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Chapter **1**

Type 2 Diabetes: The Basics

Taking care of your diabetes means taking care of your whole body: from positive thinking in your brain to checking the bottoms of your feet for scrapes and cuts. It's a whole-body endeavor, and we're here to take you on that journey as you discover what diabetes is, how to manage and treat it, and how to prevent complications down the road.

This chapter starts off with the basics of diabetes: what it is and how it affects your body. These are the Biology 101 facts that you can reference down the line. It's fascinating stuff (and you don't need a medical degree to understand it). Then we tell you how it's diagnosed and what the contributing risk factors are.

What Exactly Is Diabetes?

You have diabetes, or perhaps someone you love has diabetes. That's not an easy diagnosis to hear. But it doesn't have to be a scary unknown either. In fact, scientists know more about diabetes and have more tools at their disposal than ever before.

The following sections explain how diabetes affects your body. It's good to know what's happening before you dive into how to manage and treat diabetes.

Getting the lowdown on blood glucose

Diabetes is a disorder in which the amount of *glucose* (sugar) in your blood is too high. But why would your blood glucose be high?

It all comes down to eating, that amazing topic that everyone likes to obsess about. When you eat food, your body breaks down that food into glucose; the glucose travels in your bloodstream to waiting cells. That glucose really wants to get out of your blood and into your cells because that's how you get energy. That's the goal!

Insulin is a hormone that helps move glucose from your blood into your cells. However, people with type 2 diabetes don't make enough insulin or aren't as sensitive to that hormone. So, the glucose gets trapped in the blood and can't get inside their cells. Then high blood glucose — or diabetes — happens.



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Glucose is just a simple form of carbohydrate. The simplest carbohydrates are sugars, and the simplest sugar is glucose. It's your body's main source of energy, used to power everything from getting up in the morning to taking your dog for a walk.



TIP

Is it blood glucose or blood sugar? Actually, they're the same thing. Blood glucose is simple sugar. So, you may hear people say their "sugars" are too high or their "blood glucose" is too high. *Blood glucose* is the more technical term; *sugar* is the more colloquial term. We use *blood glucose*, or simply *glucose*, in this book.

Appreciating the power of the pancreas

The pancreas, which is totally essential and underappreciated (until it stops working), is little, about 6 inches long, and it sits right behind the stomach (see Figure 1-1).

The pancreas has beta cells, which make insulin, and alpha cells, which make another hormone called glucagon. Both insulin and glucagon are important for metabolizing food.

FIGURE 1-1:
The pancreas
and its
specialized cells.

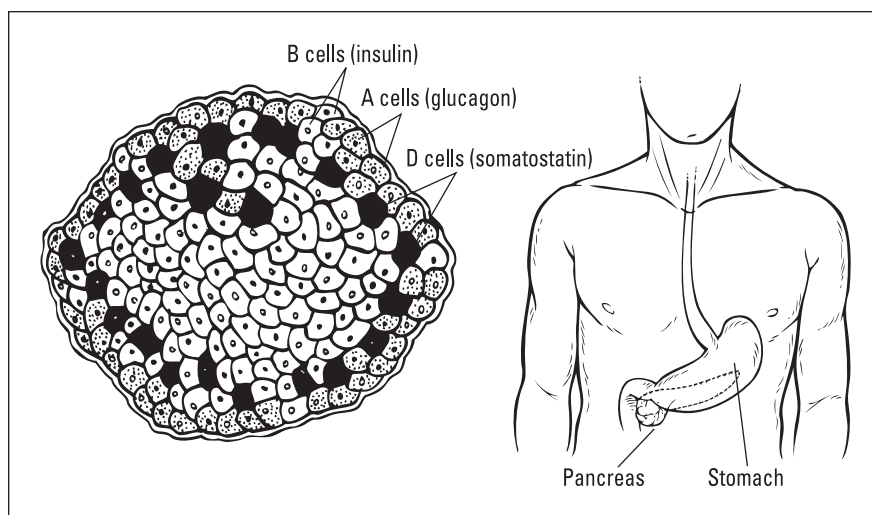


Illustration by Kathryn Born, MA

The mighty hormone insulin

You've probably heard of insulin, and you may associate it with injections or an insulin pump. We usually think of that as the synthetic or man-made medication. But the hormone in your body is also insulin, and it's one of the most important hormones for helping you metabolize your food and get energy.

Beta cells in the pancreas are the only cells that make insulin. In type 2 diabetes, several things are happening with those beta cells:

- » **The beta cells don't work well.** They don't make as much insulin as they're supposed to.
- » **There may be fewer beta cells than usual.**
- » **The beta cells that are making all the insulin get burned out (super tired) and eventually make less insulin.** It's a cycle in which insulin production can get worse over time.

At the same time that beta cells are struggling in the pancreas, another crazy thing happens: Cells in the body become less sensitive to insulin. So, even though the insulin may be sitting right next to the glucose by a cell, saying, "Hey, let us in!" the cell doesn't let them in. Instead, the cells need more insulin than ever before to let those glucose molecules inside. This is called *insulin resistance* or *decreased insulin sensitivity*.

It's a double whammy: The pancreas makes less insulin, and yet the body needs more insulin than ever before. Not a good combination.

If your body doesn't make enough insulin or if you have insulin resistance, your glucose can't get inside your cells, and it builds up in your blood. This condition is called *high blood glucose* or *hyperglycemia*. It's the key factor that defines diabetes.

Scientists are still trying to figure out why beta cells fail or die — and why the body becomes less sensitive to insulin. If they can get to the bottom of those questions, we're on our way toward a cure for type 2 diabetes.



TIP

In the meantime, scientists know that insulin sensitivity can be improved by exercise. Just a short bout of exercise can improve insulin sensitivity for up to 24 hours. That's just another amazing effect of breaking a sweat besides burning calories.



REMEMBER

Insulin is a hormone that helps your cells use glucose for energy. It's made by beta cells in the pancreas. People with type 2 diabetes may not make enough insulin or may not be as sensitive to insulin — or both.

Glomming on to glucagon

Your pancreas makes another hormone, glucagon, which works together with insulin to turn food into energy (refer to Figure 1-1). Glucagon works very closely with the liver by stimulating glucose stored inside it. This step is essential when you need extra energy and you're not eating. For example, your liver may release glucagon when you exercise or if you need energy between meals.



REMEMBER

Getting energy from the foods you eat, but also having access to more energy whenever you need it, is a delicate balance.

Understanding the impacts of high blood glucose on the body

People with type 2 diabetes have too much glucose in their blood. High blood glucose can create problems in the short term and long term. Not only can it make you feel crummy from time to time, but it can also cause dangerous complications down the road.

As blood glucose levels rise, your body tries to flush out extra glucose from your blood by filtering it through your kidneys and out through your urine. That's why people with undiagnosed diabetes or diabetes that isn't adequately managed pee a lot. So much peeing causes people to feel thirsty, dehydrated, and tired. Dehydration can also cause blurred vision.



WARNING

High blood glucose may not cause these symptoms in everyone, or sometimes the symptoms just aren't that noticeable. People can walk around for years without any symptoms or knowledge that they have high blood glucose and diabetes. That's why it's important to have an annual exam with a healthcare provider — they can track your blood glucose, and many other factors that affect your health, over time.

In the long term, high blood glucose damages blood vessels and nerves. This damage can lessen blood flow throughout your body, from your heart to your head to your feet. This, in turn, can lead to complications such as eye disease, heart disease, stroke, and kidney failure. (Turn to Chapter 7 to find out more about complications.)



REMEMBER

The great news is that you can take active steps to lower your blood glucose by eating wholesome foods, exercising, losing weight, and taking prescribed medications. You don't have to experience problems in the short or long term. The most important thing to remember is that you can take control of your blood glucose and diabetes.

Paying attention to blood pressure

Six out of ten people with diabetes have high blood pressure or take medications to lower it. That's a big number. Blood glucose and blood pressure go hand in hand. Why? Because they're both related to your blood vessels.

High blood glucose can damage blood vessels, causing them to narrow and inhibit the flow of blood. This, in turn, can cause high blood pressure, which can lead to further damage, such as a heart attack, stroke, or kidney failure.

Also, diabetes and high blood pressure share similar risk factors, including smoking, having obesity, and eating foods high in saturated fats. For example, if you have excess weight and smoke cigarettes, that's a twofold stress on your body.



WARNING

High blood pressure doesn't have any symptoms. You won't know you have it unless you have your blood pressure checked by your healthcare provider. Make sure you have it tested every time you visit the clinic.

Most people with diabetes have a blood pressure goal of less than 130 mmHg for systolic blood pressure (the top number) and less than 80 mmHg for diastolic blood pressure (the bottom number) to reduce their risk of cardiovascular disease and other complications.

The Other Types of Diabetes

In the previous section, we talk all about type 2 diabetes, but there are actually many different types of diabetes. The most common type by far is type 2 diabetes — it accounts for 90 percent to 95 percent of all people with diabetes. In the following sections, we cover type 1 diabetes, gestational diabetes, other types of diabetes, and prediabetes.

Type 1 diabetes

Type 1 diabetes is another common type of diabetes. It usually comes on much more quickly and more severely than type 2 diabetes. In general, people with type 1 diabetes have to take insulin right away to survive because their bodies don't make any insulin. They have to take insulin for the rest of their lives. This is unlike type 2 diabetes, which has a more gradual progression and may or may not eventually require taking insulin.

Type 1 diabetes used to be called “juvenile diabetes” because it was thought to occur more often in children. However, recent research has shown that type 1 diabetes is more common in adults than kids. More than half of all new cases are diagnosed in adults, and more than 40 percent occur after age 30.

Type 1 diabetes is an autoimmune disease in which the body destroys its own beta cells and, therefore, can no longer produce insulin. Of all the people with diabetes, about 5 percent have type 1 diabetes. (The nearby sidebar explains how doctors determine whether you have type 1 or type 2 diabetes.)

TYPE 1 OR TYPE 2?

Sometimes it's not obvious at first whether someone has type 1 or type 2 diabetes. A blood glucose test only tells you that you have diabetes, not whether it's type 1 or type 2 (or some other form). For example, some adults may have type 1 diabetes, but still have some insulin production. This makes it appear more like type 2 diabetes at first. This is sometimes called *latent autoimmune diabetes in adults* (LADA).

People with type 1 diabetes often have antibodies in their blood that signal an autoimmune disease. So, your doctor can give you a blood test to detect autoantibodies and diagnose type 1 diabetes.

Gestational diabetes

Gestational diabetes is a type of diabetes that occurs during the second or third trimester of pregnancy. It usually goes away after giving birth, but women with gestational diabetes are more likely to someday have type 2 diabetes. Their children are also more likely to develop type 2 diabetes and to develop obesity.



TIP

Diabetes detected in early pregnancy is considered preexisting diabetes, not gestational diabetes. Women with preexisting type 2 diabetes should try to have their blood glucose on target before they become pregnant. They also need to exercise, eat healthy foods, and often take medications to manage their blood glucose during pregnancy.

Women with gestational diabetes can take medications, eat healthy foods, and exercise to manage their blood glucose during pregnancy. Not managing blood glucose during pregnancy can increase the risk of *preeclampsia*, a complication of pregnancy from high blood pressure that can be serious and cause injury during birth because babies are large. When you've had gestational diabetes, you have a two in three risk of having it again in subsequent pregnancies.



TIP

All pregnant women should be tested for gestational diabetes during the 24th to 28th week using an oral glucose tolerance test (see Chapter 8 for more details on tests to diagnose gestational diabetes). Then women with gestational diabetes should get a test for type 2 diabetes 4 to 12 weeks after giving birth and every one to three years thereafter.

Other types of diabetes

Type 1, type 2, and gestational diabetes are the main types of diabetes, but they're not the only ones. Other forms of diabetes occur because of mutations in single genes. You can inherit these gene mutations, or they can occur out of the blue. Maturity-onset diabetes of the young (MODY) and neonatal diabetes mellitus are two of the most common forms.

Cystic fibrosis-related diabetes is another type of diabetes common in people with cystic fibrosis, which occurs because of scarring of the pancreas. This also destroys beta cells and stops insulin production.

Prediabetes

Prediabetes is another term you've probably heard alongside type 2 diabetes. And it's exactly what it sounds like. Prediabetes is a higher-than-normal blood glucose level that isn't high enough to be diabetes. Two out of five American adults

have prediabetes, although many don't know they have it; eight out of ten Americans who have prediabetes are undiagnosed.

Why does prediabetes matter? Well, it turns out that making changes to the foods you eat, exercising more, and losing excess weight can reduce your risk for diabetes. This is especially true for people with prediabetes. Finding out you have prediabetes can be a wakeup call to make changes to your lifestyle and health, or take medication.



REMEMBER

In one study called the Diabetes Prevention Program, people with prediabetes who lost 5 percent to 7 percent of their body weight through changes to diet and exercise reduced their risk of developing diabetes by 58 percent during the three-year course of the study. This was a landmark study that showed that people at risk for type 2 diabetes can make changes to prevent or delay the disease.

How Diabetes Is Diagnosed

A healthcare provider can diagnose diabetes by measuring the amount of glucose in your blood using a simple blood test. There are four main tests:

» **A1C test:** The A1C test measures your average blood glucose over three months. It's a picture of your blood glucose over time. It actually measures the percentage of *hemoglobin* (a protein) in your blood that has been *glycated* (attached to glucose) over the past three months. You'll hear the number as a percentage, such as 7 percent. A1C can be used both to diagnose diabetes and to assess how well you're managing diabetes if you have it. You can eat or drink what you want before you have an A1C test, so there's no need to fast.

For diagnosis, an A1C of 6.5 percent or more means you have diabetes. Prediabetes can be diagnosed with an A1C of 5.7 percent to 6.4 percent.

You'll probably hear a lot more about your A1C because it's the test most commonly used to evaluate diabetes management. If you have diabetes, your provider will give you an A1C test at least twice a year or every three months, if needed.

» **Fasting plasma glucose test:** A fasting plasma glucose test can be used to diagnose diabetes. It's also a simple blood test, and it measures your blood glucose as a snapshot in that moment. So, it's different from the A1C test, which measures your blood glucose over several months. You can't eat or drink anything besides water for eight hours before a fasting plasma glucose test.

A reading of 126 mg/dL or above means you have diabetes. Prediabetes can be diagnosed with a fasting plasma glucose of 100 to 125 mg/dL.

» **Random plasma glucose test:** A random plasma glucose test is another test to diagnose diabetes. Just as it sounds, it can be done “randomly” as a snapshot of your blood glucose. Sometimes healthcare providers do this test if you have other clear signs of diabetes. A reading of 200 mg/dL or above, with symptoms, means you have diabetes.

» **Oral glucose tolerance test:** An oral glucose tolerance test can also diagnose diabetes by measuring how well the body uses glucose. You don’t eat or drink anything besides water for eight hours before the test. At your appointment, you’ll have your blood drawn for a baseline measure. Then you’ll drink a liquid with 75 grams of glucose, and you’ll have your blood drawn two hours later. If your reading is 200 mg/dL two hours after drinking the liquid, you have diabetes.



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If a test result doesn’t unequivocally confirm high blood glucose, your provider may ask you to take two tests at the same time to confirm a diagnosis or take the same test at two different times.

Table 1-1 shows the different types of tests used to diagnose diabetes and lists the readings that indicate whether you have diabetes or prediabetes.

TABLE 1-1

Criteria to Diagnose Diabetes

Test	Prediabetes	Diabetes
A1C test	5.7%–6.4%	6.5% or above
Fasting plasma glucose test	100–125 mg/dL	126 mg/dL or above
Random plasma glucose test		200 mg/dL or above, with symptoms
Oral glucose tolerance test	140–199 mg/dL	200 mg/dL or above

The Risk Factors for Diabetes

No one knows exactly why some people get diabetes and other people don’t get diabetes. There isn’t a single test that can predict whether you’ll develop type 2 diabetes. Instead, type 2 diabetes develops because of a combination of genetic and environmental factors. There isn’t just one trigger.

However, there are known risk factors for type 2 diabetes. Finding out your risk for diabetes may empower you to make changes such as exercising more or quitting smoking.



Use the following checklist to determine your risk of developing type 2 diabetes. If you have several risk factors, talk to your doctor about being tested. You can also go to www.diabetes.org/risktest to discover your risk for type 2 diabetes.

- » **Older age, particularly over 45 years of age:** Age is a significant risk factor because more people 45 years old and older have type 2 diabetes than younger people. Everyone should be tested for type 2 diabetes when they reach 35 years of age and then at least every three years after that.
- » **Overweight or obesity:** Obesity is the leading risk factor for type 2 diabetes. If you have obesity, you have a greater risk for type 2 diabetes than having overweight. Losing 5 percent to 7 percent of your body weight may reduce your risk of diabetes.
- » **A family history of type 2 diabetes:** Family history is another important risk factor. Having a parent or sibling with type 2 diabetes puts you at risk, too. The genes you've inherited are a risk factor, although no one has pinpointed a single "diabetes gene."
- » **Race and ethnicity:** Your race and ethnicity can also put you at risk for type 2 diabetes. Native Americans, Blacks, Hispanics, and Asian Americans have a higher risk of diabetes than non-Hispanic whites. Blacks and Hispanics are more than 50 percent more likely to develop diabetes than non-Hispanic whites are.
- » **Gestational diabetes:** Gestational diabetes is another risk factor that gives moms and their babies a lifetime risk of type 2 diabetes.
- » **High blood pressure:** Elevated blood pressure increases the risk of diabetes. One study found a more than 50 percent increase in new-onset diabetes for each 20 mmHg higher systolic blood pressure (the upper number in the reading).
- » **High LDL ("bad") cholesterol and triglycerides and low HDL ("good") cholesterol:** These three markers often coincide with insulin resistance and increase risk for diabetes. Taking cholesterol-lowering statins may modestly increase risk for type 2 diabetes, but the cardiovascular benefits may outweigh diabetes risk.
- » **Sedentary lifestyle:** Sedentary behaviors like watching TV, using a computer, and driving are independently associated with an increased risk for type 2 diabetes, in one study.
- » **Smoking or using other tobacco products:** You have a 30 percent to 40 percent higher risk for type 2 diabetes if you smoke than if you don't smoke. Nicotine can raise your blood glucose.