

Managing Cystic Fibrosis- Related Diabetes “(CFRD)”

An Instruction Guide for Patients and Families

4th Edition

Carol Brunzell, R.D., C.D.E., L.D.

Dana S. Hardin, M.D.

Antoinette Moran, M.D.

Terri Schindler, R.D., M.S.

Kathleen Schissel, R.D., L.D.



| Adding *tomorrows* every day.

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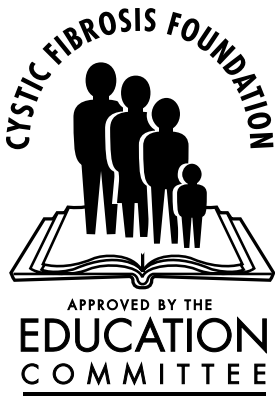
CAROL BRUNZELL, R.D., C.D.E., L.D.
*University of Minnesota
Medical Center, Fairview
Minneapolis, Minnesota*

DANA S. HARDIN, M.D.
*Ohio State University
Children’s Hospital of Columbus
Columbus, Ohio*

ANTOINETTE MORAN, M.D.
*University of Minnesota
Medical Center, Fairview
Minneapolis, Minnesota*

TERRI SCHINDLER, R.D., M.S.
*University Hospitals
Case Medical Center
Cleveland, Ohio*

KATHLEEN SCHISSEL, R.D., L.D.
*University of Minnesota
Medical Center, Fairview
Minneapolis, Minnesota*



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Address Content-Oriented Correspondence to:

Dana S. Hardin, M.D.

Division Chief of Pediatric Endocrinology

Children's Hospital of Columbus and The Ohio State University

700 Children's Drive ED 543

Columbus, Ohio 43205-2696

hardind@pediatrics.ohio-state.edu

Address All Other Correspondence to:

Cystic Fibrosis Foundation

6931 Arlington Road

Bethesda, Maryland 20814

(800) FIGHT CF

info@cff.org

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Introduction

If you are reading this, you or someone you love has likely been told they have cystic fibrosis–related diabetes (CFRD). This guide was written to add to the information given to you by the diabetes and CF care teams. The chapters cover the topics needed to manage CFRD. To help you focus on the main points, there are learning goals at the start of each chapter. Although much is written for those with other types of diabetes, little has been written for those with cystic fibrosis (CF) and diabetes. If you’ve been told that you have CF and diabetes, you might feel stressed. You might feel hopeless. Diabetes is not the “last straw,” though. To manage it well, learn as much as you can. You should be able to do all the things you want to do . . . even eat the foods you like.

Though we’ve put all we know in this guide, there’s still much we don’t know. This guide was written for all. In the United States, blood sugar levels are reported as milligrams per deciliter (mg/dL). In Canada and Europe, they are reported as millimoles per liter (mmol/L). Both are used in this guide.

An Important Note for Our Patients and Their Caregivers

The North American Cystic Fibrosis Foundation sponsored the consensus conference for CFRD in 1998. This important conference highlighted the problems faced by people with CF and has since resulted in many new research studies on CFRD.

We have updated this manual based on these important research findings. Therefore, we have also updated the classification of diabetes and impaired glucose tolerance. The guidelines and definitions presented here reflect the consensus by experts in CF and diabetes and replace the guidelines and definitions from the 1998 CF consensus conference.

The authors and the CF Foundation hope this guide will help you and your family understand the unique nature of CFRD, and help you manage it and live well with diabetes.

Cystic Fibrosis–Related Diabetes (CFRD)

LEARNING GOALS

At the end of this chapter, you should be able to:

- grasp how the body uses insulin to turn food into fuel for the body.
- see that CFRD is common among people with CF, especially in adults.
- list the difference between CFRD and type 1 or type 2 diabetes.
- state the causes of CFRD.
- understand the symptoms of CFRD.

Diabetes

When people eat, food breaks down into sugar, fat, and protein. Sugar enters the bloodstream and **blood sugar** levels rise. The increase in blood sugar signals the pancreas to secrete **insulin**. Insulin works by helping protein, fat, and sugar leave the blood and enter the cells where they are used for fuel. People with **diabetes** either do not make enough insulin or do not respond to insulin the right way, so insulin is not there to help sugar leave the blood and enter cells. People with diabetes do not convert food into fuel very well. They lose weight, lack energy, and can have other problems. Diabetes is very common in people with **cystic fibrosis (CF)**. It most often occurs as they get older. People with CF and diabetes have a unique type of diabetes called **cystic fibrosis–related diabetes (CFRD)***. One study found that up to 75% of adults with CF have some form of **glucose intolerance** and 15% have CFRD. CFRD is not the same kind of diabetes found in people without CF. There are important differences in the way it is diagnosed and treated. You and those who care for you need to know how CFRD is unique.

Diabetes

Type 1: The body can't make insulin.

Type 2: The body lacks normal responses to insulin and doesn't make enough insulin.

CFRD: The body can't make or use insulin.

Non-CF Diabetes

The most common types of diabetes are type 1 and type 2 diabetes. CFRD has some features that are common in both. **Type 1 diabetes** used to be called **insulin-dependent** or juvenile-onset diabetes. It occurs most often in childhood. People with type 1 diabetes can't make any insulin, so they must take insulin to stay alive. This is why type 1 diabetes is often called "insulin-dependent diabetes." People with type 1 diabetes who miss insulin doses get very sick and can get **ketoacidosis** (a life-threatening change in blood acidity). **Type 2 diabetes** used to be called **non-insulin dependent** or adult-onset diabetes. It is caused by the lack of a normal response to insulin in addition to not making enough insulin. This type of diabetes occurs most often in overweight people over the age of 40. People with type 2 diabetes don't often get ketoacidosis, but they can get very sick when their blood sugars are too high. People with type 2 diabetes do not always need insulin to manage their diabetes. Some use insulin. Some take pills. Most are told to lose weight. Some manage type 2 diabetes through diet and exercise alone.

*Words that appear italicized and bolded are defined in the glossary starting on page 66.

CFRD Causes

CFRD is unique, though it shares features with both type 1 and type 2 diabetes. As in type 1 diabetes, the pancreas does not make enough insulin. Thus, people with CF have *insulin deficiency*. This is likely due to scars in the pancreas because of thick mucus. Most people with CF make less insulin than normal, though not all with CF get diabetes. Some people with CF get diabetes because they may have *insulin resistance*. This means that the cells in the body do not use insulin the right way so more insulin is needed to change food into fuel and keep blood sugars in the normal range.

Because many with CF have both insulin deficiency and insulin resistance, more people with CF get diabetes than do people without CF. Even when people with CF are not acutely ill, their *chronic underlying* infections can cause insulin resistance. A third cause of insulin resistance is higher than normal *cortisol* levels. The hormone cortisol is a *steroid*. It is made in the *adrenal glands*. Our bodies make higher than normal cortisol levels in response to stress. High cortisol levels get in the way of insulin's action. Steroid-containing drugs (called *corticosteroids*) can also increase cortisol levels. These drugs are sometimes needed to treat lung disease. When taken, they can, for a little while, worsen blood sugar control. In people with CF who do not have diabetes, using corticosteroids can give them diabetes for a little while during and after corticosteroid treatment. People can have CFRD only sometimes (*intermittent CFRD*) or always (*chronic CFRD*). If you have intermittent CFRD, you may only need to take insulin when sick or during steroid treatment. If you have chronic CFRD, you need insulin treatment at all times to prevent

Years of too-high blood sugars cause problems with:

- Eyes
- Kidneys
- Nerves

Diabetes Goal:

Keep blood sugars at normal levels.

high blood sugar levels. Although CFRD is unique from type 1 or type 2 diabetes, the problems caused by diabetes are the same for all. These include eye, kidney, and nerve problems. These problems are caused by many years of blood sugar levels that are too high. **Every person's goal for diabetes treatment, no matter what kind they have, is to keep blood sugar levels as normal as they can.** This helps to prevent diabetes-caused problems.

CFRD Symptoms

Often having to urinate (*polyuria*) and often needing to drink (*polydipsia*) are classic symptoms of diabetes. These symptoms are caused by high blood sugar levels (*hyperglycemia*). It's easy not to notice these symptoms in CF. People with CF often drink more (and then use the bathroom more) because of dry mouth. Other symptoms of CFRD include feeling very tired, losing weight without trying or having a hard time gaining weight, and a loss of lung function that you can't explain. Infection and lung disease can also cause these symptoms, so diabetes may not be found until certain blood tests are run to look for it. Unlike people with type 1 diabetes, people with CF don't often get ketoacidosis. **Any time you have weight loss that you can't explain or have a hard time gaining weight, your CF care team should run diabetes tests. If you know you have diabetes and are having problems keeping your weight up, review how you manage diabetes with your diabetes care team.** Your CF treatment plan should be taken into account when CFRD is being diagnosed and managed. Contact your CF care center to learn more about diabetes. You can find the nearest CF care center by calling (800) FIGHT CF or by going to the CF Foundation Web site at <http://www.cff.org/LivingWithCF/CareCenterNetwork/>.

CFRD Symptoms

- Polyuria
- Polydipsia
- Being very tired
- Losing weight
- Not able to gain weight
- Loss of lung function

How We Diagnose CFRD

LEARNING GOAL

At the end of this chapter, you should be able to:

- list the tests used to *diagnose* CFRD.

Tests Used to Diagnose CFRD

Oral Glucose Tolerance Test (OGTT)

This test is often advised if CFRD is suspected. First, you must *fast* (nothing to eat or drink) for 8 hours. Then, blood is drawn to measure your *baseline* or *fasting blood glucose* level. You will then be asked to drink a liquid form of *glucose* (called *glucola*). Your blood sugar will be measured again 2 hours later. Often, blood sugar is measured at 1, 2, and 3 hours later. Your blood sugar levels after drinking glucola (often called a *glucose load*) will show if you have diabetes. If 2 hours after drinking glucola you have a blood sugar level of 200 mg/dL or 11.1 mmol/L or more, you have diabetes. If your baseline glucose is 126 mg/dL or 7.0 mmol/L or more, you have **CFRD with fasting hyperglycemia**. Insulin treatment is needed. If your baseline glucose is less than 100 mg/dL or 5.6 mmol/L, and your 2-hour blood sugar is 200 mg/dL or 11.1 mmol/L or more, you have **CFRD without fasting hyperglycemia**. Insulin treatment may or may not be needed.

Tests for CFRD

- Oral glucose tolerance test (OGTT)
- Fasting blood glucose
- Casual blood glucose

Casual Blood Glucose Levels

A *casual blood glucose* level is one that is drawn without caring what time of day it is or when a meal was last eaten. If this level is less than 100 mg/dL or 5.6 mmol/L, diabetes is not likely. If this level is 200 mg/dL or 11.1 mmol/L or more, diabetes is likely. Glucose levels from 100 to 199 mg/dL or 5.6 to 11.0 mmol/L are in the “gray zone” and show a need for more tests. The CF Foundation advises that people with CF have a casual blood glucose drawn at least once a year. Often, this is done at the annual visit.

Test	Time	Blood Glucose Level	Diagnosis	Action
Casual blood glucose	Done at any time regardless of eating	<100 mg/dL (<5.6 mmol/L)	CFRD is not likely	Do blood glucose levels every year or earlier if CFRD symptoms occur (see Ch. 1)
		100-199 mg/dL (5.6-11.0 mmol/L)	Gray zone	Do a fasting blood glucose test or an OGTT
		≥200 mg/dL (≥11.1 mmol/L)	CFRD likely	Do a fasting blood glucose test or an OGTT
Fasting blood glucose	Done in the morning before breakfast	<100 mg/dL (<5.6 mmol/L)	Normal	Do blood glucose levels every year or unless CFRD symptoms occur
		100-125 mg/dL (5.6-6.9 mmol/L)	Impaired fasting glucose	Make sure the level was fasting. If so, an OGTT should be done.
		≥126 mg/dL (≥7.0 mmol/L)	CFRD with fasting hyperglycemia	Make sure the level was fasting. More testing may be done to confirm CFRD diagnosis unless you have symptoms (see Ch. 1). Other tests may be another fasting glucose test or an OGTT. If you have CFRD, you will learn to manage it with insulin.
OGTT (with normal fasting glucose)	2 hours after glucose load	<140 mg/dL (<7.8 mmol/L)	Normal glucose tolerance	Do blood glucose levels every year or earlier if CFRD symptoms occur (see Ch. 1).
		140-199 mg/dL (7.8-11.0 mmol/L)	Impaired glucose tolerance	Do an OGTT every year or earlier if CFRD symptoms occur (see Ch. 1).
		≥200 mg/dL (≥11.1 mmol/L)	CFRD without fasting hyperglycemia	High risk of getting CFRD with fasting hyperglycemia. You will learn to use a blood sugar meter (see Ch. 4) and how to count carbohydrates in the food you eat (see Ch. 9). Your doctor may give you insulin if you have symptoms, are ill, or are taking steroids.

Treating CFRD

LEARNING GOALS

At the end of this chapter, you should be able to:

- state how insulin helps lower blood sugars and improve nutrition.
- understand the effect of insulin deficiency in CF.
- list the many different types of insulin and explain how they work.
- list the oral agents (diabetes pills) and explain why they are often not used to treat CFRD.

Insulin

What Insulin Is

Insulin is a hormone. It lowers blood sugar levels. It is made in the pancreas by *beta cells*. These cells are found all through the pancreas in the *islets of Langerhans*. Making insulin is one of the jobs of the *endocrine pancreas*. A separate part of the pancreas — the *exocrine pancreas* — makes *digestive enzymes* that flow into the *intestine* to help digest food. Most people with CF have damage to the whole pancreas and do not make enough digestive enzymes. They have to take *enzyme supplements*. People with CF who do not need enzyme supplements often do not get CFRD.

Class of insulin	Time to start working	Peak	Lasts	Generic name (Brand name)	Note
Rapid-acting	15 to 25 minutes	30 to 90 minutes	2 to 4 hours	Lispro (Humalog®) Aspart (NovoLog®) Glulisine (Apidra®)	Covers meals.
Short-acting	30 minutes	2 to 3 hours	6 to 8 hours	Regular	Can be used for nighttime tube feedings.
Intermediate-acting		6 to 8 hours	13 hours	NPH	In CF, most often used to cover meals Can be used for tube feedings.
Long-acting			24 hours	Glargine (Lantus®) Detemir (Levemir®)	Basal insulin.

What Insulin Does

Insulin helps your body cells use the energy (calories) from the food you eat for fuel and growth. Food contains nutrients, which are *carbohydrates* (sugars and starches), protein, and fat. Insulin helps the body cells absorb these food nutrients. Carbohydrates are changed to sugar for the body's instant fuel needs. Insulin allows the sugar to move from the blood into the cells where it is burned for fuel. The body cannot turn sugar into fuel without insulin. Without enough insulin, sugar builds up in the blood until it spills into the urine. This loss of sugar in the urine makes people with diabetes need to go to the bathroom a lot (polyuria) and be thirsty (polydipsia). Muscles are made from *protein*. Insulin allows the body cells to take up the building blocks of protein (*amino acids*) and build muscle tissue. Without enough insulin, protein breakdown and muscle loss occur. Muscle loss can affect breathing because lung function depends on muscle strength. Lastly, insulin allows the body to use and store fat in the diet as body fat. Without enough insulin, the body's fat stores are drained and weight loss occurs. People with CF make less insulin, which can cause CFRD. CFRD needs to be treated. Right now, insulin is the only drug proven to work for the treatment of CFRD. Insulin can only be given by a shot. In the past, insulin came from the pancreas of cows and pigs. Now, most people with diabetes use "human" insulin. This insulin doesn't really come from humans; it has the same genetic makeup as human insulin. It is made through *genetic engineering*. No one brand of insulin is better than another, but it is important for you to learn about all types of insulin and how they work.

Insulin helps:

- Sugar in the blood get into the cells
- The body turn sugar into fuel
- The cells use amino acids to build muscle
- The body use and store fat

Insulin Types

There are many types of insulin. Insulin types are grouped by how fast they work and by how long they last in the body. There are four broad classes of insulin: *rapid-acting* (*lispro* [Humalog[®]], *aspart* [NovoLog[®]], *glulisine* [Apidra[®]]), *short-acting* (*regular*), *intermediate-acting* (*NPH*), and *long-acting* (*glargine* [Lantus[®]] and *detemir* [Levemir[®]]). Insulin action (when it peaks, or when it is the strongest, and how long it lasts) may vary from person to person.

Rapid-Acting Insulin

Lispro (Humalog[®]), aspart (NovoLog[®]), and glulisine (Apidra[®]) start working 15 to 25 minutes after they're taken. They have their peak effect in 30 to 90 minutes. They often last 2 to 4 hours but can last as long as 5 hours. They can be given 5 to 15 minutes before the meal. These insulins are most often used to cover meals and snacks.

Short-Acting Insulin

Regular insulin starts working 30 minutes after it's taken. It has its peak effect in 2 to 3 hours and lasts 6 to 8 hours. Of course, this varies from person to person. Regular insulin should be given at least 30 minutes before eating so that it is working as food is being digested. It is not often used in CF to cover meals because hypoglycemia (low blood sugar) is common 3 to 4 hours after the meal because of how long regular insulin lasts. It can be used with intermediate-acting insulin for nighttime gastrostomy tube feedings.

Intermediate-Acting Insulin

NPH is made with *zinc* and a protein called *protamine*. These compounds allow NPH to be used by the body more slowly. It has its peak effect in 6 to 8 hours and lasts around 13 hours. Of course, this varies from person to person. NPH can be used with regular insulin for nighttime gastrostomy tube feedings.

Long-Acting Insulin

Glargine (Lantus®) is called a *basal insulin* because one dose gives a constant amount of insulin for about 24 hours with no peak. Basal insulin gives your body the insulin it needs when you are not eating. Basal insulin is not strong enough to give the extra insulin needed to cover meals. People who take glargine still need to cover meals and snacks with rapid-acting insulin. Glargine cannot be mixed in the same syringe with other insulins. Detemir (Levemir®) is another long-acting insulin that can be taken once or twice a day. It also is not strong enough to cover meals and snacks. Detemir should not be mixed in the same syringe with other insulins. Many people with CF need only rapid-acting insulin before meals and snacks. Long-acting insulin is needed if you have high blood sugar levels before breakfast.

Did You Know:

Often 1 unit of rapid-acting insulin will lower blood sugar about 50 mg/dL or 2.75 mmol/L.

Insulin Treatment

Basal Insulin

All people need a small amount of insulin at all times. This low level of insulin is often called *background* or *basal* insulin. The pancreas makes this insulin. People with type 1 diabetes don't make basal insulin. This is one reason why they get so sick when they don't get their insulin shots.

Most people with CF make less insulin than people without CF who do not have diabetes. Many people with CFRD do not need to take long-acting insulin because they make enough basal insulin.

Meal Coverage

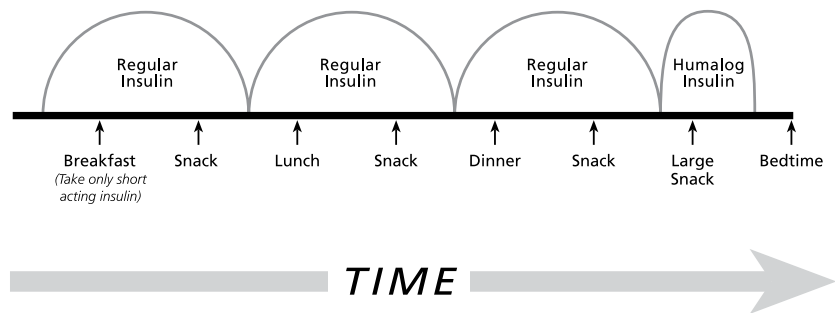
Normally, the pancreas secretes insulin as a *bolus* (all at once) to cover the meal you are eating. Rapid-acting insulin is taken before meals to provide the extra insulin bolus that is needed for food. Often, the best way to figure out a pre-meal insulin dose is to count the total amount of carbohydrates in the meal. See Chapter 9, "Nutrition and CFRD."

Correction Insulin

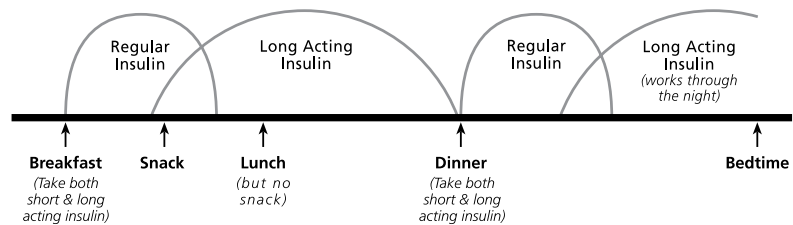
High blood sugar levels show that your body cells are not able to use the nutrients from food you eat very well for fuel. This can cause you to lose weight. If your blood sugars are too high, you can add extra rapid-acting insulin to your normal insulin dose to "correct" or lower your blood sugar. Often, one unit of rapid-acting insulin will lower your blood sugar around 50 mg/dL or 2.75 mmol/L. Work with your health team to find your *correction dose*. Good blood sugar control will improve your *nutrition* status and help you gain weight.

Sample Insulin Plans

If you have normal blood sugar first thing in the morning



If you have problems with high blood sugar first thing in the morning



Timing Goal:

Take insulin so it peaks when sugar from your meal is absorbed into your blood.

How Often Insulin Is Given

Most people with CFRD need three or more insulin shots per day to control blood sugar levels. The more often people with diabetes take insulin with their food, the better their blood sugar control will be. They can adjust their insulin dose based on what they eat. Taking insulin with meals and snacks will allow them to eat when they want, and as much as they want, and still keep blood sugars in control. Most people with CFRD have trouble with high blood sugar levels after meals but their blood sugars return to normal again 4 or more hours after eating. These people may only need to take rapid-acting insulin before each meal. Long-acting insulin is added only when needed if you have fasting hyperglycemia. The goal is to take insulin so that its peak occurs when sugar from the carbohydrates in your food are absorbed into your blood. Your insulin type, and the time it is given, should be matched to your eating, activity, and sleeping schedule. It is important that you give your caregiver or health team as much information as you can about your habits. Your best blood sugar control can be achieved if your insulin shots fit your routine. Some people with CF have high blood sugar levels only during nighttime nasogastric or gastrostomy drip feeding (also called *milk drips* or *tube feedings*). If this is the only time you have high blood sugars, you may be given one shot of intermediate-acting insulin or a mix of short-acting plus intermediate-acting insulin at the start of the feeding.

Blood sugars rise when:

- You “get sick”
- Your body is stressed
- You are getting sick

When Do You Need More Insulin?

When people get sick, they need more insulin. Insulin doesn’t work as well when the body is stressed. People without diabetes can make more insulin in their pancreas when they are sick. People with CFRD can’t, so their blood sugars rise. Check your blood sugar often to see if you need more insulin. Sudden high blood sugar levels may mean your body is stressed or you are getting sick. This may be the first sign that a “little cold” is really a bigger illness needing stronger treatment. Always tell your doctor if your blood sugar levels rise without warning. Getting enough insulin while sick will prevent weight loss and help you heal faster. When you check blood sugar levels often and record the results, you can see patterns of low or high blood sugar at certain times of day (*pattern management*). This information can help you and your doctor adjust your insulin dose between visits. If you take rapid-acting insulin before meals, you can use the blood sugar level (along with the amount of carbohydrates and planned exercise) to decide how much insulin to take. You control diabetes by knowing your blood sugar levels and changing your insulin doses to meet your body’s needs. You will feel better if you are in good control. See also page 28, “Exercise & Low Blood Sugar.”

Diabetes Self-Care Record											Date / /		
Time	Diabetes Medication Or Insulin		Blood Sugar Results	Food Intake		Carbohydrate Information		Physical Activity		Other Factors			
	Type	Amount		Amount	Type of food/ drink	Units	Grams	Type	Amount	Stress/illness			
Breakfast			Before										
			2 hrs After										
Snack													
Lunch			Before										
			2 hrs After										
Snack													
Dinner			Before										
			2 hrs After										
Snack													

Storing & Handling Insulin

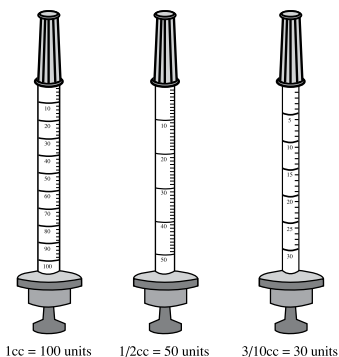
Bottles of insulin that aren't open should be stored in the refrigerator. Once opened, insulin is good at room temperature for 1 month. Many people like to inject room temperature insulin because cold insulin may sting. To warm the insulin, roll the bottle between your hands for 1 to 2 minutes before using the insulin. Alcohol wipes should be used to clean the top of the bottle before taking the insulin out. All insulin (except NPH) is clear, and should be thrown away if your insulin looks cloudy. Any bottle of insulin looking "clumpy" should be thrown away. Insulin should be thrown away if it freezes or gets hotter than 86°F. NovoLog® and Apidra® are stable to 98.6°F. Insulin in a pen, or **cartridge** for use with an **insulin injection pen**, should be stored in the refrigerator until opened. Once in use, cartridges or pens of Lantus®, Levemir®, regular, Humalog®, and NovoLog® insulin are good for 28 days, and NPH insulin is good for 14 days. Insulin pens that are being used should be stored at room temperature. To avoid damaging your insulin, never leave your insulin in the car, or any other place where it may get too hot or too cold.

Throw away insulin if it:

- Looks cloudy (except NPH)
- Looks "clumpy"
- Freezes
- Gets hotter than 86° F

Insulin Syringes and Needles

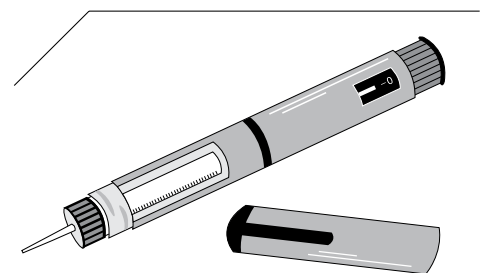
Syringes and Needles



Insulin can be given using a syringe with a needle. Insulin syringes measure insulin as units per cubic centimeter (cc). The most common type of insulin sold in the United States contains 100 units of insulin per cc (U-100 insulin). A standard insulin syringe holds either 3/10 cc (30 units), 1/2 cc (50 units), or 1 cc (100 units). A 3/10 cc syringe has more space between the unit lines. It is simpler to use with small insulin doses (30 units or less). This is likely the size of insulin syringe you will use. Needles have varied widths. With needles, smaller widths have larger numbers. A 31-gauge needle is the smallest needle. A 20-gauge needle is very large. Most insulin syringe needles are 29- to 31-gauge. Needles also come in varied lengths. Many people like short needles (such as 1/4 inch). If you prefer short needles, ask your doctor to prescribe them.

Insulin Injection Devices

You can choose between many injection devices. They are often called "pens" because they are about the size of an ink pen. They have a very small insulin needle. Insulin is stored in a cartridge inside the pen. Some pens are reused, though their cartridge of insulin is thrown away when empty. Other pens are thrown away when the cartridge of insulin runs out. Insulin cartridges and disposable pens come with varied types, or mixes, of insulin. Your diabetes doctor can help you choose the best type of insulin for you. Insulin injection devices can make giving insulin simpler. They can be carried in a purse or pocket. An insulin injection device can really be useful if you take only rapid-acting insulin before meals. It is easy to take it with you when you go out to eat.



Insulin Pumps

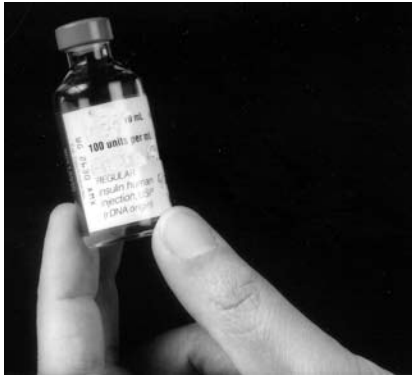
Instead of taking insulin shots, some people use **insulin pumps** (also called **continuous subcutaneous insulin infusion [CSII]**). A pump gives insulin through an **infusion set** (a thin, short, plastic tube), which is put into the skin using a tiny needle. Once the tube is in place, clear tape is put over the site and the needle is taken out. The infusion set is changed every 2 or 3 days. The pump connects to the infusion set. The pump is set to give a constant dose of insulin all through the day. This is called a **basal dose**. A larger dose of insulin is given with meals

or snacks. This is called a *bolus dose*. The pump offers great blood sugar control without the need for daily shots. It is helpful to people who don't like taking shots. It is easier for people who eat large snacks outside of meal times. If you like eating meals and snacks at varied times, the pump may be the best way for you to control your blood sugar levels. People using pumps should check their blood sugar at least four times per day. If you don't want to check your blood sugar this often, a pump may not be the best way for you to get insulin. To learn more about insulin pumps, meet with your *diabetes care team*.

Taking Insulin Shots With a Syringe

Before taking an insulin shot, always check the bottle to be sure you are getting the right type of insulin and that it has not *expired*. Many people like to roll the bottle between the palms of their hands for 1 to 2 minutes to warm the insulin. Cold insulin stings some people. Be sure to wipe the top of the insulin bottle with alcohol before you put the needle in the bottle. When you use both intermediate- and short- or rapid-acting insulin at one time, always withdraw the short- or rapid-acting insulin into your syringe before you withdraw the intermediate-acting insulin. Once you withdraw the right amount of insulin, your skin should be clean. Try not to use alcohol on your skin as it may dry out too much. Never mix long-acting insulin (Lantus® or Levemir®) in the same syringe with short- or rapid-acting insulin. This will destroy the long-acting insulin.

Check the insulin type and date of expiration (a)



Roll insulin bottle to warm (b)

Clean top with alcohol wipe (c)



Withdraw the insulin (d)

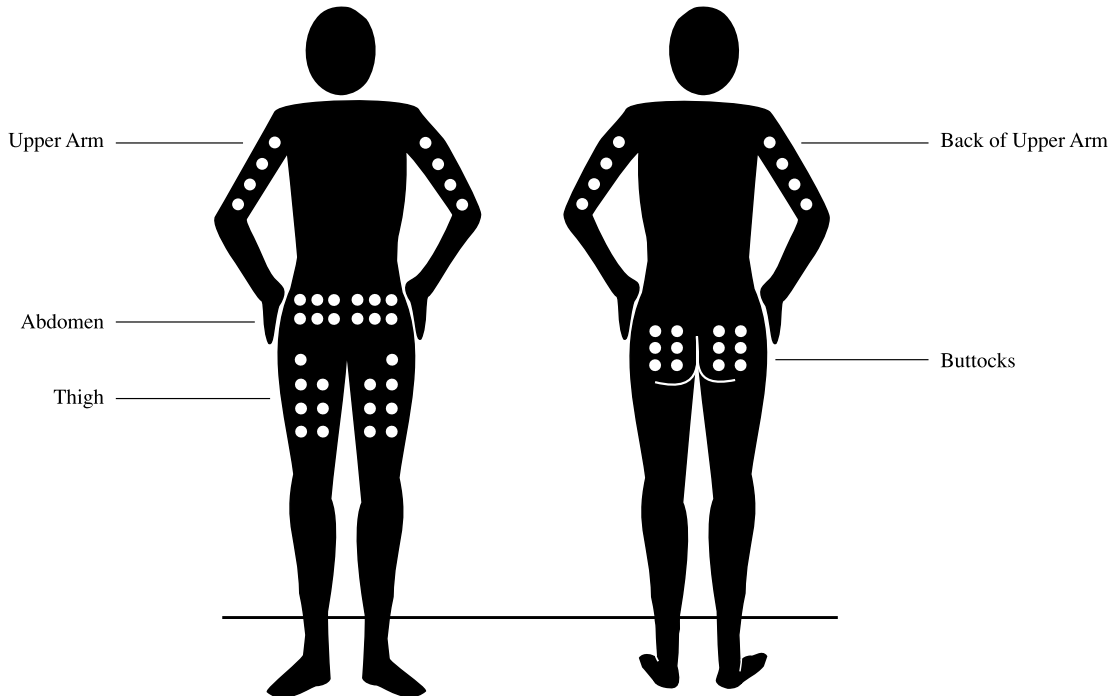
Clean skin with alcohol wipe (e)



Give the shot (f)

Where Insulin Is Given

Insulin can be given in the thigh, buttocks, arm, and tummy. The best place for you will likely be where you have the most fat below the skin. The needle should be put just under the skin into fat. It may help to pinch up a fold of skin and fat before putting in the needle. Try to pick a new place to give the insulin each time (also called rotating the injection site). The picture below shows some good places to give insulin.



Oral Agents (Diabetes Pills)

Many people with CFRD wish they could treat their diabetes with pills. At this time, though, insulin is the only medical treatment for CFRD advised by the CF Foundation. Pills weren't advised by the 1998 CF Foundation consensus conference committee for CFRD due to the lack of research showing that they work in CFRD and are safe. Some small studies have since been published, so doctors may prescribe pills in certain cases. There are two major types of *oral agents*: those that make people *secrete* more insulin and those that make people more sensitive to insulin. *Oral hypoglycemic agents*, such as *glipizide* (*Glucotrol*®) and *glyburide* (*Micronase*®, *DiaBeta*®, *Glynase PresTab*®), make people secrete more insulin. In people with CF, low blood sugar is a common side effect of these drugs. Drugs in the repaglinide class also make people secrete more insulin but don't cause low blood sugar as often. Drugs that make people more sensitive to insulin, such as *metformin* (*Fortamet*®, *Glucophage*®, *Glumetza*®, *Riomet*®), also decrease glucose output from the liver. These drugs carry some risk of lactic acidosis, so research is needed before using them in CF. Some oral agents make people secrete more insulin and make them more sensitive to insulin. Research is needed to see if they are useful in treating CFRD.

Name	Action
Glipizide (Glucotrol®)	Secrete more insulin
Glyburide (Micronase®, DiaBeta®, Glynase PresTab®)	Secrete more insulin
Metformin (Fortamet®, Glucophage®, Glumetza®, Riomet®)	Make cells more sensitive to insulin

Blood Sugar Testing

LEARNING GOALS

At the end of this chapter, you should be able to:

- explain what blood sugar levels are OK for certain age groups and times of the day.
- state when blood sugar should be tested.
- list the steps taken to check and record blood sugar levels.
- understand the reasons for wrong results.

When to Check Blood Sugar

Most doctors advise that you check your blood sugar 3 or 4 times per day to help you decide how much insulin you need. Most people with diabetes check their blood sugar before breakfast, before lunch, after school or before supper, and before their bedtime snack. You should always check your blood sugar when you first wake up in the morning. With CFRD (compared with other types of diabetes), blood sugar levels after a meal may be much higher than blood sugar levels from times when you have not eaten. For this reason, you may be asked to check your blood sugar 2 hours after eating a meal instead of before eating. If you take intermediate-acting insulin in the evening, check your blood sugar in the middle of the night once every 2 to 3 weeks to make sure that low blood sugar does not occur during sleep. If you get nighttime tube feedings (also called “milk drips”), check your blood sugar 1 or 2 times per week in the middle of the feeding. If you get bolus feedings, check your blood sugar 2 hours after the bolus. **You will likely need more insulin if your blood sugar level is more than 180 mg/dL or 10.0 mmol/L in the middle of a nighttime tube feeding or 2 hours after a bolus feeding.** Check your blood sugar level 2 hours after your largest meal (a *postprandial glucose level*) often. The blood sugar level 2 hours after a meal should be less than 180 mg/dL or 10.0 mmol/L. Check with your diabetes care team to see what your goal should be. If your blood sugar level is often higher than 200 mg/dL or 11.0 mmol/L, you need more rapid-acting insulin before your meal.

Advised Blood Sugar Levels for CFRD		
Age (in years)	Before eating (no food for 2 hours)	Bedtime* (before bedtime snack)
6-12	90-180 mg/dL or 5.0-10.0 mmol/L	100-180 mg/dL or 5.5-10.0 mmol/L
13-18	90-130 mg/dL or 5.0-7.2 mmol/L	90-150 mg/dL or 5.0-8.3 mmol/L
19+	70-130 mg/dL or 3.9-7.2 mmol/L	90-150 mg/dL or 5.0-8.3 mmol/L

Check your blood sugar:

- When you first wake up
- Before lunch
- After school or before supper
- Before a bedtime snack
- 2 hours after your largest meal

** If your blood sugar level is less than 100 mg/dL or 5.5 mmol/L, add 1 carbohydrate unit or 15 grams of total carbohydrates to your bedtime snack. See Chapter 9, “Nutrition and CFRD.”*

** If your blood sugar level is less than 70 mg/dL or 3.9 mmol/L, add 1 carbohydrate unit to your bedtime snack and recheck your blood sugar between 12:00 am and 2:00 am. If this happens more than once in a week, call your diabetes care team for advice.*

The only sure way to check blood sugar levels at home is with a glucose meter. Studies show that you cannot guess your blood sugar levels based on how you feel.

How to Check Blood Sugar

Finger “Sticks”

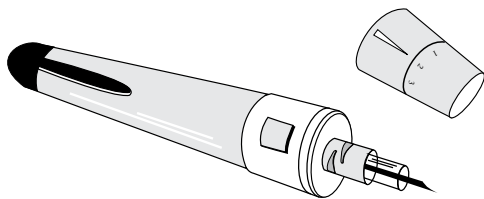
You’ll need a *lancet* to check your blood sugar. A lancet has a tiny, spring-loaded needle made for gently getting a drop of blood from the tip of your finger for checking your blood sugar. There are many different brands of lancets. Before using a lancet, wash your hands with warm water to clean them and increase blood flow.

Washing your hands also helps remove any sugar on your finger so your reading won’t be falsely high. You may

need to use alcohol to clean

your finger if you can’t wash your hands. Don’t use alcohol if you can wash your hands, because alcohol dries out the skin. It can help to put your hand on top of a table. Prick the side of the finger rather than the fleshy pad. That will hurt less. If you don’t get a drop of blood after

pricking your finger, hold your hand down at your side to increase blood flow to your finger. Change the finger you use each time so your fingers don’t get sore.

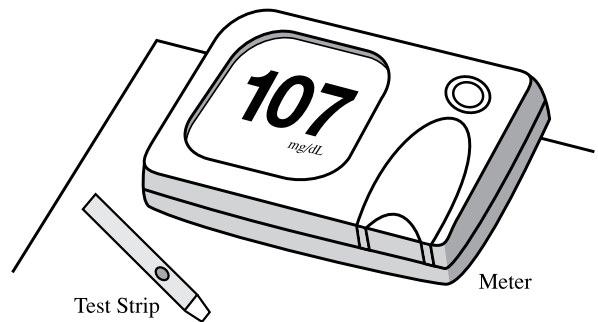


Finger sticks:

- Prepare lancet
- Wash your hands or clean with rubbing alcohol
- Prick side of finger
- Put a drop of blood on the test strip

Blood Sugar Meters

There are many brands of meters for sale. Each meter differs in the way it is used. Each brand has test strips that are made to go with the meter. To get correct results, keep the test strips in their bottle until they are ready for use. Do not use *generic* or out-of-date test strips. **Use the test strips that are right for the meter! Follow all of the steps for coding, cleaning, and checking to see that the meter is working right. If you have problems with your meter, you can call the 1-800 phone number on the back of the meter for help.**



Blood Sugar Testing Results

Recording Results

Always record your results in a diabetes record, even if your meter has a memory. Look for patterns in blood sugar readings at certain times of day that may signal a need to change your insulin dose. When you record your results, you can also note any special things going on at the time that might account for those results. For instance, next to a low blood sugar reading you might write, “I did not eat enough” or “I worked out more than normal.”

Summary

Good blood sugar control is very important for your health. Your blood sugar level is best measured by using a blood sugar meter. Record the time of the test, the date, how you feel, and other things going on that may affect your blood sugar, and the blood sugar value. Bring along these results, and the meter, when you come to clinic. If the results are often outside of the desired range, the insulin dose should be changed. You can call, mail, or fax the test results to your diabetes care team. Your doctor can advise changes in insulin or you can make some changes on your own. The longer you have CFRD, the more comfortable you will feel about changing your insulin dose. **Tell your diabetes care team about any problems before your next clinic visit.** Though blood sugar testing takes time and adds to the cost of caring for CFRD, it is very important. Good diabetes control can only occur with blood sugar testing. The whole family must support this effort. In many states, insurance companies must pay for diabetes supplies by law. The local *American Diabetes Association (ADA)* can tell you more about the laws in your state. **You and your diabetes care team will work together to help you manage your diabetes. The more you check blood sugar levels, the more you will know. The more you know, the better you be able to manage your diabetes.**

Wrong results:

Your blood sugar reading may be wrong if:

- Your finger is not clean and dry
- You do not follow all of the meter’s steps for use and care
- The meter parts are dirty (such as with dried blood)
- The codes on the strip and the meter don’t match
- The drop of blood is too small for the pad
- The test strips are expired or not stored right

How We Manage CFRD

LEARNING GOALS

At the end of this chapter, you should be able to:

- list the tests used to manage diabetes.
- explain how diabetes care team and ophthalmology visits help to manage CFRD.

Tests to Help Manage CFRD

Hemoglobin A₁C (glycosylated hemoglobin)

Normally, red blood cells live about 3 months. Hemoglobin A₁C shows how much sugar is “stuck” to your red blood cells. The test shows how high your blood sugar levels have been for the past 3 months. It shows long-term blood sugar control. Hemoglobin A₁C can be measured at a clinic visit. You do not have to fast. The advised hemoglobin A₁C for adults with diabetes is less than 7%. People with CFRD often have an artificially low hemoglobin A₁C. This is because their red blood cells live for less than 3 months. This test can still be used to track your blood sugars over time, but your actual blood sugar values are more precise.

Urine Microalbumin

Uncontrolled diabetes can eventually lead to kidney disease. The amount of protein (albumin) in your urine shows the health of your kidneys. Once you are diagnosed with CFRD, the protein level in your urine will be checked at least once per year (a “spot” urine check). If your protein is higher than normal, you will be asked to collect your urine for 24 hours. You have kidney disease if your protein in the 24-hour sample is too high. There is medicine to treat this. Good blood sugar control can help prevent kidney damage.

Urine Sugar Testing

Urine can be tested for sugar, but **this is not a sure way to diagnose or manage diabetes**. The blood sugar level that causes sugar to spill into the urine varies from person to person. Often it varies in the same person from time to time. Urine sugar testing should never be done instead of blood sugar testing.

Urine or Blood Ketone Testing

When fat is used for fuel by body cells instead of sugar, the body makes *ketones*. Ketones are found in the urine and blood. You may know some people who check their urine or blood for ketones, but you will likely not have to. We don’t know why, for sure, but people with CFRD don’t often have large ketone levels and don’t usually need to test for ketones. Your doctor will tell you if you need to check for ketones.

Lipid Profile

Blood *lipids* are *cholesterol* and *triglycerides*. People with type 1 and type 2 diabetes are at risk for heart disease and stroke if their cholesterol and triglyceride levels are high. Heart disease and stroke are known as the *macrovascular complications of diabetes*. Lipid profiles are checked every year in people with type 1 and type 2 diabetes. Right now, people with CFRD appear to be at a very low risk for having heart disease and stroke. They don’t often need routine lipid profile checks. Unless you have a strong family history of stroke or heart disease, you will likely not be checked often. This may change as we learn more about CFRD.

Other Tools to Manage CFRD

Diabetes Care Team Visits

Besides your routine visits to the CF Foundation-accredited care center, you should also be seen by a diabetes care team every 3 to 4 months. These visits are very important to help you manage your CFRD. They will examine you and review your diet, your blood sugar control, and insulin doses. Always bring your blood *glucose meter* to these appointments. Uncontrolled diabetes can cause the body to heal more slowly. It is important to show your diabetes care team any new wounds or wounds that haven't healed as they should. A goal of these visits is to discuss any questions you have about your diabetes treatment plan to help control your blood sugars to prevent future problems.

Yearly *Ophthalmology* Visits

In about 15% of people with CFRD, diabetes can cause *retinopathy*, an eye disease. This eye disease can cause blurred vision at first and blindness later on. Blood sugars that are not well controlled may cause retinopathy about 5 years or longer after being diagnosed with diabetes. See an *ophthalmologist* (eye doctor) once a year to be sure that you do not have retinopathy. If you do, the ophthalmologist can treat it. Good blood sugar control can help prevent it.

Low Blood Sugar (Hypoglycemia)

LEARNING GOALS

At the end of this chapter, you should be able to:

- list the common signs of low blood sugar.
- explain how to treat low blood sugar.
- describe how to manage diabetes on days when you are too sick to eat your normal diet.
- explain how to avoid low blood sugar with exercise.

What Is Hypoglycemia?

Hypoglycemia is low blood sugar. Levels less than 70 mg/dL or 3.9 mmol/L are too low and can be dangerous. Blood sugars this low don't often occur unless a person is taking insulin. People who are taking insulin shots can have VERY low blood sugar levels. **Blood sugar levels can drop fast and must be treated fast!** Early treatment prevents worse symptoms. When you are newly diagnosed, you and the people you live and work around must learn the symptoms of hypoglycemia and how to treat it.

Low Blood Sugar Symptoms

The body gives a warning when blood sugars are getting low. **WARNINGS VARY FROM PERSON TO PERSON.** Others may see these symptoms in you before you do.

If your blood sugar is low and you don't treat it, you may pass out, have a *seizure*, or have *convulsions*. If you are taking insulin, it is very important that you treat your low blood sugar right away so that symptoms don't worsen. Symptoms often occur when blood sugar levels are not yet low enough for you to pass out. The early signs of low blood sugar are caused by the release of a hormone called *adrenaline*. Adrenaline is also called the "fight or flight" hormone because most people release it when they are excited or scared. Among other things, it dilates the

Common symptoms of low blood sugar:

- Sudden hunger
- Upset stomach (nausea)
- Shaky feeling hands or body
- More sweat than normal (often a "cold" sweat)
- A pale face color
- Weakness
- Headache
- Confusion (you may feel or look "spaced out" or "dazed")
- Blurred vision or double vision
- A change in the way you act or feel (crying, feeling nervous, acting "drunk" or angry, etc.)
- Fast heartbeat
- Tingling or numbness in your lips and mouth

pupils, raises the heart rate, and makes people feel shaky and sweaty. If you feel these symptoms, check your blood sugar. If it is less than 70 mg/dL or 3.9 mmol/L, you need to treat it quickly by eating or drinking foods that contain carbohydrates.

Low Blood Sugar Causes

When your body doesn't have enough sugar to burn for fuel, your blood sugar level drops. The drop in blood sugar triggers the release of *counter-regulatory hormones*, which help your body correct low blood sugar. These *hormones* cause the symptoms of low blood sugar. Very low blood sugar levels often only occur if people are taking insulin. Low blood sugar tied to insulin use is often called an *insulin reaction* or a *reaction*.

Low Blood Sugar in CF Without Diabetes

People with CF who are not taking insulin may have slightly low blood sugar levels and feel the warning symptoms listed above. These symptoms occur because your body's own insulin secretion isn't well timed to when you eat your meals. Although slightly low blood sugar can feel bad, it is not a danger. Your blood sugar should never drop really low unless you are taking insulin. People not taking insulin who feel low blood sugar symptoms can stop or prevent them by eating small meals every 2 to 3 hours. These meals should contain carbohydrates. Although eating prevents low blood sugar, you can also try products that contain uncooked starch. This can be found in stores in cookie-like bars (like Nite Bite Bars™ or Extend Bars™). These bars should not be used to treat blood sugars less than 70 mg/dL or 3.9 mmol/L because they will not raise blood sugar quickly. Always treat very low blood sugar with simple sugars that do not require enzymes. Ask your dietitian to help you with a meal plan if you have low blood sugars.

Low blood sugar with insulin use is often caused by:

- Late or missed meals and snacks
- Extra exercise that burns more sugar
- An insulin dose that is too high
- Absorbing the insulin too fast, which can happen with exercise or if the shot is given in the muscle instead of just under the skin
- Lack of low blood sugar warning symptoms (for example, when you are asleep)
- Getting too much insulin or wrongly mixed insulin types
- Drinking alcohol on an empty stomach when taking insulin

Low Blood Sugar Treatment

The best treatment for very low blood sugar is to eat or drink a simple sugar source that does not require enzymes for digestion. If your blood sugar is less than 70 mg/dL or 3.9 mmol/L, you should take 15 grams of carbohydrates (such as in 3 or 4 glucose tablets; ½ cup of regular soda, juice, or lemonade; 1 cup of skim milk; 1 tablespoon of sugar or honey; or 1 piece of medium-sized fruit). If your blood sugar is less than 50 mg/dL or 2.75 mmol/L, you should take 30 grams of carbohydrates (a double serving of the above). If you are taking insulin, you should always carry glucose tablets with you. Use them when you feel “low” but don't have time to test or when you have no other sugar source.

To treat low blood sugar, eat or drink:

- 3 or 4 glucose tablets
- ½ cup of regular soda, juice or lemonade
- 1 cup of skim milk
- 1 Tbsp of sugar or honey
- 1 piece of medium-sized fruit

It is not safe to feed a person who has passed out because they will likely choke. If your blood sugar is so low that you pass out or can't drink, someone else needs to give you a *glucagon* shot. Glucagon is a hormone that “squeezes” extra sugar out of the liver and raises the blood sugar level. You should have glucagon with you. Those who live with you should know how to give it. Glucagon can cause nausea and throwing up

for up to 6 hours. Even if the package is not opened, glucagon expires after 1 year. Check your glucagon now and then to see when it expires. Replace it when needed. Always wear an ID bracelet or necklace stating that you have diabetes and CF. This is the first thing that rescue workers look for. It tells them that you might need glucagon or *intravenous (IV)* sugar if your blood sugar is low.

Important:

Always have a quick-acting sugar with you, and wear an ID that states you have diabetes and CF.

Driving and Low Blood Sugar

People with diabetes can still drive. If taking insulin, though, they should do all they can to prevent low blood sugar while driving.

- Check your blood sugar before you drive. NEVER drive if your blood sugar is less than 100 mg/dL or 5.5 mmol/L.
- Eat a snack with carbohydrates before you drive.
- Pack plenty of snacks with carbohydrates for long trips.
- Pull over and check your blood sugar if you feel shaky. If it is low, eat a snack.
- Don't take insulin on an empty stomach before driving to a restaurant. Take insulin when you get your food.
- Keep glucose tablets in your car.

Sick Days and Blood Sugar

When you are not able to eat your normal diet, it can be hard to control blood sugar. Your blood sugar often rises when you are sick. You are also more likely to get dehydrated if you have a fever, *diarrhea*, high blood sugar, or are throwing up. If you are throwing up or have lost your *appetite*, tell your diabetes care team.

These guidelines will help you to manage your blood sugar when you can't eat your normal diet:

1. Check your blood sugar every 4 to 6 hours when your blood sugar is up.
2. Tell your doctor that your blood sugar is higher than normal.
3. Use your normal insulin dose, unless your doctor tells you to change.
4. If you can't eat solids, drink liquids. Replace 15 grams of carbohydrates from solids with 15 grams of carbohydrates from liquids.
5. Sip at least 8 to 12 ounces of fluid every hour. Alternate fluids that do contain carbohydrates (juice, milk, supplements, soda) with fluids that do not (water, sugar-free drinks).
6. Even if your blood sugar is not high, call your doctor if you can't eat your normal diet for more than 24 hours or if you have diarrhea or are throwing up for more than 6 hours.
7. Most people with CFRD do not have large amounts of ketones. You may never have been asked to check your urine for ketones. If you are supposed to check your urine for ketones when well, check more often when sick. Call your doctor if your urine ketones are moderate or large.

8. Don't miss CF treatments when sick!
9. Tell your doctor or CF care team when you have a fever!
10. Higher than normal blood sugar levels may mark the start of a more severe illness. Always tell your CF Foundation-accredited care center team and your diabetes care team if your blood sugar is high for more than 2 days.

Exercise and Low Blood Sugar

Tips for exercising:

- Avoid giving insulin shots in the parts of the body you will work out
- Check your blood sugar before, during, and after your workout so you can watch your blood sugar patterns
- Eat a snack with carbohydrates before you begin if your blood sugar is less than 100 mg/dL or 5.5 mmol/L
- Have a source of carbohydrates with you (such as glucose tablets)

Routine exercise is good for many reasons. It can help control your blood sugars by making your body respond better to insulin. Exercise can strengthen your lungs and help you feel better. Exercise can help with depression. Exercise may also cause low blood sugar (hypoglycemia) because muscles use sugar for fuel. People with CFRD can work out safely as long as they understand the following:

You may need to adjust your insulin dose to match your activity level. Even if your blood sugar is more than 100 mg/dL or 5.5 mmol/L, eating an extra carbohydrate snack before starting is wise. You may need an extra 15 to 30 grams or more of carbohydrates for each hour of intense or lengthy exercise. The blood sugar lowering effect of a workout can last as long as 12 to 24 hours, so you may need to eat an extra bedtime

snack with carbohydrates on the days you've exercised really hard. Record exercise in the "comments" section of your blood sugar records so that your doctor will know if exercise caused low blood sugar.

Abnormal Glucose Tolerance in CF

LEARNING GOAL

At the end this chapter, you should be able to:

- describe the types of abnormal glucose tolerance in CF and know treatment for each.

As discussed in Chapter 2, “How We Diagnose CFRD,” a blood sugar level taken after not eating any food for 8 hours is called a **fasting blood glucose (FBG)**. A normal value should be less than 100 mg/dL or 5.6 mmol/L. As discussed in Chapter 4, “Blood Sugar Testing,” a blood sugar level checked 2 hours after eating a meal is called a **postprandial glucose level**. This value should normally be less than 140 mg/dL or 7.8 mmol/L. In Chapter 2, “How We Diagnose CFRD,” we also discussed the oral glucose tolerance test (OGTT). This test is used to diagnose not just CFRD but also the varied types of abnormal glucose tolerance in CF.

CFRD With Fasting Hyperglycemia

In CFRD with fasting hyperglycemia, both the fasting blood glucose and the postprandial glucose levels are higher than normal. People with this type of CFRD are the most likely to have classic diabetes symptoms (see Chapter 1, “Cystic Fibrosis–Related Diabetes [CFRD]”). This type of diabetes should always be treated.

CFRD Without Fasting Hyperglycemia

People with normal fasting blood sugar (less than 100 mg/dL or 5.6 mmol/L) but with a blood sugar 200 mg/dL or 11.1 mmol/L or greater 2 hours after an oral glucose load have CFRD without fasting hyperglycemia. This is a milder form of diabetes. Often, these people do not have the classic diabetes symptoms. If you have CFRD without fasting hyperglycemia, check your blood sugar levels at home (**self-monitoring of blood glucose [SMBG]**) once a week. Your diabetes care team will want to see what your blood sugar is: (1) before breakfast (fasting), (2) before your main meal, and (3) 2 hours after your main meal. You may also be asked to check your blood sugar 2 hours after a meal a few times per week. Your doctor may ask you to take insulin if your blood sugar 2 hours after a meal is often 200 mg/dL or 11.1 mmol/L or greater. Don’t drink a lot of sweet drinks such as soda. Eat meals and snacks throughout the day, all with the same amount of carbohydrates. Talk with your dietitian about spreading your carbohydrates throughout the day to help even out your blood sugars. When you are sick, you should test your blood sugar daily. You will need insulin in the future if fasting hyperglyce-

Test your blood sugar:

- Before breakfast
- Before your main or largest meal
- 2 hours after your main meal
- Daily when sick

mia develops. You will mostly likely need insulin when you are sick or taking corticosteroids. Though your doctor may not place you on insulin all of the time, you may be given a trial of insulin therapy because of:

- Not gaining or maintaining your weight,
- A decline in your lung function,
- Being sick, or
- Feeling extra tired.

The “rules” for treating this type of diabetes may change. The latest advice is to prevent high blood sugar levels after meals, which may prevent other diabetes problems, too.

Intermittent Diabetes (“Now and Then Diabetes”)

Some people with CF may have diabetes only when they are sick or taking corticosteroids. If you are one of these people, you must be treated with insulin when taking this drug or are sick so that you do not lose too much weight. Insulin may be stopped later. Intermittent diabetes, or “now & then” diabetes can occur with or without fasting hyperglycemia. You will need a yearly OGTT. Once you have had “now & then” diabetes, you are likely to have it again. You will need to be checked for diabetes when you are sick or taking corticosteroids.

Impaired Glucose Tolerance

Impaired glucose tolerance:

- Avoid sweet drinks, e.g., soda
- Eat same amount of carbohydrates

People with a fasting blood sugar of 100 to 125 mg/dL (5.6 to 6.9 mmol/L) have impaired fasting glucose (IFG), and those with a blood sugar of 140 to 199 mg/dL (7.8 to 11.0 mmol/L) 2 hours after an oral glucose load have *impaired glucose tolerance (IGT)*. These two conditions are similar, but not exactly the same. Impaired fasting glucose is rare in CF patients who don’t have diabetes. But of those people with CF, 30% to 40% have impaired glucose tolerance. This means

that their blood sugar levels may be higher than normal, but not as high as in CFRD. If you have impaired glucose tolerance, you may have diabetes in the future. Impaired glucose tolerance can only be diagnosed by an OGTT. If you have impaired glucose tolerance, you should be tested with an OGTT yearly. You should be tested early if you have diabetes symptoms. You should also be tested when you are sick, to be sure you do not have “now and then” diabetes. Avoid drinking too many sweet drinks, such as soda. Eat meals and snacks throughout the day, all with the same amount of carbohydrates. Talk with your dietitian about spreading carbohydrates throughout the day to even out your blood sugars.

Diabetes When Pregnant

Women with CF are at high risk for having diabetes when pregnant. Diabetes that is diagnosed when pregnant is called *gestational diabetes*. Women with CF should have an OGTT as soon as they find out they are pregnant. If they have already had an OGTT within 6 months of getting pregnant, then they should have another OGTT at the end of the first trimester. This is sooner than for pregnant women who do not have CF. Insulin should be started when diabetes is diagnosed, to preserve both the baby’s and mother’s health. Women with CF who already have diabetes should consult their doctors before getting pregnant. They should have good blood sugar control before getting pregnant. They need to check their blood sugar more often and take the right amount of insulin. During pregnancy, insulin needs increase, especially during the second and third trimesters.

Any woman with CF who gets pregnant should be treated by a high-risk obstetrician. If she has diabetes before getting pregnant or gets gestational diabetes, she should see an *endocrinologist*. An endocrinologist is a doctor with special training in the treatment of diabetes and other diseases of the glands that make hormones. Uncontrolled blood sugars and/or poor nutrition status can hurt both mother and baby and can lead to poor weight gain and possible problems with the baby.

Women with gestational diabetes who do not have CF are often told to decrease the amount of carbohydrates in their diet. This does not work for women with CF and gestational diabetes. Eat a high-calorie, healthy CF diet when pregnant. Good nutrition is crucial! Insulin is often the treatment of choice because it promotes weight gain for the mother and baby. Cutting back on food is never a good choice in CF. Nutrition needs are higher when you are pregnant, so it is very important to get all the calories you need to gain the right amount of weight and have a healthy baby. To learn more, see Chapter 10, “Nutrition and CFRD When Pregnant.”

The Diabetes Care Team

LEARNING GOAL

At the end of this chapter, you should be able to:

- describe the members of the total care team.

Though you may know your *pulmonologist* (lung doctor) well, you may not know an *endocrinologist* (diabetes doctor). If you have CFRD or abnormal glucose tolerance, you should see a diabetes doctor and a lung doctor. The diabetes doctor will design a treatment plan to meet your diabetes needs and maintain health. Most diabetes doctors work with *certified diabetes educators*. These are often nurses and dietitians with special training to manage diabetes. Get to know the nurses and dietitians who work with your CF and endocrine doctors. Diabetes educators can help you manage your diabetes by spending extra time teaching you about blood sugar control and insulin dosing. Diabetes educators can teach you how to tell when insulin doses need changing. Other members of the diabetes care team include a social worker or psychologist. You may end up not meeting all of the diabetes care team members if you already work closely with the CF dietitian and social worker. Your diabetes and CF doctors and you need to work as a team to manage your diabetes. Your total care team includes YOU and your family; your CF doctor, nurse, dietitian, and social worker; and your diabetes doctor, nurse, dietitian, diabetes educators, and social worker. **You are the most important member of your total care team!** Your role on the team is to tell the others what you need and how you feel. Bring your blood glucose meter to all clinic visits. Tell them about your medicines and physical activity. Tell them about your schedule (when you wake up, go to bed, eat meals, and eat snacks). Stick with a routine. You can have a plan for school or work days and a plan for weekends, if needed. This makes it simpler to manage diabetes. Being open with the other team members allows the total care team to match your treatment to your needs as a person with CF and CFRD.

Nutrition and CFRD

LEARNING GOALS

At the end of this chapter, you should be able to:

- describe a high-calorie, healthy diet using the food guide pyramid.
- figure carbohydrate content from a standard food label and adjust insulin.
- manage late meals, alcohol, and sugar substitutes.

A High-Calorie, Healthy Diet

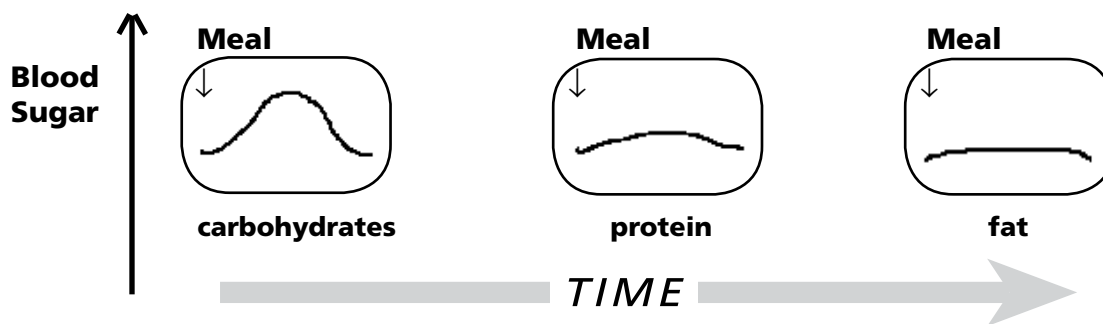
To ensure good health, it is important to maintain a healthy body weight. With type 1 or type 2 diabetes, people are often advised to eat a low-fat, low-salt, and sometimes low-calorie diet. People with CF have different nutrition needs, though. Even with CFRD, you still need to eat your normal high-calorie, high-protein, high-fat, high-salt diet to help you get and maintain a healthy body weight. Keeping your blood sugar at near-normal levels will help to maintain your weight and ensure good health. You can learn to manage your blood sugars by balancing your food, insulin, and physical activity. A healthy diet means eating a variety of foods from all food groups. Added fats and sweets provide a good source of extra calories. All foods are healthy and, when eaten in the right amounts, can help you get and maintain a healthy body weight. The only change is that, now that you have CFRD, you need to learn how to measure or count the foods that affect your blood sugar the most.

The six major food groups contain six different nutrients: carbohydrates, protein, fat, vitamins, minerals, and water. Carbohydrates, protein, and fat provide fuel (calories) for our bodies. Foods that contain carbohydrates affect blood sugar the most because the body turns them into blood sugar. Foods that are made up mostly of protein and fat have much less of an effect on blood sugar. The graphs below show how carbohydrates, protein, and fat affect blood sugar.

The six major food groups:

- 1) Grains
- 2) Fruits
- 3) Vegetables
- 4) Meats
- 5) Dairy
- 6) Fats

Nutrient Effects on Blood Sugar



Carbohydrates have the most effect on blood sugar levels and protein and fats really have little influence. However, fats can slow the absorption of carbohydrates from the intestine, and therefore have an indirect effect on blood sugar levels.

Carbohydrates

Carbohydrates are found in:

- Grains (bread, rice, pasta, and cereal)
- Fruits (fresh, canned, and dried fruit)
- Starchy vegetables (potatoes, corn, peas, and winter squash)
- Milk and yogurt
- Legumes (beans)
- Desserts
- Sweetened drinks
- Snack foods

Foods with carbohydrates have the greatest impact on blood sugar. Protein and fats have little effect on blood sugar. Fats can sometimes slow carbohydrates from being released from the stomach, depending on how much fat is eaten at one time, so they have an indirect effect on blood sugar. The main way to control blood sugar with diet is to control the carbohydrates in your meals and snacks. This does not mean that you should avoid carbohydrates. They contain important nutrients and are the body's main source of fuel. Carbohydrates are turned into sugar that is then used as "fuel" for all body functions. The insulin you take works to help your body use the fuel (or calories) that carbohydrates provide (along with protein and fat) and keeps your blood sugar at normal levels. Food groups that contain carbohydrates include grains (bread, rice, pasta, and cereal), fruits (fresh, canned, and dried fruit and fruit juice), starchy vegetables (potatoes, corn, peas, and winter squash), milk and yogurt, legumes, desserts, sweetened drinks, and snack foods. The two main types of carbohydrates in these foods are "sugars" and "starches." When eaten in the same amounts, both types affect blood sugar the same way. Foods that are high in fiber

have no special effect on blood sugar. By checking your blood sugar and watching the amounts and kinds of carbohydrates eaten, you will learn how varied combinations of foods affect your blood sugar levels. Make sure that you eat carbohydrates at times when there is enough insulin in your body to change them into fuel. If you are on a fixed insulin dose (two or three shots per day with the same dose each time), you will be better able to manage blood sugar by eating the same amount of carbohydrates during each of your daily three meals and three snacks. Eat at about the same times each day, too. People who are willing to take four or more shots of rapid-acting insulin per day or use an insulin pump have more options when choosing when and how much to eat. If you want more options, your doctor or diabetes educator can teach you how to adjust your rapid-acting insulin based on how many carbohydrates you plan to eat during meals and snacks. This is called **carbohydrate counting**. You and your dietitian can decide how many carbohydrates to eat for each meal and snack based on your normal eating habits. This will be how many "carbohydrate units" or "grams" of carbohydrates you can eat at each meal and snack. There are other ways to plan meals and snacks, Your dietitian can help you decide which way is best for you.

Carbohydrate Units

Foods that contain carbohydrates can be broken down into carbohydrate "units," or carbohydrate "choices." Some doctors prefer to prescribe insulin based on the amount of carbohydrates a person normally eats at meals and snacks. For instance, 1 unit of rapid-acting insulin may cover about 12 to 15 grams of total carbohydrates (about 1 carbohydrate unit). This varies from person to person and depends on many other things. Food labels will tell you the carbohydrate content in the foods you eat using "grams of carbohydrate." Another way to count carbohydrates is to count "carbohydrate units." One carbohydrate unit equals about 12 to 15 grams of total carbohydrates. To figure out how many carbohydrate units are in the food, divide the grams of total carbohydrates by 15. The grams of sugar in the food are included in the total carbohydrates. Note: dietary fiber can't be digested. If a food item has more than 5 grams of fiber, you can subtract half the grams of fiber from the grams of total carbohydrates to figure the "real" grams of carbohydrates in the item. For instance:

Carbohydrate Unit:

1 carbohydrate unit = about 12 to 15 grams of total carbohydrates

In this food label, the serving size is listed as ½ cup. All of the nutrient values listed below the serving size are based on ½ cup of this food. As you can see, the total carbohydrate content in ½ cup of this food is 13 grams or 1 carbohydrate unit. Because there are only 3 grams of fiber per serving, you would not subtract that from the total carbohydrate content. If you plan to eat more than the listed serving size, multiply the data on the label by how many servings you plan to eat. If you plan to eat 1 cup of this food item, you will be eating 2 times the serving size on the label, because ½ cup x 2 = 1 cup. To find the total carbohydrate content of your 1 cup of food, multiply 13 grams by 2, which equals 26 grams. Because you are getting 6 grams of fiber (3 grams of fiber per serving x 2 servings = 6 grams of fiber), subtract half of those grams from the total carbohydrate content. 26 grams – 3 grams = 23 grams of “real” carbohydrates, or 1.5 carbohydrate units. Some people prefer to count carbohydrate units; others prefer to count only grams of carbohydrates. Your dietitian can help you decide which way is best for you.

Nutrition Facts	
Serving Size 1/2 cup (90g)	
Servings Per Container 4	
Amount Per Serving	
Calories 100	
Calories from Fat 30	
	% Daily Value
Total Fat 3g	5%
Saturated Fat 0g	
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 300mg	13%
Total Carbohydrates 13g	4%
Dietary Fiber 3g	12%
Sugars 3g	
Protein 3g	

Meals Using Carbohydrate Units

Here is an example of a 7-carbohydrate-unit breakfast (figured from grams of total carbohydrates):

Food Item	Carbohydrate Grams	Carbohydrate Units
8 ounces whole milk	13 g	1 unit
1 cup sweetened dry cereal	28 g	2 units
1 large banana	27 g	2 units
2 slices toast	32 g	2 units
margarine or butter	0 g	0 units
2 fried eggs	0 g	0 units
Total:	100 g	7 units

Note: 12 to 15 grams of total carbohydrates = 1 carbohydrate unit.

Daily Meal Plans Using Carbohydrate Units or Grams

Here is an example of a meal plan using carbohydrate units or grams of carbohydrate for someone needing about 3,000 calories per day. Meat, vegetable, and fat (they have no or very little carbohydrates) servings would be added to foods for a well-balanced diet.

Meal	Carbohydrate Units	Carbohydrate Grams
Breakfast	5 or 6 carbohydrate units	75 to 90 grams of carbohydrates
AM Snack	2 or 3 carbohydrate units	30 to 45 grams of carbohydrates
Lunch	5 or 6 carbohydrate units	75 to 90 grams of carbohydrates
PM Snack	2 or 3 carbohydrate units	30 to 45 grams of carbohydrates
Dinner	5 or 6 carbohydrate units	75 to 90 grams of carbohydrates
Bedtime Snack	2 or 3 carbohydrate units	30 to 45 grams of carbohydrates

If you are on fixed doses of insulin with 2 or 3 daily shots, eat the same amount of carbohydrates at each meal and snack. Also, eat at about the same times each day. Eat a well-balanced daily diet composed of many types of foods. You do not have to avoid high-carbohydrate foods or eat the same types of food. Basing your diet on carbohydrate units or grams gives you options and helps you control your blood sugar levels (along with medicine and physical activity). You and your dietitian can base your own meal plan on your normal eating habits. If you want more options in your meal plan, talk to your doctor, dietitian, or diabetes educator about insulin changes and making an *insulin-to-carbohydrate ratio*. See Chapter 11, “Carbohydrates in Common Food Items” and review your own meal plan with your dietitian.

Insulin-to-Carbohydrate Ratios (Carbohydrate Counting)

Using an insulin-to-carbohydrate ratio will give you the most options about when and how much you eat. You do not need to follow a meal plan using this method. To use this method, you need to know:

1. how to count the carbohydrates in the foods you eat (see Chapter 11, “Carbohydrates in Common Food Items”).
2. how insulin works (see Chapter 3, “Treating CFRD”).
3. how to “match” or adjust your rapid-acting insulin to the carbohydrates you plan to eat.
4. how to use a “correction dose” of insulin when your blood sugar is outside your target range.

If you use basal or background insulin (such as glargine [Lantus®]) or an insulin pump, this insulin should work well before you can figure your insulin-to-carbohydrate ratio. Most people with CFRD need about 1 unit of rapid-acting insulin (Humalog®, NovoLog®, or Apidra®) for every 15 grams of carbohydrates or 1 carbohydrate unit. Some people need more than this (1 unit of insulin for every 7 or 8 grams of carbohydrates or ½ carbohydrate unit). Some people need less than this (1 unit of insulin for every 30 grams of carbohydrates or 2 carbohydrate units). You and your care team can figure the ratio that’s right for you. You’ll need to keep a strict record for at least 3 days to figure your ratio. Bring your record to clinic.

Your record should contain:

- The time of shot, meal, and blood sugar check
- The type and dose of insulin(s)
- Your blood sugar before the meal or snack and 2 hours after, when you can
- The amount of food eaten (using cups, teaspoons, etc.)
- The carbohydrate content of the food eaten (in grams or units)
- Any physical activity (type and how long)
- Any stress, illness, or other medicines (such as steroids) you are taking that may affect your blood sugar

Your ratio may change from time to time because of illness, stress, weight changes, medicines, and physical activity. Work with your care team if your ratio ever stops working well. Once you’ve figured your ratio, you can use it to cover meals and snacks. For instance, if you were told that you needed about 1 unit of rapid-acting insulin for every 15 grams of carbohydrates (1 carbohydrate unit) and you planned on eating 90 grams of carbohydrates (6 carbohydrate units) for lunch, then you would take 6 units of rapid-acting insulin to cover your lunch ($90 \div 15 = 6$).

Lunch Example		
Food Item	Carbohydrate Grams	Carbohydrate Units
1 turkey and cheese sandwich with mayonnaise	30 grams	2 units
2 ounces potato chips	30 grams	2 units
8 ounces whole milk	15 grams	1 unit
1 medium apple	15 grams	1 unit
Total:	90 grams	6 units

For this lunch, you would take 6 units of rapid-acting insulin to cover 90 grams of carbohydrates or 6 carbohydrate units.

Insulin Correction Doses

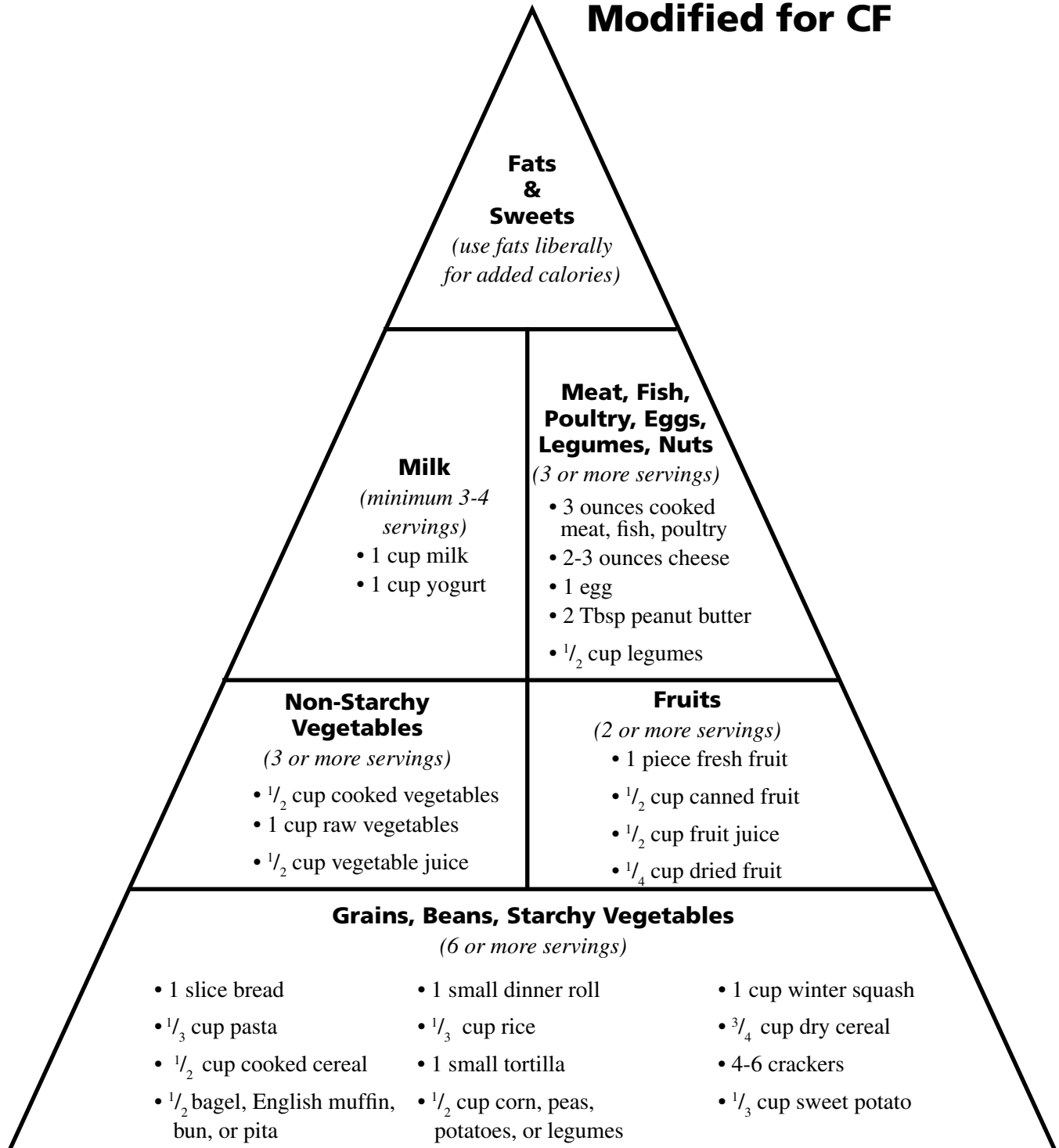
A correction dose is extra insulin given before meals when your pre-meal blood sugar is higher than the range you want for your blood sugar. For instance, if your pre-meal blood sugar was 170 mg/dL or 9.4 mmol/L, your blood sugar range is 80 to 120 mg/dL or 4.4 to 6.7 mmol/L. You need 1 unit of rapid-acting insulin to “drop” or “correct” your blood sugar about 50 mg/dL or 2.75 mmol/L ($170 - 120 = 50$ mg/dL), so you would add 1 unit of insulin to your meal dose. The total for the lunch example above would then be 7 units of insulin: 6 units for the meal and 1 extra unit for correction. Your doctor or diabetes care team can give you a correction scale when needed. Only rapid-acting insulins are used for correction.

Rapid-acting insulins:

- Humalog®
- NovoLog®
- Apidra®

THE FOOD GUIDE PYRAMID

Modified for CF



Use the food guide pyramid to plan a healthy diet. Ask your dietitian for the number of servings that is right for you.

The “CF” Food Guide Pyramid

Fats

The food guide pyramid shows us that a healthy diet consists of eating many types of grains, fruits, vegetables, meats, and dairy products. Most people with type 1 and type 2 diabetes (and most Americans, as well) are advised to eat a low-fat diet to help prevent obesity, *atherosclerosis*, and heart disease. For people without CF, the foods at the top of the pyramid are to be eaten in much smaller amounts than the foods at the bottom of the pyramid. This advice does not apply to you. People with CF need a high-fat, high-calorie diet. **Fats are high in calories. Eat lots of them!** Adding fats and sugars will increase your total calories. If you are trying to gain weight, choose high-fat foods. The enzymes you take when you eat help your body to absorb the nutrients and calories that fats provide. Even with enzymes, you may still end up losing or *malabsorbing* some of the fat you eat. That’s why you need a high-fat diet to help you maintain your weight. Make sure your enzyme doses are correct so you can get the most from the food you eat. Fat does not have a big effect on blood sugar. It can slow absorption from the stomach when you eat a lot of fat at a meal, though, so it has an indirect effect on blood sugar. The more fat in your food, the later your blood sugar may peak. Eat many types of high-fat foods, as well as foods high in *omega-3 fatty acids*, which have many good health benefits.

High-Fat Foods
Margarine ¹ , butter, cream, cream cheese, sour cream
Oil (olive, peanut, canola ² , flaxseed ² , soybean ² , corn, safflower, coconut, sunflower, palm kernel), lard, shortening, mayonnaise ¹ , salad dressing ³
Bacon, salt pork, fatback, chitterlings
Avocados, black and green olives
Peanut butter, peanuts, pecans, walnuts ² , almonds, cashews
Coconut
Sesame seeds ³ , tahini ³ , pumpkin seeds, sunflower seeds ³ , flaxseed ³

¹How high fat these foods are depends on the brand. Check the labels!

²These foods are high in omega-3 fatty acids.

³These foods may contain some carbohydrates.

Protein

Protein does not have a big impact on blood sugar levels. Still you need to eat enough protein for good health. Protein is used by the body to build, repair, and maintain muscles and other body tissues. It helps to regulate the immune system and other body processes. Protein is made up of amino acids (the “building blocks” of protein). There are essential and non-essential amino acids. Essential amino acids can’t be made by the body so they must be obtained by eating certain foods. Animal sources of protein such as meats, poultry, fish, eggs, and dairy products are complete protein sources because they contain all of the essential

Foods high in omega-3 fatty acids:

- Canola, flaxseed, and soybean oil
- Walnuts
- Flaxseeds
- Mackerel
- Herring
- Salmon
- Albacore tuna
- Trout
- Anchovies

amino acids. Plant proteins from legumes, nuts, and meat substitutes are incomplete because they do not contain all of the essential amino acids. Protein has 4 calories per gram. Meats and meat substitutes have varied amounts of fat. Increase calories by **choosing higher-fat meats and cheeses and using high-fat cooking methods** such as frying and deep-frying.

Lower Fat	Higher Fat
USDA Select or Choice Beef (round, sirloin, flank, tenderloin, lean ground beef, roast)	USDA Prime Cuts (ribs, corned beef, prime rib, hot dogs, regular ground beef)
Lean Pork (fresh and boiled ham, Canadian bacon, tenderloin, chops)	Pork (spareribs, ground pork, sausage, chorizo, pickled pigs feet)
Poultry Without Skin (chicken, turkey, Cornish game hen)	Poultry (fried poultry, poultry with skin, ground poultry)
Seafood – baked or grilled (fresh and frozen fish, crab, shrimp, lobster, clams, tuna, shrimp, lobster, tuna in water, sardines, oysters, herring, salmon)	Seafood (fried fish, crab cakes, tuna in oil, shrimp or lobster salad)
Wild Game (venison, buffalo, rabbit, ostrich, duck, pheasant, goose [no skin])	Wild Game (with skin on)
Low-Fat Cheeses (cottage cheese, fat-free or low-fat cheese products, grated Parmesan, part-skim cheeses such as ricotta and mozzarella)	High-Fat/Regular Full-Fat Cheeses (cheddar, Swiss, Colby, Monterey Jack, American)
Tofu, Tempeh, Soy Products, Egg Substitutes, Low-Fat Deli Meats	High-Fat Deli Meats (bologna, pastrami, salami), Eggs, Peanut Butter

Milk/Dairy

Milk and other dairy products are important sources of protein, carbohydrates, and fat. They also provide calcium and other vitamins and minerals. Eat or drink at least 3 to 4 servings per day. A serving size of milk is 8 ounces, or 1 cup. With the exception of cheese, most dairy products contain carbohydrates and need to be counted.

Fruits

Fruits, fruit juices, canned fruit, and dried fruit provide carbohydrates, vitamins, minerals, and fiber. They are part of a balanced diet. Fruit juice, in particular, contains a concentrated amount of carbohydrates. Fresh fruit contains fiber. See the food lists in Chapter 11, “Carbohydrates in Common Food Items.”

Vegetables

Vegetables are an important part of a balanced diet. Eat at least 3 servings per day. A serving size is often ½ cup cooked vegetables or vegetable juice or 1 cup raw, leafy vegetables. Non-starchy vegetables have about 5 grams of carbohydrates per serving. Because vegetables are low in calories, try stir-frying them with oil or adding cheese sauce, butter, margarine, or dips for extra calories. Starchy vegetables including corn, peas, winter squash, and potatoes are found in the starch group in the food pyramid with grains and beans because they have more carbohydrates. See the food lists in Chapter 11, “Carbohydrates in Common Food Items.”

Grains, Grain Products, and Beans

Breads, cereal, rice, and beans tend to make up a large part of the overall diet. They provide an important source of fuel in the form of carbohydrates as well as fiber, vitamins, and minerals. You should eat at least six servings of grains every day. Try to eat some whole grains every day.

Salt and Other Vitamins and Minerals

Whether they have CFRD or not, people with CF lose lots of salt each day in their sweat. This salt lost needs to be replaced by using extra table salt and eating salty foods. Salt can be added while cooking or at the table. Convenience foods (snack items, canned and packaged foods, and processed meats and cheeses), condiments (ketchup, mustard, soy sauce, pickles, olives), and restaurant and fast foods are often high in salt, or sodium. You need at least 4,000 milligrams of sodium daily. One teaspoon of salt contains about 2,300 milligrams of sodium. Check food labels for the sodium content to help you choose high-sodium foods. Eating many types of foods from all of the food groups each day plus taking your multi-vitamin pills will help you get all the vitamins and minerals you need. Your dietitian can tell you which multi-vitamin is right for you.

Water

Water is important for good health. We often forget it. Drink at least 64 ounces (8 cups) of some type of fluid each day to replace water lost with rapid breathing and sweating.

Free Foods

“Free foods” are foods that have less than 20 calories or less than 5 grams of carbohydrates per serving. Don’t eat a lot of them. You need lots of calories each day to maintain a healthy body weight. Be careful to watch the portion size or just count it as a carbohydrate unit if the serving size you plan to eat adds up to a carbohydrate unit (such as 3 or 4 servings eaten at once).

Free Food Examples	
Beverages/Liquids	Bouillon, broth, gelatin, coffee, tea, lemon and lime juice, club soda, diet soft drinks, sugar-free tonic, water
Sugar Substitutes	Aspartame, acesulfame-K, saccharin, sucralose, neotame
Condiments	BBQ sauce, catsup, horseradish, mustard, relish, salsa, soy sauce, hot pepper sauce, taco sauce, teriyaki sauce, pickles, vinegar
Herbs and Spices	All

High-Calorie Supplements

At times, you may not feel like eating or may not be hungry. You may struggle to gain or maintain weight. High-calorie supplements are a great source of extra calories during these times. They can help you gain and maintain weight and improve nutrition status. You can make them part of your daily meal plan using the chart on the next page. The calories of each supplement will vary. Your doctor or dietitian can help you choose the right one for you.

Supplement	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Boost™	8 ounces (1 can)	2 ½	41
Boost Plus™	8 ounces (1 can)	3	45
Boost Pudding™	1 serving (5 ounces)	2	32
Carnation Instant Breakfast™	1 serving (1 packet mixed with 8 ounces whole milk or half and half)	2 ½	39
Carnation Instant Breakfast Plus™	8.45 ounces (1 can)	3	44
Carnation Instant Breakfast VHC™	8.45 ounces (1 can)	3	49
Duocal™	2 tablespoons	1	12
Ensure™	8 ounces (1 can)	2	40
Ensure Plus™	8 ounces (1 can)	3	50
Polycose powder	3 tablespoons	1	17
Power milk	1 cup whole milk with 1 tablespoon heavy cream and 1 tablespoon chocolate or strawberry syrup	2	30
Resource Breeze™	8 ounces	3 ½	31
Scandishake™	1 package mixed with 8 ounces whole milk	5	70
Scandical™	2 tablespoons	½	8
Sportshake™ Chocolate	8 ounces	3	44
Sportshake™ Vanilla	8 ounces	2 ½	39

Insulin Coverage of High-Calorie Supplements

People with CFRD need to cover the food they eat and their high-calorie supplements with insulin. Some people get many cans of supplement while sleeping by *gastrostomy* or *nasogastric* tube. Often, a single shot of combined regular plus NPH insulin given before the drip starts will cover the whole feeding. Check blood sugars 2 or 3 hours after the tube feeding starts, and when it ends. This will help to fine-tune the insulin dose.

Special Cases

Late Meals

The timing of meals and snacks matters when taking insulin! Review the time-action of your insulin dose with your diabetes care team so you know when to eat meals and snacks when the insulin is the strongest. This will help you avoid low blood sugar. If your meal is late but you have taken your insulin, eat or drink something with 15 to 30 grams of carbohydrates (or 1 to 2 carbohydrate units) while you are waiting. Try not to delay meals for more than 1 hour. If your meal is late, check your blood sugar more often to avoid low blood sugar.

Alcohol

Ask your doctor if you can drink alcohol. If you can, never drink it on an empty stomach when taking insulin or other diabetes medicine because alcohol increases the risk of low blood sugar. If you plan on drinking alcohol, know the effect it has on blood sugar. If you are not careful, alcohol can cause blood sugar to go either too high (from the sugar in mixed drinks) or very low. When you are not drinking alcohol, your liver will release glucose (sugar) into your blood to prevent low blood sugar. When you are drinking alcohol, your liver is busy breaking down the alcohol so will release less glucose into the blood. This puts you at risk for *hypoglycemia* (low blood sugar). See Chapter 6, “Low Blood Sugar (Hypoglycemia).” You are at a higher risk if you drink on an empty stomach. Signs of being drunk are a lot like signs of low blood sugar. If alcohol has clouded your thinking, you may not treat your low blood sugar the right way. Those around you may not know that you have low blood sugar. This puts you in grave danger!

If you drink alcohol:

- Ask your doctor if any amount of alcohol is safe for you.
- Always wear a diabetes ID bracelet or necklace.
- Only drink when blood sugars are well-controlled.
- Eat foods that contain carbohydrates when drinking alcohol.
- Never drink alone.
- Some think that one drink for women and two for men may be safe. One drink is 12 ounces of beer, 4 to 5 ounces of wine, or 1.5 ounces of distilled spirits, cordials or liqueurs.
- Check your blood sugar after drinking to learn your response to alcohol. You may also need to check your blood sugar during the night especially if you drank too much or you have been physically active while drinking alcohol.
- Ask you doctor how your CF medicines interact with alcohol.

Sugar Substitutes

Daily sugar substitutes are thought to be safe. There are five approved for use in the United States by the Food and Drug Administration. They are *aspartame*, *acesulfame-K*, *saccharin*, *neotame*, and *sucralose*. The *acceptable daily intake (ADI)* for aspartame is 50 milligrams per kilogram of body weight (1 kg = 2.2 lbs). This amount includes a 100-fold safety factor. The average daily intake of these sweeteners for people with diabetes is about 2 to 4 milligrams per kilogram of body weight. What is often used per day, then, is well within safe levels. For instance, a can of diet soda contains about 170 milligrams of aspartame. An average adult weighing about 150 lbs would need to drink 20 12-ounce cans of soda or eat 97 packets of tabletop sweetener to reach the ADI. Sugar alcohols are another type of low-calorie sugar substitute. *Sorbitol*, *mannitol*, and *xylitol* are examples of these. Too much can cause diarrhea. Use them with caution.

Read food labels for the carbohydrate content of foods that contain sugar substitutes. Those foods may contain other sources of carbohydrates (as sugar-free yogurt contains milk). Include all carbohydrates in your total count. Many food items with sugar substitutes are low in calories. If you have CF, you need extra calories. You may be better off eating the regular, rather than low-calorie, version of food, except when it comes to regular soda. Drinking too much of this may cause high blood sugar because of its high carbohydrate content. A 12-ounce can of regular soda has about 40 to 45 grams of total carbohydrates, or 3 carbohydrate units. Plus, regular soda has no vitamins or minerals for good health. Eat a balanced CF diet and use good sense when choosing high-calorie foods.

Nutrition and CFRD When Pregnant

LEARNING GOALS

At the end of this chapter, you should be able to:

- explain how gestational diabetes is treated.
- describe the nutrition guidelines for CF and pregnancy.
- detail how to manage special diet concerns while pregnant.

For your health and your baby's health, it is important to eat a healthy diet and control your blood sugars before and while you're pregnant. Eat many types of nutritious foods. Apply the guidelines from The "CF" Food Guide Pyramid to your high-calorie diet for CF. The pyramid gives advice on the number of servings from each food group for a healthy, balanced diet. The higher number of servings is for people who are very active, growing, underweight, pregnant, or breast-feeding. Because of your CF, you need more calories than what is advised for people without CF. If you have CF and are pregnant, you need even more! You will have to eat three meals and many snacks each day to meet your and your baby's nutritional needs. Because your need for protein, calcium, iron, and folic acid are increased, you need to take extra vitamins. Check your blood sugar many times each day. Take the right amount of insulin to cover your carbohydrates. Control your blood sugars (see Chapter 9, "Nutrition and CFRD"). Know what your blood sugar goals are.

Gestational Diabetes

Gestational diabetes is diabetes that occurs while you're pregnant and goes away when the baby is born. While pregnant, the body naturally makes more insulin. Gestational diabetes occurs when the pancreas can't keep up with the extra demand for insulin. If you have gestational diabetes, learn how to count carbohydrates so you can manage your blood sugars until the baby is born. Eating three meals and at least three or four snacks each day will help. Spreading out foods with carbohydrates throughout the day will help. Avoid drinking too many sweet drinks including regular soda, juice, punch, lemonade, and others. Replace these drinks with healthy foods using the CF Food Guide Pyramid. Your dietitian can help create a plan with the same amounts of carbohydrates throughout the day. Try to gain the weight you have been advised to gain. Don't lose weight by not eating certain foods as a way to control blood sugar. Women who have gestational diabetes but do not have CF can watch what they eat, limit weight gain, and control blood sugar. For women with gestational diabetes and CF, this way to control blood sugar is not safe for you or your baby. You will likely need insulin at some point to help you gain weight and control blood sugar.

Blood sugar goals are:

- Less than 95 mg/dL or 5.3 mmol/L while fasting
- Less than 140 mg/dL or 7.8 mmol/L, 1 hour after meals
- Less than 120 mg/dL or 6.7 mmol/L, 2 hours after meals

Blood Sugar Goals While Pregnant

To have a healthy baby, you must keep your blood sugar levels as close to normal as you can while pregnant.

Weight Gain While Pregnant

The amount of weight to gain while pregnant depends on your weight before getting pregnant. Ask your doctor about your special needs. Work with your dietitian while pregnant to gain the right amount of weight. This is crucial for your health and your baby's health.

Basic Guidelines for Gaining Weight When Pregnant	
Body Mass Index (BMI) Before Getting Pregnant*	Advised Weight Gain in Pounds (lbs) or Kilograms (kg)
BMI less than 21.9	28 to 40 lbs or 12.5 to 18.0 kg
BMI 22 to 24.9	25 to 35 lbs or 11.5 to 16.0 kg
BMI 25 to 29.9	15 to 25 lbs or 7.0 to 11.5 kg
Pregnant With Twins	35 to 45 lbs or 16.0 to 20.5 kg

* Before getting pregnant, most women with CF are underweight or have normal weight.

Nutrition When Pregnant

Calories and Protein

If your weight was normal before you got pregnant, you need to add at least 300 calories and 2 to 3 ounces of protein each day to your diet to meet your increased calorie and protein needs while pregnant. If you were underweight, you will need to add even more calories. There are calories in all foods, so eating larger portions and adding extra fat will help add extra calories. These are great sources of protein: beef, pork, poultry, fish, seafood, eggs, dairy products, dried peas and beans, tofu, nuts, and peanut butter. If you are having a hard time gaining weight, add high-calorie supplements to your diet. Be sure to adjust your digestive enzymes so your body can use the extra calories you are taking in.

Calcium

All pregnant women need at least 1000 milligrams of calcium daily. They can get this by eating four servings of dairy products per day. Women with CF need more than this because not all of the calcium they eat is absorbed from their intestines. You can get about 300 to 400 milligrams of calcium in 8 ounces of milk or yogurt. You can get about 200 to 300 milligrams in 1½ to 2 ounces of cheese. Other good sources of calcium include calcium-fortified soy milk, rice milk, or juice; calcium-fortified grain products; green leafy vegetables; and canned salmon or sardines with bones. You may need a calcium supplement if you can't get enough calcium in food.

Every day while pregnant eat:

- 300 extra calories
- 2 to 3 ounces more of protein
- 1,000 mg of calcium
- 30 mg of iron
- 400 micrograms (0.4 mg) of folic acid
- Drink 8 to 12 cups of fluids

Iron

While pregnant, your need for iron increases to 30 milligrams per day. Great sources of iron are found in red meats, liver, eggs, dried peas and beans, and enriched or whole grain breads and cereals. Eating a food high in vitamin C along with the high-iron food will help you better absorb the iron. Good sources of vitamin C are citrus fruits and juices, strawberries, green peppers, broccoli, green leafy vegetables, and tomatoes. You may also need an iron supplement.

Folic Acid

It is very important to get enough folic acid in your diet before you get pregnant and during the first trimester while pregnant for proper brain and spine development in your baby. You need 400 micrograms (0.4 mg) of folic acid per day. Great sources can be found in folic acid–fortified cereals, breads, and grain products; green leafy vegetables; dried peas and beans; and citrus fruits and juices. Take a folic acid supplement, too.

Vitamins A, D, & E

It is very important to get the right amounts of vitamins A, D, and E while pregnant. You may need more than normal, but too much can be as harmful as too little. People with CF don't absorb these vitamins well. Your care team will check your blood levels to make sure you are getting the right amount.

Special Concerns

Caffeine and Sugar Substitutes

Caffeine and sodas sweetened with aspartame (*NutraSweet*®) appear to be safe while pregnant. Because they don't have nutritional value, use these in moderation. Limit your intake of drinks with caffeine and sugar substitutes to 2 cups per day or less.

Alcohol

If you are planning to get pregnant or are pregnant now, do not drink alcohol. No amount is safe for your baby.

Fluid

Be sure to drink plenty of fluids while pregnant. Drink at least 8 to 12 cups per day.

Seafood Concerns

Fish is a great source of protein and other nutrients. Some seafood is safer to eat while pregnant than others. There are concerns that some fish from polluted waters may contain harmful bacteria and chemicals. Avoid eating shark, king mackerel, swordfish, tilefish, and tuna while pregnant. Check your local health department or department of fisheries about the safety of fish caught in your local lakes and streams. Buy only very fresh fish and either use it within 24 hours or freeze it right away. Avoid eating raw fish, such as sushi, when pregnant. A few people have eaten raw fish that contained parasites and others got hepatitis A from raw fish. It is safe to eat 12 ounces of shellfish, canned fish, smaller ocean fish, or farm-raised fish per week.

Taste and Smell Changes While Pregnant

Many pregnant women notice changes in the way some foods taste and smell. Some foods may taste worse and some smells may make you queasy. This is normal and likely related to hormone changes. Avoid foods that bother you. If food odors upset your stomach, see if someone else can cook. Food cravings can also occur. Some are good, such as craving milk or fruit. Some are harmful, such as craving dirt, clay, or laundry starch. These cravings are known as *pica* and may be a symptom of anemia. If you crave non-food items like these, tell your doctor right away. If you can't eat enough because of taste and smell changes, see your dietitian.

Feeling Sick and Throwing Up While Pregnant

Many women feel sick and throw up while pregnant because of hormone changes. These problems often (but not always) go away after the first 12 weeks. Some women really struggle and need to be watched closely by their health care team. Try to "eat through" feeling sick and throwing up so you don't lose weight. Eat smaller meals and snacks more often. Try eating only dry food for a morning snack such as crackers or toast, avoiding drinking during meals, eating cold foods to avoid food smells, and eating ice chips if fluids are hard to keep down. Get help from your dietitian if you can't eat enough because you feel sick and are throwing up.

Constipation

Constipation while pregnant is common. Take your enzymes regularly with meals and snacks. If you are having problems with your bowel movements, talk with your doctor or dietitian. Eat foods high in fiber and drink lots of fluids. Fiber is found in whole grains, bran cereals, fresh fruits, vegetables, dried peas, beans, and nuts. Regular exercise helps, too.

Carbohydrates in Common Food Items

LEARNING GOAL

At the end of this chapter, you should be able to:

- quickly find the carbohydrate content of common food items.

Carbohydrate Counting

Carbohydrates are the main food nutrient that affects blood sugar. To control blood sugar, it is important to learn how to measure or count the carbohydrates in the foods you eat. This chapter contains lists of the carbohydrate units and grams in common foods. It also contains common household measurements and portion sizes. All foods are listed in cooked, ready-to-eat portions. Review this chapter with your dietitian as you plan your own meals, based on your eating habits, and decide how to spread out your day's carbohydrates. At the end of this chapter, there is a sample menu and meal plan that you can use. Work with your dietitian to create your meal plan. If you don't have a dietitian, ask your doctor to refer you to one that understands both diabetes and CF.

Common Household Measurements

3 teaspoons (tsp) = 1 tablespoon (Tbsp)

4 Tbsp = $\frac{1}{4}$ cup = 2 fluid ounces

8 Tbsp = $\frac{1}{2}$ cup = 4 fluid ounces

16 Tbsp = 1 cup = 8 fluid ounces

1 cup = $\frac{1}{2}$ pint

2 cups = 1 pint

1 ounce = 30 grams (dry weight)

Estimating Portion Sizes

These handy tips will help you estimate portion size:

3 ounces cooked meat/protein = a deck of cards, or the size of a woman's palm

1 ounce cheese = 4 stacked dice

$\frac{1}{2}$ cup casserole, grain, or vegetable covers about $\frac{1}{4}$ of a standard size dinner plate

$\frac{1}{2}$ cup fruit = the size of a tennis ball

Carbohydrate Conversion Guide	
Total Carbohydrate Grams	Carbohydrate Units
0 – 5 grams	0 units
6 – 10 grams	½ unit
11 – 20 grams	1 unit
21 – 25 grams	1 ½ units
26 – 35 grams	2 units
36 – 40 grams	2 ½ units
41 – 50 grams	3 units
51 – 55 grams	3 ½ units
56 – 65 grams	4 units
66 – 70 grams	4 ½ units
71 – 80 grams	5 units
81 – 85 grams	5 ½ units
86 – 95 grams	6 units
96 – 100 grams	6 ½ units
101 – 110 gram	7 units
111 – 115 grams	7 ½ units
116 – 125 grams	8 units
126 – 130 grams	8 ½ units
131 – 140 grams	9 units
141 – 145 grams	9 ½ units
146 – 154 grams	10 units

Breads

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Bread	1 slice (1 ounce)	1	15
Breadsticks (Soft)	1, 6-inch (1 ounce)	1	17
Challah	¾ ounce	1	17
Cornbread*	2 ounces	2	25
Croutons*	12 large	½	8
Dinner Roll	1 roll (1 ounce)	1	13
Focaccia Bread	1 wedge (2 ounce)	2	28
French Bread	1 slice (1.3 ounce)	1 ½	22
Hot Dog/Hamburger Bun	1 bun (1.5 ounce)	1 ½	22
Lefse	1 plain (1 ounce)	1	15
Matzo	1 ounce	1 ½	24
Pita	1 (2 ounces)	2	33
Taco Shell	2 hard shells	1	14
Tortilla (Corn or Flour)	1, 6-inch (1 oz)	1	13
Tortilla (Flour)	1, 10-inch (2.5 oz)	2	34

*To get the extra calories you need, eat more of these higher fat foods.

Pasta, Grains, and Other Side Dishes

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Barley	½ cup	1 ½	22
Chow Mein Noodles*	½ cup	1	13
Couscous	½ cup	1	18
Kasha/Buckwheat	½ cup	1	17
Pasta	½ cup	1 ½	22
Pasta Side Dish (Packaged)	½ cup	1 ½	22
Rice (White, Brown)	½ cup	1 ½	22
Rice (Wild)	½ cup	1	18
Rice-a-Roni™*	½ cup	1 ½	22
Rice Pilaf	½ cup	1 ½	22
Stuffing*	½ cup	1 ½	22

*To get the extra calories you need, eat more of these higher fat foods.

Breakfast Items

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Bagel (Small)	1 (2 ounce)	2	29
Bagel (Medium)	1 (3 ounce)	3	45
Bagel (Large)	1 (4 ounce)	4	56
Biscuit*	1 (1 ounce)	1	14
Cereal – Bran Flakes	1 cup	2 to 3	32 to 45
Cereal – Cooked (Oatmeal)	1 cup	2	27
Cereal (Dry, Sweetened)	1 cup	1 ½ to 2 ½	25 to 38
Cereal (Dry, Unsweetened)	1 cup	1 ½ to 2	22 to 29
Cinnamon Roll*	1 small	1 ½	23
Croissant*	1 (2 ounce)	2	26
Danish*	1 small (2 ounce)	2	29
Doughnut* (Cake)	1 medium	1 ½	25
Doughnut* (Frosted or Glazed)	1 medium	2	32
French Toast* (No Syrup)	1 slice	1	15
English Muffin	1 muffin	2	26
Grits	1 cup	2	30
Hash Browns*	1 cup	2	26
Muffin*	1 large (3 ounce)	2 ½	36
Muffin* (Giant)	1 giant (6 ounce)	5	72
Pancake* (No Syrup)	1 6-inch pancake	1 ½	22
Scone*	1 large (4 ounces)	4	60
Waffle* (no syrup)	1 small	1	15

*To get the extra calories you need, eat more of these higher fat foods.

Starchy Vegetables and Legumes (Beans)

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Beans - Baked	½ cup	2	27
Beans, Peas, Lentils (Cooked)	½ cup	1	20
Corn	½ cup	1	15
Corn on the Cob	1 medium	1	14
French Fries*	Small order (16 to 25 fries)	1 to 2	30
Peas	½ cup	1	11
Potato (Baked)	1 small (3 ounces)	1	17
Potato (Mashed)	½ cup	1	18
Potato (Sweet)	½ cup	2	30
Potato Pancake*	1 medium	1	11
Potato Salad*	½ cup	1	14
Potatoes Au Gratin (Packaged*)	½ cup	1	18
Squash (Winter)	½ cup	½	9
Tater Tots*	½ cup	1	15

*To get the extra calories you need, eat more of these higher fat foods.

Crackers, Chips, and Popcorn

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Club™ Crackers	7 crackers	1	15
Graham Crackers	2 full crackers	1 ½	21
Popcorn* (Microwave)	1 bag	3	48
Potato Chips*	12 to 18 chips (1 ounce)	1	15
Pretzels	1 ounce	1 ½	22
Rice Cakes	2 large cakes	1	15
Ritz™ Crackers*	8 crackers	1	16
Saltine Crackers	7 crackers	1	15
Tortilla Chips*	1 ounce	1	17
Triscuit™ Crackers	5 crackers	1	16
Wheat Thins™*	12 crackers	1	16

*To get the extra calories you need, eat more of these higher fat foods.

Condiments and Spreads

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Honey, Sugar, Jelly, Jam	1 tablespoon	1	15
Peanut Butter*	2 tablespoons	0	5
Syrup (Pancake)	2 tablespoons	2	26
Syrup (Pancake, Light)	2 tablespoons	1	12
Syrup (Pancake, Sugar-Free)	2 tablespoons	0 to ½	4 to 8

*To get the extra calories you need, eat more of these higher fat foods.

Drinks

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Cappuccino (Espresso, Foamed Milk)	16 ounces	1	12
Cocoa (Hot)	1 cup (8 ounces)	2	27
Iced Tea, Sweetened	16 ounces	3	50
Latte (Espresso, Steamed Milk)	16 ounces	1	18
Lemonade, Punch, Kool-Aid™	1 cup (8 ounces)	2	26
Mocha (Espresso, Chocolate, Milk)	16 ounces	3	41
Soda (Regular)	1 can (12 ounces)	2 ½ to 3	38 to 46
Sports Drink	20-ounce bottle	2	32

Milk, Milk Substitutes, and Yogurt

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Chocolate Milk	1 cup (8 ounces)	2	26
Milk (2% or Whole)*	1 cup (8 ounces)	1	11
Rice Dream™, Vanilla	1 cup (8 ounces)	2	27
Soy Milk, Silk™, Vanilla	1 cup (8 ounces)	½	10
Yogurt (Fruit)	1 cup (6 to 8 ounces)	2 to 3	27 to 45
Yogurt (Light)	1 cup (6 to 8 ounces)	1	11 to 16
Yogurt (Plain)	1 cup (8 ounces)	1	16

*To get the extra calories you need, eat more of these higher fat foods.

Fresh, Frozen, and Canned Fruit

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Banana (Large)	1	2	30
Canned Fruits (in Natural Juice)	½ cup	1	15
Dried Fruit	¼ cup	1 to 1 ½	16 to 23
Fresh Berries, Melon, Papaya	1 cup (pieces)	1 to 1 ½	11 to 21
Fresh Fruit (Raw)	1 medium piece	1	11 to 18
Fruit Sauces, Unsweetened	½ cup	1	15
Grapefruit	½	1	13
Grapes	15	1	17
Other Fresh Fruit (Cut)	½ cup	1	11 to 18
Raisins	¼ cup	2	29

Fruit Juices

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Apple, Grapefruit, Orange, Pineapple	4 ounces	1	15
Cranberry, Grape, Prune	3 ounces	1	15
Bottled Juice	16 ounces	4	60

Combination Foods

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Mexican			
Burrito*	1 burrito	3 to 4	39 to 65
Fajita	2 fajitas (small)	2 ½	40
Quesadilla*	1 entrée size	2 ½	40
Refried Beans*	½ cup	1	17
Taco,* Regular, Soft	1 small taco	1	12 to 18

*To get the extra calories you need, eat more of these higher fat foods.

Combination Foods (Cont.)

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Italian			
Calzones	1 regular	6 ½	100
Fettuccini Alfredo*	1 cup	3	47
Lasagna*	1 cup	2	31
Manicotti*	2 pieces	2 ½	36
Pizza (Thick, Restaurant)*	1 medium slice	2	27 to 29
Pizza (Thin, Restaurant)*	1 medium slice	1 ½	21 to 23
Ravioli*	1 cup	2	30
Spaghetti Sauce From Jar	½ cup	1 to 1 ½	11 to 22
Spaghetti With Meat Sauce*	1 cup	3	45
Tortellini*	1 cup	2 ½	37
Asian/Indian			
Chow Mein (No Rice)	12 ounces	1 ½	25
Egg Rolls*	1 large	1	15
Lo Mein*	8 ounces	2 ½	37
Mock Duck/Wheat Gluten	3 ounces	0	3
Naan	1 ounce	1	11
Rice - Basmati, Jasmine	1 cup	3	44
Rice - Fried*	1 cup	3	42
Stir Fry (Meat & Veg. Only)	8 ounces	½ to 1	9 to 15
Sweet & Sour Pork* (No Rice)	8 ounces	3	46
Wonton (Plain)	4 pieces	1	16
Middle Eastern			
Falafel Sandwich	11.6 ounces	5 ½	85
Gyros Sandwich	12 ounces	3 ½	55
Hummus*	4 tablespoons	½	8
Tabouli	½ cup	1	15

*To get the extra calories you need, eat more of these higher fat foods.

Combination Foods (Cont.)

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
American			
Casserole (With Meat & Noodles)*	1 cup	2	30
Cold Cut Sub Sandwich*	6-inch	3	45
Corn Dog*	1 regular	1 ½	23
Grilled Cheese Sandwich*	1 sandwich	2	30
Hamburger or Hot Dog on Bun*	1 sandwich	1 ½ to 2	22 to 30
Macaroni & Cheese*	1 cup	3	45
Pot Pie*	1 10-ounce pie	3 ½	55
SpaghettiOs® With Meatballs*	1 cup	2	32
Veggie Burger on Bun	1 sandwich	2 to 3 ½	26 to 39
Southern/Creole			
Hominy	1 cup	2	33
Hush Puppies*	5 pieces	2 ½	35
Red Beans & Rice	1 cup	4	56
Shrimp Gumbo	1 cup	1	19
Succotash	½ cup	1	17
Soup			
Bean*	1 cup	2	34
Chicken Noodle	1 cup	1	12
Chili (With Beans)*	1 cup	1 ½	25
Cream of Broccoli*	1 cup	1 ½	20
Minestrone	1 cup	1 ½	20
Miso (Paste)	3 tablespoons	1	15
New England Clam Chowder*	1 cup	1	17
Tomato With Milk	1 cup	1 ½	22
Vegetable Beef	1 cup	½	10

*To get the extra calories you need, eat more of these higher fat foods.

Fast Foods

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Arby's™			
Arby's Melt*	1 sandwich	2 ½	36
Beef N' Cheddar*	1 sandwich	3	44
Chicken Cordon Bleu (Crispy)*	1 sandwich	3	49
Chicken Fillet (Crispy)*	1 sandwich	3	50
Curly Fries*	1 order (small)	2 ½	39
French Fries (Homestyle)*	1 order (small)	3	44
Regular Roast Beef*	1 sandwich	2	34
Burger King™			
Apple Pie*	1 pie	3	45
BK Big Fish*	1 sandwich	4 ½	67
French Fries*	1 order (medium)	3	41
Onion Rings*	1 order (medium)	2 ½	37
Original Chicken Sandwich*	1 sandwich	3 ½	52
Whopper Jr.*	1 sandwich	2	31
Whopper/Whopper With Cheese*	1 sandwich	3 ½	51
Dairy Queen™			
Banana Split*	1 split	6 ½	98
Chocolate Dipped Cone*	1 medium cone	4	60
Chocolate Malt*	1 medium malt	10 ½	157
Chocolate Sundae*	1 medium sundae	5	70
Dilly Bar*	1 bar	1 ½	24
Hot Dog*	1 hot dog	1 ½	21
Moo Latte (Cappuccino)*	16 ounces	5	73
Oreo Blizzard*	1 medium blizzard	7	103
Peanut Buster Parfait*	1 sundae	6 ½	96
Single Hamburger*	1 sandwich	2	33
Vanilla Cone*	1 medium cone	3 ½	53

*To get the extra calories you need, eat more of these higher fat foods.

Fast Foods (Cont.)

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Kentucky Fried Chicken™			
BBQ Baked Beans	1 order	3	45
Biscuit*	1	1 ½	24
Coleslaw*	1 order	1 ½	22
Mashed Potatoes	1 order	1 ½	20
Original Recipe Breast*	1 piece	½	7
Original Recipe Drumstick*	2 pieces	0	2
Original Recipe Wing*	2 pieces	½	8
Potato Wedges*	1 order	2	33
McDonald's™			
Apple Pie*	1 pie	2 ½	36
Big Mac*	1 burger	3	45
Biscuit With Sausage*	1 regular	2	29
Cheeseburger*	1 burger	2	33
Chicken McNuggets*	6 pieces	1	15
Chocolate Chip Cookies*	1 box	2 ½	39
Cinnamon Roll*	1 regular	4	60
Egg McMuffin*	1 regular	2	30
Filet-O-Fish*	1 sandwich	2 ½	38
French Fries*	1 medium	3	47
Hamburger*	1 burger	2	31
Hash Browns*	1 order	1	15
Hotcakes With Syrup*	1 order	7	105
Hot Fudge Sundae*	1 sundae	3 ½	54
McChicken (Crispy)*	1 sandwich	2 ½	40
McDonaldland Cookies*	1 box	3	42
Oreo McFlurry*	12 ounces	6	88
Quarter Pounder*	1 burger	2 ½	37

*To get the extra calories you need, eat more of these higher fat foods.

Fast Foods (Cont.)

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Pizza Hut™			
Pan Pizza*	2 medium slices	4	56
Stuffed Crust*	2 large slices	5	78
Thin ‘N Crispy*	2 medium slices	3	44
Subway™			
Cookie (Any Kind)*	1 cookie	2	30
Ham, Turkey, Roast Beef	6-inch	3	46
Meatball Marinara*	6-inch	4	63
Sweet Onion Chicken Teriyaki	6-inch	4	65
Taco Bell™			
Burrito Supreme*	1 order	3 ½	51
Chalupa Supreme*	1 order	2	29
Crunchy Taco*	1 order	1	13
Fiesta Taco Salad*	1 order	5 ½	82
Gordita Supreme*	1 order	2	29
Mexican Pizza*	1 order	3	47
Nachos*	1 order	2	32
Nachos Bell Grande*	1 order	5	79
Soft Chicken Taco*	1 order	1 ½	21
Taco Supreme*	1 order	1	15
Wendy’s™			
Baked Potato (Bacon & Cheese)*	1 potato	5	75
Chili	1 order (small)	1 ½	24
Classic Single*	1 burger	2 ½	37
Frosty*	1 medium	4 ½	68
Ultimate Chicken Sandwich*	1 sandwich	2 ½	36

*To get the extra calories you need, eat more of these higher fat foods.

Desserts and Sweets

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Frozen Treats			
Frozen Yogurt	½ cup	1 ½ to 2	22 to 30
Fudge Bar	1 bar	1 to 2	17 to 30
Ice Cream*	½ cup	1 to 2	15 to 30
Ice Cream Bar*	1 bar	1 to 3	15 to 45
Popsicle	1 popsicle	1	15
Sherbet	½ cup	1 ½ to 2	22 to 30
Pudding/Gelatin			
Gelatin	½ cup	1	19
Instant Regular Pudding*	½ cup	2	30
Candy			
Chocolate Bar*	1 2-ounce bar	2	30
Fruit Roll-Up	1 roll	1	12
Gummy Bears	small bag	2	29
Jelly Beans	small bag	1 ½	24
Junior Mints™*	regular box-16 mints	2	35
M & M's™*	regular package	2	34
Peanut M & M's™*	regular package	2	33
Skittles™	small package-40 pieces	3 ½	54
Snickers™*	1 bar	2	35
Sucker (Lollipop)	2	1	11
Twix™*	regular package-2 bars	2 ½	37
Twizzlers™	3 pieces	2	30
Baked Goods			
Angel Food Cake	2 ounces	2	32
Apple Crisp*	4 ounces	3	43
Banana Bread*	2 ounces	2	33
Brownie*	2 ounces	2 ½	36
Cake & Frosting*	3 ounces	2 ½ to 4	35 to 48
Cheesecake (Fruit Topping)*	3 ounces	3	41 to 48
Cheesecake (Plain)*	3 ounces	2	26

Desserts and Sweets

Food Item	Serving Size	Carbohydrate Units per Serving	Carbohydrate Grams per Serving
Cream Pie*	1 slice	2 to 3 ½	30 to 53
Fruit Pie*	1 slice	3 to 3 ½	43 to 55
Lemon Bar*	1 small bar	1 ½	24
Cookies			
Animal Crackers	13 pieces	2	30
Chocolate Chips Ahoy™*	3 cookies	1 ½	21
Fig Newtons™	3 cookies	2	33
Fortune			
	2 cookies	1	12
Ginger Snaps	4 snaps	1 ½	23
Granola Bar (Fruit Filled)	1 bar	2 to 3	22 to 41
Granola Bar (Plain)	1 bar	1 to 1 ½	15 to 20
Homemade Cookie*	1 cookie, 1 ounce	1 to 1 ½	14 to 22
Kellogg's™ Rice Krispie Bar*	1 bar	1	15
Mrs Fields™ Cookie*	1 large	1 ½ to 4	24 to 56
Oreo™ Cookies*	3 cookies	1 ½	24
Pepperidge Farm™ Cookie*	1 cookie	1 to 1 ½	15 to 22
Shortbread Cookies*	3 cookies	1	14
Vanilla Wafers	5 cookies	1	13

*To get the extra calories you need, eat more of these higher fat foods.

Sample Meal Plan		
Time	Carbohydrate Grams*	Carbohydrate Units*
Breakfast		
AM Snack		
Lunch		
PM Snack		
Dinner		
Evening Snack		
Advised Amount of Added Fat per Day:		
Advised Amount of Meat, Poultry, Fish, Cheese, or Eggs per Day:		
Advised Amount of Vegetables per Day:		

*12 to 15 carbohydrate grams = 1 carbohydrate unit

Sample Menu			
Time	Food Item	Serving Size	Carbohydrate Units per Serving
Breakfast			
AM Snack			
Lunch			
PM Snack			
Dinner			
Evening Snack			

Glossary

Acceptable daily intake (ADI) – The amount you can safely consume each day.

Acesulfame-K – A sugar substitute.

ADI – See “Acceptable daily intake.”

Adrenal glands – The glands in the body that make the hormone cortisol.

Adrenaline – A “fight or flight” hormone. Made by the adrenal gland.

Amino acids – The building blocks of protein. Insulin allows the body to take up amino acids and build muscle tissue.

Apidra® (generic: glulisine) – A rapid-acting insulin.

Appetite – A desire for food or drink.

Aspart – A rapid-acting insulin. The generic form of NovoLog®.

Aspartame – A sugar substitute. The generic form of NutraSweet®.

Atherosclerosis – When fats clog the inner lining of the artery walls.

Background insulin – All people need a small amount of insulin at all times. This low level of insulin is often called “background” or “basal” insulin. People with type 1 diabetes don’t make background insulin. Some individuals with CFRD need to take a background insulin. One dose gives a constant amount of insulin for about 24 hours with no peak. Background insulin does not give the extra insulin needed to cover meals. Glargine (Lantus®) and detemir (Levemir®) are background insulins.

Basal dose – A constant dose of basal or background insulin that lasts throughout the day.

Basal insulin – All people need a small amount of insulin at all times. This low level of insulin is often called “basal” or “background” insulin. See “Background insulin.”

Baseline – In diabetes, the fasting glucose level.

Beta cells – Special cells in the pancreas, found in the islets of Langerhans that make the hormone insulin.

Blood glucose – The main sugar in the bloodstream. Also known as blood sugar. A major source of body cell fuel.

Blood sugar – See “Blood glucose.”

Body mass index (BMI) – A measurement of body fat, using weight-to-height ratio.

Bolus – All at once.

Bolus dose – A larger dose of insulin given with meals and snacks.

BMI – See “Body mass index.”

Carbohydrate counting – Counting how many carbohydrates you plan to eat and adjusting your rapid-acting insulin to cover them.

Carbohydrate unit – A method to measure the amount of carbohydrates in food: 1 carbohydrate unit = 12 to 15 grams of total carbohydrates.

Carbohydrates – Two types: simple (sugars) and complex (starches). Carbohydrates are the main nutrients that affect blood sugar. They are used for the body’s instant fuel needs and have 4 calories per gram.

Cartridge – In this case, a container of insulin for use with an insulin injection pen.

Casual blood glucose – A blood glucose level drawn without caring what time of day it is or when a meal was last eaten.

CDE – See “Certified diabetes educator.”

Certified diabetes educator (CDE) – A doctor, nurse, or dietitian with special training to manage diabetes.

CF – See “Cystic fibrosis.”

CFRD – See “Cystic fibrosis–related diabetes.”

CFRD with fasting hyperglycemia – When the “fasting” or “baseline” blood glucose is 126 mg/dL (7.0 mmol) or more and the blood glucose 2 hours after glucose load is 200 mg/dL (11.1 mmol) or more. This type of CFRD will likely display classic diabetes symptoms and always needs insulin treatment.

CFRD without fasting hyperglycemia – When the “fasting” or “baseline” blood glucose is normal (less than 100 mg/dL or 5.5 mmol/L) but the blood glucose 2 hours after glucose load is 200 mg/dL or 11.1 mmol/L or more.

Cholesterol – A lipid (fat) found in the cell membranes of all tissues and transported in the blood.

Chronic – All of the time, or long lasting.

Chronic CFRD – CFRD that does not go away.

Constipation – When it is hard to have a bowel movement because the feces are dry and hard.

Continuous subcutaneous insulin infusion (CSII) – A method of giving a constant infusion of insulin through an insulin pump rather than insulin as taken through shots.

Convulsion – See seizure.

Correction dose – Extra rapid-acting insulin given before meals when the pre-meal blood sugar is higher than the target range.

Corticosteroids – Steroid-containing drugs (e.g., prednisone) used to treat lung disease.

Cortisol – A hormone that is a steroid. Made in the adrenal glands. Bodies make higher than normal cortisol levels in response to stress.

Counter-regulatory hormones – These hormones cause the symptoms of low blood sugar and help your body raise blood sugar.

CSII – See “Continuous subcutaneous insulin infusion.”

Cystic fibrosis (CF) – A disease that affects the exocrine (mucus) glands of the lungs, liver, pancreas, and intestines, often causing frequent airway infections and poor growth.

Cystic fibrosis–related diabetes (CFRD) – A unique form of diabetes that occurs in people with CF.

Detemir – A long-acting insulin. The generic form of Levemir®.

DiaBeta® (generic: glyburide) – An oral hypoglycemic agent that makes people secrete more insulin from the pancreas.

Diabetes – A state in which the body doesn’t make enough insulin and/or doesn’t respond to insulin the right way.

Diabetes care team – A team of people with special training to manage diabetes. The team might include a doctor (often an endocrinologist), certified diabetes educator (often a nurse or dietitian), social worker, and psychologist.

Diagnose – To decide what the problem or cause of the problem is.

Diarrhea – Passing large amounts of loose stool often.

Digestive enzymes – A substance made in the pancreas that flows into the intestine or that is taken in a capsule with meals and snacks to help digest food.

Endocrine – The hormone-making function of the pancreas. Insulin is a hormone.

Endocrinologist – A doctor with special training in the treatment of diabetes and other diseases of the glands that make hormones.

■ Glossary

Endocrine pancreas – The part of the pancreas that makes insulin that helps your body cells use the energy (calories) from food.

Enzyme – A substance made in the exocrine pancreas that flows into the intestine to help digest food.

Enzyme supplements – Enzymes, swallowed in pill form, to help the body digest food when the body doesn't make enough enzymes or the enzymes can't get from the pancreas to the intestine.

Exocrine pancreas – The part of the pancreas that makes digestive enzymes, which flow into the intestine to help digest food.

Expired – Old or out-of-date medicine.

Fast/fasting – Nothing to eat or drink for 10 to 12 hours.

Fasting blood glucose (FBG) – A blood sugar level measured after not eating any food for 10 to 12 hours. "Normal" is less than 100 mg/dL (5.6 mmol/L).

FBG – See "Fasting blood glucose."

Fortamet® (generic: metformin) – A drug that makes people more sensitive to insulin and lowers glucose output from the liver.

Gastrostomy – An opening made through the abdomen into the stomach for a feeding tube or button.

Generic – Any drug often marketed under a brand name that is sold in a package without a brand.

Genetic engineering – The science of changing genes in animals and plants.

Gestational diabetes – Diabetes only when pregnant.

Glargine – A long-acting insulin. The generic form of Lantus®.

Glipizide – An oral hypoglycemic agent that makes people secrete more insulin from the pancreas. The generic form of Glucotrol®.

Glucagon – A hormone that "squeezes" extra sugar out of the liver and raises the blood sugar level. It is given as a shot and can be used to treat low blood sugar in someone not conscious.

Glucola – Glucose in drink form.

Glucophage® (generic: metformin) – A drug that makes people more sensitive to insulin and lowers glucose output from the liver.

Glucose – A simple sugar. The main sugar in the bloodstream. A major source of body cell fuel.

Glucose intolerance – When the body has a hard time turning sugar into fuel for cells.

Glucose load – A set amount of liquid glucose (glucola), which is consumed before doing an oral glucose tolerance test (OGTT).

Glucose meter – A small machine that measures blood sugar level.

Glucotrol® (generic: glipizide) – An oral hypoglycemic agent that makes people secrete more insulin from the pancreas.

Glulisine – A rapid-acting insulin. The generic form of Apidra®.

Glumetza® (generic: metformin) – A drug that makes people more sensitive to insulin and lowers glucose output from the liver.

Glyburide – An oral hypoglycemic agent that makes people secrete more insulin from the pancreas. The generic form of Micronase®, DiaBeta®, and Glynase PresTab®. Its action is like glipizide (Glucotrol®). This drug should only be used to treat CFRD as part of a research protocol.

Glycosylated hemoglobin – See "Hemoglobin A₁C."

Glyrase Pres Tab® (generic: glyburide) – An oral hypoglycemic agent that makes people secrete more insulin from the pancreas.

Hemoglobin A₁C (glycosylated hemoglobin) – This test shows how much sugar is “stuck” to your red blood cells. It shows long-term blood sugar control. The hemoglobin A₁C goal is less than 7%.

High-calorie supplements – A great source of extra calories when you don’t feel like eating, aren’t hungry, or when you struggle to gain or maintain proper weight.

Hormones – Chemicals released by cells that either carry messages to other cells or affect cells in other parts of the body.

Humalog® (generic: lispro) – A rapid-acting insulin.

Hyperglycemia – High blood sugar levels.

Hypoglycemia – Low blood sugar levels.

IGT – See “Impaired glucose tolerance.”

Impaired glucose tolerance – A fasting blood sugar of 100 to 125 mg/dL or 5.6 to 6.9 mmol/L, and/or a blood sugar of 140 to 199 mg/dL or 7.8 to 11.0 mmol/L 2 hours after an oral glucose load during an oral glucose tolerance test (OGTT).

Infusion set – A thin, short, plastic tube that carries insulin from the pump into the body for a baseline constant dose of insulin all day.

Insulin – A hormone, secreted by the pancreas, that helps sugar leave the blood and enter the cells where it is used for fuel.

Insulin deficiency – When the pancreas doesn’t make enough insulin.

Insulin-dependent diabetes – Also called juvenile onset or type 1 diabetes. It most often occurs in childhood. In insulin-dependent diabetes, the pancreas doesn’t make insulin, so insulin must be taken daily to stay alive.

Insulin injection devices – These make giving insulin simple. They have a very small insulin needle. Insulin is stored in a cartridge inside.

Insulin injection pen – See “Insulin injection devices.”

Insulin pump – Also called continuous subcutaneous insulin infusion (CSII). Insulin pumps are used to give a constant amount of insulin rather than insulin through shots.

Insulin reaction – Low blood sugar, less than 70 mg/dL or 3.9 mmol/L.

Insulin resistance – When body cells can’t use insulin the right way, so more insulin is needed to lower blood sugars.

Insulin-to-carbohydrate ratio – Once you know how to count the carbohydrates in foods and how insulin works, you can “match” or adjust your rapid-acting insulin to the carbohydrates you plan to eat.

Intermediate-Acting–NPH – Insulin, usually given twice a day. It has its peak effect in 6 to 8 hours and lasts around 13 hours. This can vary from person to person.

Intermittent CFRD – CFRD that comes and goes (“now & then,” not all the time), with or without fasting hyperglycemia.

Intestine – The part of the body where food is digested and nutrients absorbed.

Intravenous (IV) – In a vein.

Islets of Langerhans – The cells in the pancreas where the insulin-making beta cells are grouped.

IV – See “Intravenous.”

Juvenile onset diabetes – See “Insulin-dependent diabetes.”

■ Glossary

Ketoacidosis – A life-threatening change in blood acidity. Can occur in people with type 1 diabetes.

Ketones – When fat is used for fuel instead of sugar, the body makes ketones. Ketones can be found in the urine and blood.

Kg – Kilograms. A measurement of weight. 1 kg=2.2 pounds.

Lactic acidosis – When lactic acid (made by muscles when oxygen levels drop) builds up in the bloodstream faster than it can be removed.

Lancet – A lancet has a tiny, spring-loaded needle made for getting a drop of blood from the tip of your finger for blood sugar testing.

Lantus® (generic: glargine) – A long-acting insulin.

Lbs. – Pounds.

Levemir® (generic: detemir) – A long-acting insulin.

Lipid profile – A check of blood lipid (fat) levels, including cholesterol and triglyceride. High cholesterol and triglyceride levels are uncommon in CF.

Lipids – Fat

Lispro – A rapid-acting insulin. The generic form of Humalog®.

Macrovascular complications of diabetes – Having disease in blood vessels that can cause heart disease and stroke. This typically does not happen in people with CFRD.

Malabsorbing – Not absorbing the nutrients from food for use by body cells.

Mannitol – A sugar alcohol, used as a sugar substitute.

Metformin – A drug that makes people more sensitive to insulin and lowers glucose output from the liver.

Micronase® (generic: glyburide) – An oral hypoglycemic agent that makes people secrete more insulin from the pancreas.

Milk drips – Also known as tube feedings. Getting high-calorie supplements using a pump and a gastrostomy or nasogastric tube during the night or while asleep.

Nasogastric – A tube that runs from the nose to the stomach.

Neotame – A sugar substitute.

Nighttime gastrostomy feedings – See “Nighttime tube feedings.”

Nighttime tube feedings – Getting high-calorie supplements using a pump through a gastrostomy or nasogastric tube during the night or while asleep.

Non-insulin-dependent diabetes – Also called type 2 diabetes. It most often occurs in overweight people over the age of 40. This type of diabetes is caused by the lack of a normal response to insulin and/or not making enough insulin.

NovoLog® (generic: aspart) – A rapid-acting insulin.

NPH – See “Intermediate-acting insulin.”

NutraSweet® (generic: aspartame) – A sugar substitute.

Nutrition – Having to do with the body’s need for and use of nutrients found in food.

OGTT – Oral glucose tolerance test.

Omega-3 fatty acids – A certain type of fat (found in some oils and seafood) with many good health effects.

Ophthalmologist – A doctor with special training in the care of people’s eyes.

Ophthalmology – Having to do with the eyes.

Oral agents – Drugs in pill form that, in diabetes, make people secrete more insulin or make people more sensitive to insulin.

Oral glucose tolerance test (OGTT) – This test is used to diagnose not just diabetes and CFRD but also the varied types of abnormal glucose tolerance in CF. You must first fast (nothing to eat or drink) for 12 hours. Then, blood is drawn to measure your “baseline” or “fasting” glucose level. You are then asked to drink glucose. Your blood sugar is measured again 2 hours later. Often, blood sugar is measured at 1, 2, and 3 hours later.

Oral hypoglycemic agents – See “Oral agents.”

Pancreas – An organ in the body that secretes digestive enzymes and makes hormones, including insulin.

Pattern management – Deciding how much insulin to take based on low and high blood sugar patterns at certain times of the day.

Pica – Wanting to eat non-food items. May be a symptom of anemia.

Polydipsia – Often needing to drink liquids. A classic diabetes symptom.

Polyuria – Often having to urinate (pee). A classic diabetes symptom.

Postprandial glucose level – Blood sugar level 2 hours after the largest meal.

Protamine – A type of protein.

Protein – One of the six nutrients found in the six main food groups. Protein is used by the body to build, repair, and maintain muscle and other body tissues. It helps to regulate the immune system and other body processes.

Pulmonologist – A doctor with special training to care for people with lung disease.

Reaction – In diabetes, low blood sugar of 70 mg/dL or 3.9 mmol/L or less.

Regular – In diabetes, a short-acting insulin.

Retinopathy – A type of eye disease caused by high blood sugar levels over a long period of time. Can lead to blindness. All adults with diabetes should be screened for this once per year.

Riomet® (generic: metformin) – A drug that makes people more sensitive to insulin and lowers glucose output from the liver.

Saccharin – A sugar substitute.

Secrete – To give off.

Seizure – Violent uncontrolled muscle movement.

Self-monitoring of blood glucose (SMBG) – Using a glucose meter to check blood sugar levels at home.

Sorbitol – A sugar alcohol, used as a sugar substitute.

Steroid – A compound made in the body that regulates many body functions. (See also “Corticosteroid.”)

Sucralose – A sugar substitute. Generic for Splenda®.

Triglyceride – A type of fat in the blood that is measured usually with cholesterol levels.

Tube feedings – Getting diet supplements using a pump and a gastrostomy or nasogastric tube during the night or while asleep. Also known as “milk drips.”

Type 1 diabetes – See “Insulin-dependent diabetes.”

Type 2 diabetes – See “Non–insulin-dependent” diabetes.

Underlying – Something

in the background or at the same time.

Urinate – To pee.

Urine microalbumin – The amount of protein (albumin) in urine shows kidney health.

Xylitol – A sugar alcohol, used as a sugar substitute.

Important Organizations

The following is a brief overview of three organizations that can provide additional information about cystic fibrosis and/or cystic fibrosis-related diabetes.

Cystic Fibrosis Foundation

The mission of the Cystic Fibrosis Foundation, a nonprofit donor-supported organization, is to assure the development of the means to cure and control cystic fibrosis and to improve the quality of life for those with the disease.

The Foundation has fueled dramatic improvements in research and care that have significantly changed the prognosis for people with CF. Today, the predicted median age of survival for people with CF is more than 37 years, and more than 45 percent of people with CF are age 18 or older.

To maintain this kind of progress, the Foundation funds and accredits approximately 115 care centers, 95 separate adult programs and 50 affiliate programs at major medical and teaching institutions across the country.

The Foundation's unique approach to drug discovery has yielded a therapeutics pipeline with more than 30 potential therapies in development for CF. For the first time in the history of the disease, CF clinical trial participants are taking oral drugs aimed at treating the basic defect in CF. If successful, these drugs will add decades of life for people with the disease.

The Foundation also addresses Federal and state legislative issues that affect people with CF, and maintains a strong presence on Capitol Hill to increase awareness of CF issues, influence policy and inspire legislative action. The Foundation advocates for CF research funding, healthcare policies, access to affordable CF treatment and protection of the rights of people with CF.

The Foundation is one of the most efficient organizations of its kind, with nearly 90 cents of every dollar of revenue available for investment in research, care and education programs.

For breaking news about CF research and Foundation activities, visit the Foundation's Web site at www.cff.org. If you would like more information about the Foundation or its programs, contact:

Cystic Fibrosis Foundation
6931 Arlington Road
Bethesda, Maryland 20814
(301) 951-4422
(800) FIGHT CF
www.cff.org
info@cff.org

■ Important Agencies

The Juvenile Diabetes Research Foundation International (JDRF)

The mission of The Juvenile Diabetes Research Foundation International is to find a cure for diabetes and the problems it causes through the support of research. It is the world's leading nonprofit, nongovernment-funded organization of diabetes research. To learn more, contact the manager of public information at 120 Wall Street, 19th floor, New York, NY 10005, phone 1-800-533 CURE; e-mail info@jdrf.org; Web site www.jdrf.org.

The American Diabetes Association (ADA)

This is a national organization of health team members committed to teaching the public about all forms of diabetes. The ADA is a good resource for health and legal information about diabetes. They can be reached at 1701 North Beauregard Street, Alexandria, VA 22311. Also phone: 1-800-DIABETES (1-800-342-2383; e-mail: AskADA@diabetes.org. www.diabetes.org.



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CYSTIC FIBROSIS FOUNDATION
6931 ARLINGTON ROAD
BETHESDA, MD 20814
1.800.FIGHT.CF
WWW.CFF.ORG
INFO@CFF.ORG

