, walking, swimming, cycling, jogging, dancing. Ideally you should do an activity that makes you at least mildly out of breath and mildly sweaty. You can spread the activity over the day. (For example, two 15-minute spells of brisk walking, cycling, dancing, etc per day.) Regular physical activity also reduces your risk of having a heart attack or stroke. Always check with your doctor that it is safe to start exercising if you have been inactive for a long period. [See separate leaflet called Physical Activity For Health.](#)

There are also other lifestyle changes that you can make to reduce your cardiovascular disease risk. These include:

- [Stop smoking if you are a smoker.](#)
- Ensuring that you stick to the recommended alcohol intake. [See separate leaflet called Recommended Safe Limits of Alcohol for more details.](#)

Also, make sure that your blood pressure stays within the normal range. Have your blood pressure checked regularly with your practice nurse.

Also, discuss with your doctor or practice nurse if you need a cholesterol check and/or treatment to lower your cholesterol level.

Treatments with medicines

A number of medical trials have looked at the use of various treatments with medicines for people with pre-diabetes to see if they can help to prevent diabetes and cardiovascular disease. Medicines that have been trialled include [metformin](#), [acarbose](#), a group of medicines called [ACE inhibitors](#) and another group of medicines called angiotensin-II receptor antagonists.

Lifestyle changes (as indicated above) are the most important thing if you are found to have pre-diabetes. However, the National Institute for Health and Care Excellence (NICE) has recommended that metformin should be used if a lifestyle-change programme isn't successful or isn't possible because of a disability or medical reasons. A medicine called [orlistat](#) may also be recommended to help lose weight and therefore reduce the risk of developing diabetes.

What follow-up is needed if you have pre-diabetes?

If you are found to have pre-diabetes (impaired glucose tolerance), it is important that you be followed up regularly by your doctor. This will usually mean a blood test to check your fasting blood sugar (glucose) level at least once a year. This is to make sure that you have not developed diabetes. Your doctor is also likely to keep a check on any other risk factors that you may have for cardiovascular disease. So, they may monitor your weight, your blood pressure and also suggest a blood test to check your cholesterol and triglyceride levels.

In the meantime, if you develop any symptoms of diabetes, you should visit your doctor sooner. Symptoms include excess thirst, passing large amounts of urine, tiredness, weight loss and feeling generally unwell. Symptoms tend to develop quite slowly, over weeks or months.

Can pre-diabetes be prevented?

The same things that can help prevent type 2 diabetes can help prevent pre-diabetes (impaired glucose tolerance). These include:

- Eating a healthy balanced diet.
- Losing weight if you are overweight.
- Doing some physical activity regularly.

Further help & information

Diabetes UK

Macleod House, 10 Parkway, London, NW1 7AA

Tel: (Careline) 0845 120 2960 (Admin) 0207 424 1000

Web: www.diabetes.org.uk

Further reading & references

- [Type 2 diabetes: prevention in people at high risk](#); NICE Public Health Guidance (July 2012)
- [Type 2 diabetes prevention: population and community-level interventions](#); NICE Public Health Guidance (May 2011)
- [Ford ES, Zhao G, Li C](#); Pre-diabetes and the risk for cardiovascular disease: a systematic review of the evidence. *J Am Coll Cardiol*. 2010 Mar 30;55(13):1310-7.
- [Perreault L, Pan Q, Mather KJ, et al](#); Effect of regression from prediabetes to normal glucose regulation on long-term reduction in diabetes risk: results from the Diabetes Prevention Program Outcomes Study. *Lancet*. 2012 Jun 16;379(9833):2243-51. doi: 10.1016/S0140-6736(12)60525-X. Epub 2012 Jun 9.
- [Diabetes Risk Score](#); Diabetes UK

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