Pre-diabetes (Impaired Glucose Tolerance)

In pre-diabetes (impaired glucose tolerance), your blood sugar (glucose) is raised beyond the normal range. Whilst this raised glucose level is not so high that you have diabetes, you are at increased risk of developing diabetes when you have pre-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.

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 World Health Organization (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 11.1 mmol/L after a two-hour oral glucose tolerance test.

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.

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 separate leaflet called Tests for Blood Sugar (Glucose) 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 test but this is much less often used now. Read more about the glucose tolerance test.

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 of 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:

- **Stopping 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.

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 *angiotensin-converting enzyme (ACE) inhibitors* and another group of medicines called *angiotensin-II receptor antagonists* (also known as *angiotensin receptor blockers*).

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 and 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.
What is a glucose tolerance test?

A glucose tolerance test checks how well the body processes blood sugar (glucose). It involves comparing the levels of glucose in the blood before and after drinking a sugary drink. The results of this test can help doctors to detect type 2 diabetes or pre-diabetes (impaired glucose tolerance). It is also used to help diagnose diabetes in pregnancy.

How does a glucose tolerance test work?

In most people a simple blood test is enough to detect diabetes. However, some people have 'borderline' results on routine blood tests and then a glucose tolerance test may help. Also, a glucose tolerance test can show when the body can't manage blood sugar (glucose) levels well but not yet to the stage of diabetes. This is known as pre-diabetes (impaired glucose tolerance) and is a condition that can lead to diabetes.

In healthy people, glucose levels in the blood always rise after a meal but they soon return to normal as the glucose is used up or stored. A glucose tolerance test helps to distinguish between this normal pattern and the patterns seen in diabetes and pre-diabetes.

Prior to a glucose tolerance test you are asked not to eat for a certain length of time before the test. Then you drink a sugary drink. Normally, the body should quickly move glucose from the blood into the body's cells. This would reduce the amount of glucose found in the blood samples taken. If there is a problem moving glucose into the cells, glucose remains in the bloodstream. This shows as a higher level of glucose in the blood samples.

When the results of the blood samples come back, doctors compare the level of glucose found in your blood samples taken after the test with specific values. These values can determine if you have diabetes or pre-diabetes.

What happens during a glucose tolerance test?

For the days leading up to the test you should eat a normal diet without restricting what you eat. The night before the test your doctor may ask you to stop eating 8-12 hours before you are due to have the test. You will usually be allowed to drink water but may be asked to avoid sugary drinks.

On the morning of the test your doctor or nurse will take a sample of blood before the test begins. This is known as the fasting sample; it provides a comparison for the other test results. To do this you may have a small needle placed into a vein in the back of your hand.

You will then be given a drink which contains a particular amount of sugar (in the form of glucose) and water.

Timings may vary but another blood sample will be taken 1-2 hours after you have had the drink. In some cases more samples may be taken. After the blood samples are taken, the needle in the back of your hand is removed and you can leave.

What should I do to prepare for a glucose tolerance test?

Your doctor should give you advice about what to do to prepare for a glucose tolerance test. This may include information about how long to fast for before having the test.

Are there any side-effects or complications from a glucose tolerance test?

There are usually no side-effects from a glucose tolerance test apart from a small bruise which may appear at the place where the needle was inserted. Rarely, the vein used to take the blood may become swollen; this usually settles within a few days.

Further reading & references
Type 2 diabetes: prevention in people at high risk; NICE Public Health Guidance (July 2012)


Type 2 Diabetes Know Your Risk; Diabetes UK

Position Statement - Early identification of people with, and at high risk of Type 2 diabetes and interventions for those at high risk; Diabetes UK, Nov 2015

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