

DIABETES

What is diabetes?

Diabetes is a disease in which blood glucose levels are above normal. People with diabetes have problems converting food to energy. After a meal, food is broken down into a sugar called glucose, which is carried by the blood to cells throughout the body. Cells use insulin, a hormone made in the pancreas, to help them convert blood glucose into energy.

People develop diabetes because the pancreas does not make enough insulin or because the cells in the muscles, liver, and fat do not use insulin properly, or both. As a result, the amount of glucose in the blood increases while the cells are starved of energy. Over the years, high blood glucose, also called hyperglycemia, damages nerves and blood vessels, which can lead to complications such as heart disease and stroke, kidney disease, blindness, nerve problems, gum infections, and amputation.

Types of Diabetes

The three main types of diabetes are type 1, type 2, and gestational diabetes.

- Type 1 diabetes, formerly called juvenile diabetes, is usually first diagnosed in children, teenagers, or young adults. In this form of diabetes, the beta cells of the pancreas no longer make insulin because the body's immune system has attacked and destroyed them.
- Type 2 diabetes, formerly called adult-onset diabetes, is the most common form. People can develop it at any age, even during childhood. This form of diabetes usually begins with insulin resistance, a condition in which muscle, liver, and fat cells do not use insulin properly. At first, the pancreas keeps up with the added demand by producing more insulin. In time, however, it loses the ability to secrete enough insulin in response to meals.
- Gestational diabetes develops in some women during the late stages of pregnancy. Although this form of diabetes usually goes away after the baby is born, a woman who has had it is more likely to develop type 2

diabetes later in life. Gestational diabetes is caused by the hormones of pregnancy or by a shortage of insulin.

What is pre-diabetes?

In pre-diabetes, blood glucose levels are higher than normal but not high enough to be characterized as diabetes. However, many people with pre-diabetes develop type 2 diabetes within 10 years. Pre-diabetes also increases the risk of heart disease and stroke. With modest weight loss and moderate physical activity, people with pre-diabetes can delay or prevent type 2 diabetes.

How are diabetes and pre-diabetes diagnosed?

The following tests are used for diagnosis:

- A fasting plasma glucose test measures your blood glucose after you have gone at least 8 hours without eating. This test is used to detect diabetes or pre-diabetes.
- An oral glucose tolerance test measures your blood glucose after you have gone at least 8 hours without eating and 2 hours after you drink a glucose-containing beverage. This test can be used to diagnose diabetes or pre-diabetes.
- In a random plasma glucose test, your doctor checks your blood glucose without regard to when you ate your last meal. This test, along with an assessment of symptoms, is used to diagnose diabetes but not pre-diabetes.

Positive test results should be confirmed by repeating the fasting plasma glucose test or the oral glucose tolerance test on a different day.

Fasting Plasma Glucose (FPG) Test

The FPG is the preferred test for diagnosing diabetes due to convenience and is most reliable when done in the morning. Results and their meaning are shown in table 1. If your fasting glucose level is 100 to 125 mg/dL, you have a form of pre-diabetes called impaired fasting glucose (IFG), meaning that you are more likely to develop type 2 diabetes but do not have it yet. A level of 126 mg/dL or above, confirmed by repeating the test on another day, means that you have diabetes.

| Plasma Glucose Result (mg/dL) | Diagnosis |
|--------------------------------------|------------------|
| 99 and below | Normal |
| 100 to 125 | Pre-diabetes |
| 126 and above | Diabetes* |

Table 1. Fasting Plasma Glucose Test

*Confirmed by repeating the test on a different day

Oral Glucose Tolerance Test (OGTT)

Research has shown that the OGTT is more sensitive than the FPG test for diagnosing pre-diabetes, but it is less convenient to administer. The OGTT requires you to fast for at least 8 hours before the test. Your plasma glucose is measured immediately before and 2 hours after you drink a liquid containing 75 grams of glucose dissolved in water. Results and what they mean are shown in table 2. If your blood glucose level is between 140 and 199 mg/dL 2 hours after drinking the liquid, you have a form of pre-diabetes called impaired glucose tolerance or IGT, meaning that you are more likely to develop type 2 diabetes but do not have it yet. A 2-hour glucose level of 200 mg/dL or above, confirmed by repeating the test on another day, means that you have diabetes.

| 2-Hour Plasma Glucose Result (mg/dL) | Diagnosis |
|---|------------------|
| 139 and below | Normal |
| 140 to 199 | Pre-diabetes |
| 200 and above | Diabetes* |

Table 2. Oral Glucose Tolerance Test

*Confirmed by repeating the test on a different day

Gestational diabetes is also diagnosed based on plasma glucose values measured during the OGTT. Blood glucose levels are checked four times during the test. If your blood glucose levels are above normal at least twice during the test, you have gestational diabetes. Table 3 shows the above-normal results for the OGTT for gestational diabetes.

| When | Plasma Glucose Result (mg/dL) |
|--------------|--------------------------------------|
| When Fasting | 95 or higher |
| At 1 hour | 180 or higher |
| At 2 hours | 155 or higher |
| At 3 hours | 140 or higher |

Table 3. Gestational Diabetes: Above-Normal Results for the Oral Glucose Tolerance Test

Note: Some laboratories use other numbers for this test.

Random Plasma Glucose Test

A random blood glucose level of 200 mg/dL or more, plus presence of the following symptoms, can mean that you have diabetes:

- increased urination
- increased thirst
- unexplained weight loss

Other symptoms include fatigue, blurred vision, increased hunger, and sores that do not heal. Your doctor will check your blood glucose level on another day using the FPG or the OGTT to confirm the diagnosis.

What factors increase my risk for type 2 diabetes?

To find out your risk, check each item that applies to you.

- I am 45 or older.
- I am overweight or obese
- I have a parent, brother, or sister with diabetes
- My family background is African American, American Indian, Asian American, Pacific Islander, or Hispanic American/Latino
- I have had gestational diabetes, or I gave birth to at least one baby weighing more than 9 pounds
- My blood pressure is 140/90 or higher, or I have been told that I have high blood pressure
- My cholesterol levels are not normal. My HDL cholesterol ("good" cholesterol) is 35 or lower, or my triglyceride level is 250 or higher
- I am fairly inactive. I exercise fewer than three times a week.

When should I be tested for diabetes?

Anyone 45 years old or older should consider getting tested for diabetes. If you are 45 or older and your BMI indicates that you are overweight (see table 4), it is strongly recommended that you get tested. If you are younger than 45, are overweight, and have one or more of the risk factors, you should consider testing. Ask your doctor for a FPG or an OGTT. Your doctor will tell you if you have normal blood glucose, pre-diabetes, or diabetes. If your blood glucose is higher than normal but lower than the diabetes range (called pre-diabetes), have your blood glucose checked in 1 to 2 years.

What steps can delay or prevent type 2 diabetes?

A major research study, the Diabetes Prevention Program, confirmed that people who followed a low-fat, low-calorie diet, lost a modest amount of weight, and engaged in regular physical activity (walking briskly for 30 minutes, five times a week, for example) sharply reduced their chances of developing diabetes. These strategies worked well for both men and women and were especially effective for participants aged 60 and older.

How is diabetes managed?

If you are diagnosed with diabetes, you can manage it with meal planning, physical activity, and, if needed, medications. For additional information about taking care of type 1 or type 2 diabetes, see the NIDDK booklet *Your Guide to Diabetes: Type 1 and Type 2*.

Points to Remember

- Diabetes and pre-diabetes are diagnosed by checking blood glucose levels.
- Many people with pre-diabetes develop type 2 diabetes within 10 years.
- If you have pre-diabetes, you can delay or prevent type 2 diabetes with a low-fat, low-calorie diet, modest weight loss, and regular physical activity.
- If you are 45 or older, you should consider getting tested for diabetes. If you are 45 or older and overweight, it is strongly recommended that you get tested.
- If you are younger than 45, are overweight, and have one or more of the risk factors, you should consider testing.

Additional Information

- ❑ National Diabetes Education Program - <http://www.ndep.nih.gov/>
- ❑ American Diabetes Association - <http://www.diabetes.org>
- ❑ St. Louis Diabetes Coalition - <http://www.diabetescoalition.org>
- ❑ Diabetes Education Program at St. Anthony's Medical Center - <http://www.stanthonysmedcenter.com/healthcareServ/otherServ/diabetesEducation.asp>

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