

Diagnosis of Diabetes

National Diabetes Information Clearinghouse



National
Institute of
Diabetes and
Digestive
and Kidney
Diseases

NATIONAL
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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

Type 1 Diabetes and Type 2 Diabetes

To move away from basing the names of the two main types of diabetes on treatment or age at onset, an American Diabetes Association expert committee recommended in 1997 universal adoption of simplified terminology. The National Institute of Diabetes and Digestive and Kidney Diseases agrees.

Former Names	Preferred Names
Type I juvenile diabetes insulin-dependent diabetes mellitus IDDM	type 1 diabetes
Type II adult-onset diabetes noninsulin-dependent diabetes mellitus NIDDM	type 2 diabetes



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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.

Table 1. Fasting Plasma Glucose Test

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

*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.

Table 2. Oral Glucose Tolerance Test

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

*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.

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

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

Note: Some laboratories use other numbers for this test.

For additional information about the diagnosis and treatment of gestational diabetes, call the National Diabetes Information Clearinghouse (NDIC) at 1-800-860-8747 and request a copy of *What I Need to Know About Gestational Diabetes* or read it online at www.diabetes.niddk.nih.gov/dm/pubs/gestational/index.htm.

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 (see the body mass index [BMI] in table 4).
- 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.

Checking My Weight

BMI is a measure used to evaluate body weight relative to height. You can use BMI to find out whether you are underweight, normal weight, overweight, or obese. Use table 4 to find your BMI.

- Find your height in the left-hand column.
- Move across in the same row to the number closest to your weight.

The number at the top of that column is your BMI. Check the word above your BMI to see whether you are normal weight, overweight, or obese. If you are overweight or obese, talk with your doctor about ways to lose weight to reduce your risk of diabetes or pre-diabetes.

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 listed on page 3, 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.

For additional information about how you can lower your risk for type 2 diabetes, call the NDIC at 1-800-860-8747 to request a copy of *Am I at Risk for Type 2 Diabetes?* or view the booklet online at www.diabetes.niddk.nih.gov/dm/pubs/riskfortype2/index.htm. Also, the National Diabetes Education Program (NDEP) offers several booklets as part of its “Small Steps, Big Rewards” campaign on preventing type 2 diabetes, including information on setting goals, tracking progress, implementing a walking program, and finding additional resources. Call the NDEP at 1-800-438-5383 to request printed copies or view the materials online at www.ndep.nih.gov/diabetes/prev/prevention.htm.

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, call the NDIC at 1-800-860-8747 to request a copy of *Your Guide to Diabetes: Type 1 and Type 2* or view the booklet online at www.diabetes.niddk.nih.gov/dm/pubs/type1and2/index.htm.

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.

Table 4. Body Mass Index

Height (inches)	Normal										Overweight										Obese										Extreme Obesity																																																																																																																																																																																																																																																																																			
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Source: Adapted from *Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report*.

- 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 listed on page 3, you should consider testing.

For More Information

National Diabetes Education Program

1 Diabetes Way
Bethesda, MD 20892-3600
Phone: 1-800-438-5383
Fax: 703-738-4929
Internet: www.ndep.nih.gov

American Diabetes Association

National Service Center
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The National Diabetes Information Clearinghouse (NDIC) is a service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK). The NIDDK is part of the National Institutes of Health under the U.S. Department of Health and Human Services. Established in 1978, the Clearinghouse provides information about diabetes to people with diabetes and to their families, health care professionals, and the public. The NDIC answers inquiries, develops and distributes publications, and works closely with professional and patient organizations and Government agencies to coordinate resources about diabetes.

Publications produced by the Clearinghouse are carefully reviewed by both NIDDK scientists and outside experts.

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U.S. DEPARTMENT OF HEALTH
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NIH Publication No. 05-4642
January 2005