

Diabetes Mellitus Type 2

What You Should Know

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Please refer to the glossary for a definition of terms.

What is Diabetes?

Food is broken down in our bodies to make sugar and other nutrients. We use sugar or glucose for energy. Insulin moves glucose out of the blood and into the cells of the body to be used for energy. People with Type 2 diabetes may not make enough insulin and their livers may produce more glucose than normal. Also, their bodies may be resistant to insulin. This means the body cannot effectively use the insulin. With decreased insulin and insulin resistance, the sugar stays in the bloodstream and the body cannot use that sugar for energy. Type 2 diabetes is almost always a permanent condition.

Approximately 16 million people in the United States have diabetes. About 90% of people with diabetes have Type 2 diabetes.

What Causes Diabetes?

Type 2 diabetes is a disease of resistance to insulin. Early on in Type 2 diabetes, the pancreas can make enough insulin to partially control blood glucose levels. However, with time the pancreas appears to fail and blood glucose rises. The person with Type 2 diabetes may need insulin for control.

There is a genetic tendency to inherit this disease. One third of the children and 38% of siblings of people with Type 2 diabetes also have diabetes or have abnormal glucose tolerance. If one identical twin has Type 2 diabetes, the chance that the other twin will get Type 2 diabetes is 90% to 100%. Type 2 diabetes can also be related to environmental triggers such as obesity, severe illness, inactivity, and aging. Certain medications such as prednisone or anti-rejection medications (especially tacrolimus or Pro-Graf[®]).

What are Symptoms of Diabetes?

- Increased Thirst
- Increased Urination
- Increased Hunger
- Tired

- Decreased Energy
- Blurred Vision
- Weight Loss
- Lingering Infections

How is Diabetes Diagnosed?

Diagnosis of diabetes is made with a blood test called a fasting blood glucose. The diagnosis is made if the result is equal to or greater than 126 mg/dL. Two elevated blood sugars are necessary for diagnosis. A person may also be diagnosed with diabetes if a random blood glucose shows a level to be equal to or greater than 200 mg/dL.

What Medications are Used to Treat Diabetes?

Several medications are on the market to treat Type 2 diabetes. These medications may have different ways of acting. Among these medications are pills that:

- cause the pancreas produce more insulin
- decrease insulin resistance
- decrease glucose production from the liver
- decrease absorption of carbohydrates

If the pancreas is no longer making enough insulin, it may be necessary to use insulin to treat Type 2 diabetes. Insulin is injected into the fatty tissue under the skin with a syringe. Sometimes, people with Type 2 diabetes take a combination of pills or take pills and insulin. If someone with diabetes becomes pregnant, they may need to take insulin and stop the pills to treat diabetes. The pills may be resumed after the delivery. Nutrition, exercise and the appropriate medication therapy are key to controlled diabetes. The chart following gives more information about some of the medicines that may be used.

Medications & How they work	Special Considerations
<ul style="list-style-type: none"> • Metformin (Glucophage[®]) Decreases glucose production from the liver	Metformin should not be taken in the presence of kidney disease, congestive heart failure or pulmonary disorders. Also, it should be discontinued for surgical procedures and for any test requiring contrast dye.
<ul style="list-style-type: none"> • Glipizide (Glucotrol[®], Glucotrol XL[®]) • Glyburide (Diabeta[®], Glynase[®], Micronase[®]) • Glimepiride (Amaryl[®]) • Repaglinide (Prandin[®]) Increase insulin production from the pancreas	Can cause hypoglycemia (low blood glucose).
<ul style="list-style-type: none"> • Rosiglitazone (Avandia[®]) • Pioglitazone (Actos[®]) Increases insulin sensitivity in muscle	Liver function tests should be performed every other month with Avandia [®] & Actos [®] for the first year of use. Use both with caution in people with edema.
<ul style="list-style-type: none"> • Acarbose (Precose[®]) • Miglitol (Glyset[®]) 	Low blood sugars must be treated with dextrose or lactose (dextrose is the best)

Inhibits absorption of carbohydrates	
<ul style="list-style-type: none"> • Insulin Provides insulin if you are insulin deficient	Can cause hypoglycemia

How is Diabetes Monitored?

People with diabetes monitor their diabetes control by performing blood glucose monitoring at home. Most people with Type 2 diabetes should be monitoring their blood glucose levels two or more times per day. It is important to write down the blood glucose values and look for trends of highs and lows in order to troubleshoot what is causing them. Also, people with diabetes need regular visits with their health care provider to insure that proper tests are ordered and that the diabetes is managed correctly. Below are guidelines regarding how to stay healthy with diabetes.

What Happens When Diabetes is Poorly Controlled?

When people with diabetes have prolonged high blood sugars (over years), long term complications develop. Long term complications of high blood sugar are serious and generally decrease quality of life. Long term complications of high blood sugar include the following:

- Heart Disease (Heart Attacks)
- Problems with circulation (Vascular Disease)
- Kidney Disease (Nephropathy)
- Nerve Problems (Neuropathy)
- Eye Disease (Retinopathy)
- Amputation
- Impotence or Sexual Dysfunction.
- Problems with slow digestion (Gastroparesis)
- Stroke
- High Lipids (high cholesterol or high triglycerides)
- Infections

The Good News about Controlling Diabetes

The good news is that blood glucose levels can generally be well controlled. A study done in England, the United Kingdom Prospective Diabetes Study (UKPDS), showed that improved blood glucose control in Type 2 diabetes helped reduce long term complications. With a decrease in A1C from 8% to 7%, the risk of eye disease decreased by 21% and the risk of kidney disease by 34%. It also showed that improved blood pressure control was also beneficial. It is currently recommended that your blood pressure be controlled to a goal of 130/80 or less if you have diabetes.

How to Stay Healthy with Diabetes

What should people with diabetes do 4 times a year?

- See the endocrinologist/diabetes educator (perhaps more often)
- A1C should be measured every 3 months. A1C is a measure of the average blood glucose over the past 3 months.

What should people with diabetes do every year?

- Have a urine test for microalbumin to check for kidney function.
- Have fasting blood test drawn for serum creatinine, cholesterol and triglyceride levels.
- See an ophthalmologist for a dilated eye exam.
- Make sure all vaccinations are up to date (flu, pneumonia, tetanus).
- See the dentist (every six months).
- See an OB/GYN every year (for women).

What should people with diabetes be doing regularly?

- Testing blood sugar, recording them and troubleshooting with the diabetes team.
- Examining and caring for feet and skin.
- Having blood pressure checked.
- Learning about diabetes and taking an active role with diabetes care.
- Using exercise, nutrition, and medication effectively to control diabetes.
- Having regular appointments with a primary care provider.
- Flossing and caring for teeth.
- Not smoking. Smoking cessation programs are available. Smoking increases the risk (4 to 6 times) for heart attack, nephropathy, and amputation.
- Not drinking too much alcohol. Ask the doctor if it is safe to have one drink a day. (This may partially depend on some of the results of your blood tests.) Never drink alcohol without food since this may cause hypoglycemia.

What are normal values for tests?

- A1C
 - Normal: 4% to 6%. Goal: less than 7%
- Cholesterol
 - Goal: less than 200 mg/dL
- LDL ("**L**ousy" cholesterol)
 - Goal: less than 100 mg/dL
- HDL ("**H**ealthy" cholesterol)
 - Goal: more than 45 mg/dL in men
 - More than 55mg/dL in women
- Triglycerides
 - Goal: less than 150 mg/dL
- Blood Pressure
 - Normal: 120/80 Goal: less than 130/80
- Microalbumin:
 - Normal: less than 30 mg/G in spot urine sample
- Blood Sugar
 - Normal is 70 to 110 mg/dL before meals
 - Goal is 70 to 120 mg/dL before meals
 - Goal before bedtime is 100 to 140 mg/dL
 - Goal two hours after a meal is less than 140 mg/dL
 - (When on the correct dose of insulin, there is usually a 30 to 50 mg/dL raise in blood glucose two hours after a meal.)

Healthy Advice....

If you have diabetes, it is important to be aware of the following items.

- Learn what makes blood sugars go up and down. When problems arise, medications should be adjusted first (with guidance from a health care provider), then diet and exercise routines should be adjusted to get things under control. Most abnormal blood sugar readings have an obvious cause.
- Blood pressure should be maintained at less than 130/80 to decrease the likelihood of eye and kidney disease, or progression of those diseases.
- Impotence may be treatable.
- A diabetes educator should occasionally watch you perform a finger stick blood test. Also, the blood sugar machine needs to be tested against the lab (not another glucose meter) to check for accuracy.
- If you use insulin, a diabetes educator should watch you draw up and inject a shot to make sure you are doing it correctly.
- People with diabetes need to work very hard at keeping their diabetes under control since they are the ones ultimately responsible for their care. They should ask their health care provider for assistance and advice about what else can be done to improve diabetes control.
- Depression strikes people with diabetes at higher than usual rates. Depression should not be ignored. If you are depressed, be sure to discuss this with your health care provider or seek the help of a mental health professional. Depression is treatable! Medications are safe, non-addictive and usually do not affect blood sugar.
- Be sure to check the insides of their shoes before putting them on, and never go barefoot.
- Take advantage of whatever patient education is available.
- Read everything you can about diabetes. Information is available in books, magazines and on the Internet. (Whichever is used, authoritative sources should always be sought. Bad advice can do more harm than no advice at all.)
- Keep up with new medical advances, both in terms of technology and medications.
- Before switching jobs, consider how your health insurance will be affected. Is the COBRA program an option? Does the new job offer health benefits? Also, it is important for people with diabetes to not have any breaks in their insurance so that they won't be denied coverage due to a pre-existing condition.
- Toenails should be trimmed to follow the natural curve of the nail and the edges filed. Leave a little white showing and don't cut the corners too deep. A moisturizer should be used (not between the toes). Feet should not be soaked (it dries them out).
- If a pair of shoes has caused a blister to develop, they should be discarded.
- Think positively! Diabetes can be controlled. It does not have to control you.
- Consult a dietitians for an update on how to meet current nutritional goals.
- Fat in your diet should be limited and fiber should be increased.
- Five servings of vegetables should be eaten everyday.
- Carry a form of carbohydrate for treatment of hypoglycemia (we suggest dextrose based glucose tablets, Sweet Tarts[®], Sprees[®] or Smarties[®]).
- If needed and you are having difficulty with syringe injections, consider alternate delivery routes such as an insulin pump or an insulin pen.
- Check your blood sugar before driving. Do not drive within 20 minutes of treating a low blood sugar.
- Exercise most days of the week (if approved by your health care provider).
- Be watchful for delayed hypoglycemia after exercise. Hypoglycemia can occur anywhere from 6 to 24 hours following exercise.
- If your blood sugar is above 250mg/dL before exercise, test for ketones. If ketones are present, they should be treated and you should not exercise until they go away.
- If you use insulin, do not inject your insulin into an exercising muscle.
- If you are overweight, try to lose weight.
- Take one stomach safety coated adult aspirin daily to help prevent heart attacks (adults only).
- Tobacco may damage the blood vessels in the heart and feet, leading to heart attacks and amputations.

- Use sunscreen.

Glossary of Terms

Blood Glucose Levels: Sometimes called blood sugar. It is a measure of the amount of glucose in the blood. If the blood sugar level is too high or too low, short and long-term health complications will occur. Normal fasting blood sugar levels are 70 - 110 mg/dL.

Gastroparesis: A complication of high sugar. Digestion slows down. This can cause acid-reflux, abdominal discomfort, nausea, vomiting and constipation.

Glucagon: An injection (shot) someone else gives to people with diabetes when they cannot be awakened or are unable to swallow during a low blood sugar reaction. It causes an increase in blood sugar by stimulating release of stored glucose from the liver. Onset of action is about 10 minutes.

Glucose: A simple sugar found in the blood. Glucose is the main source of energy or fuel for our bodies.

A1C: A measure of the average blood sugar for the past 3 months. Normal A1C is 4% to 6%. A value of 6% corresponds to a blood glucose of 114 mg/dL. This chart indicates the average blood glucose levels at various A1C values:

Hemoglobin A1c	Blood Glucose Level
6%	114 mg/dL
7%	147 mg/dL
8%	180 mg/dL
9%	214 mg/dL
10%	247 mg/dL
11%	280 mg/dL
12%	314 mg/dL
13%	348 mg/dL

Hypercholesterolemia: High cholesterol levels in the blood. Normal total cholesterol is less than 200. Goal for LDL (bad) is less than 100. Goal for HDL (good) is more than 45. If the cholesterol/triglycerides cannot be kept under control through diet and exercise, people with diabetes should ask their health care provider if they are candidates for cholesterol/triglyceride-lowering medicines.

Hyperglycemia: High blood sugar. Symptoms may include increased thirst, urination, weakness, abdominal pains, weight loss, increased hunger, nausea, change in vision, yeast infections, and fatigue.

Hypertriglyceridemia: High triglycerides (fat) in the blood. Normal is less than 150. If the cholesterol/triglycerides cannot be kept under control through diet and exercise, people with diabetes should ask their health care provider if they are candidates for cholesterol/triglyceride-lowering medicines.

Hypoglycemia: Low blood sugar – sugar below 70 mg/dL. Symptoms may include light-headedness, hunger, excessive sweating, faintness, pounding heart, trembling, headache, irritability, and in extreme cases, the inability to be awakened or seizures.

Insulin: A hormone made in the beta cells in the Islets of Langerhans in the pancreas. Insulin helps the body use glucose (sugar) for energy. If the body cannot make enough insulin, the person must use other means to keep blood glucose levels from getting too high.

Microalbumin: Microalbumin is a small protein. When this protein is spilled into the urine in levels that are too high, it is a sign of kidney damage. Normal is less than 30 mg/G. A urine collection for microalbumin should be done every year.

Nephropathy: Kidney disease, a long-term complication of high blood sugar, which may eventually lead to renal failure, dialysis or kidney transplantation.

Neuropathy: A long-term complication of high blood sugars. The hands and feet can have pain, tingling, burning, or decreased sensation. Blood sugars must be brought under control and the endocrinologist may also prescribe appropriate medications for pain. Also, feet should be examined everyday for cracks, blisters, and sores. The health care provider should examine the patient's feet at regular visits and test for sensation with a monofilament (a thin wire). Early neuropathy may be reversible with improved blood sugar control.

Retinopathy: A long-term complication of high blood sugars that affects the eyes. The blood vessels change and as the retinopathy progresses, new tiny blood vessels form in the retina of the eye. These vessels sometimes bleed, causing transient loss of vision. Repeated bleeding can lead to scarring which may cause detachment of the retina from the back of the eye. This can cause blindness. Laser surgery helps burn the small vessels to prevent them from bleeding and growing. Patients may also suffer loss of vision due to a condition called macular edema which must be diagnosed by an ophthalmologist. The ophthalmologist should be visited every year for a dilated eye exam!