

LEARN TO MATCH YOUR INSULIN TO YOUR CARBS

Learning how food, insulin, and physical activity work together to affect blood glucose (blood sugar) can help you better manage your diabetes. Foods that contain carbohydrates (carbs) raise your blood glucose. Insulin and low-to-moderate physical activity lower blood glucose. It's a balancing act!

This booklet can help people who take insulin understand how to master this balancing act. You will learn some key terms used to explain how your insulin plan works with your food and the steps you will use to:

- Match your insulin to the amount of carbs you eat and drink
- Adjust your insulin dose based on your blood glucose

You will also learn how to treat low blood glucose and get tips on preparing for appointments with your diabetes care provider. The worksheet in this booklet can help you keep track of your personal insulin treatment plan.

My Mealtime Insulin Dosing Worksheet

MY TARGET BLOOD GLUCOSE	MY PERSONAL INSULIN PLAN
Fasting or Premeal: _____ _____ hours after eating: _____	Insulin-to-Carb Ratio: _____ Blood Glucose Correction Factor: _____

Mealtime (Bolus) Insulin Dosing

Step 1: Check your blood glucose before eating a meal = _____ mg/dL

Step 2: Figure out how much **mealtime insulin** you need:

- Add up the grams of carbs in the foods you will eat.
- Divide the total grams of carbs by your **insulin-to-carb ratio**. This is the amount of **mealtime insulin** needed:

_____ grams of carbs ÷ _____ (insulin-to-carb ratio) = _____ units of rapid-acting insulin

Step 3: If your blood glucose is **high** or **low** before eating, figure out your **correction insulin**:

- When your current blood glucose level is **higher** than your target, subtract the target from your current level:

_____ mg/dL (current) – _____ mg/dL (target) = _____ mg/dL

- When your current blood glucose level is **lower** than your target, subtract your current level from the target:

_____ mg/dL (target) – _____ mg/dL (current) = _____ mg/dL

Divide this amount by your **blood glucose correction factor**. This is your **correction insulin** amount:

_____ mg/dL (from Step 3) ÷ _____ (correction factor) = _____ units of rapid acting insulin

Putting It Together: My Mealtime (Bolus) Insulin Dose

If your blood glucose is **above** your target, **add** the correction insulin (from Step 3) to your mealtime insulin dose (from Step 2).

mealtime insulin (_____ units) + correction insulin (_____ units) = _____ units

If your blood glucose is **below** your target, **subtract** the correction insulin (from Step 3) from your mealtime insulin dose (from Step 2):

mealtime insulin (_____ units) – correction insulin (_____ units) = _____ units

If your blood glucose is **at** your target, use the mealtime insulin amount from Step 2.

How Your Body Uses Insulin

In people without diabetes, the body makes the right amount of insulin to control blood glucose. **Insulin** is a hormone made by your pancreas. It is needed to keep your blood glucose from getting too high.

The pancreas releases insulin in 2 different ways:

- **Around the clock:** The pancreas releases small amounts of insulin 24 hours a day.
- **After a meal or snack:** When we digest foods and drinks with carbs, the carbs break down into glucose, and the body's blood glucose level rises. In response to the rising blood glucose, the pancreas releases insulin to help move the glucose from food into the cells to be used as fuel. The amount of insulin released depends on the amount of carbs eaten.

When your body does not make insulin or has trouble using it, glucose stays in your blood and spills into your urine. High blood glucose, also called **hyperglycemia**, over time can increase the risk of long-term problems, such as heart disease, kidney failure, reduced eyesight, and nerve problems.

If you have **type 1 diabetes**, your pancreas makes very little or no insulin for your 24-hour insulin needs. The pancreas also does not release insulin when you eat. The treatment for type 1 diabetes requires daily use of replacement insulin.

If you have **type 2 diabetes**, your pancreas either does not make enough insulin or your body is resistant to the insulin. When you have **insulin resistance**, your cells cannot use insulin properly. At first, the pancreas makes extra insulin to make up for it. Over time, the body may not be able to make enough insulin to keep your blood glucose in a healthy range. As a result, diabetes medicines will be needed. About 50% of people with type 2 diabetes experience this and benefit from using replacement insulin.

Blood Glucose Targets

Blood glucose goals are not the same for everyone. Your diabetes care provider can tell you when to check your blood glucose and help you set your blood glucose targets. Targets give you a range of numbers for your blood glucose during the day that are meant to keep you safe and healthy. The American Diabetes Association offers these general blood glucose targets. These targets are meant to prevent short-term complications and long-term complications from blood glucose levels that are too high or too low:

- 80 to 130 mg/dL when **fasting** or **before a meal**
- Less than 180 mg/dL at **peak** (the highest blood glucose value), about 1 to 2 hours after a meal begins

Your targets may be higher or lower than these guidelines based on your personal needs such as age, health history, and other factors. If you can't tell when your blood glucose is low, a higher target may be set.



Low Blood Glucose (Hypoglycemia)

Low blood glucose is known as **hypoglycemia**. For most people, a blood glucose level less than 70 mg/dL is too low. If you are elderly or have special health care issues, your diabetes care provider may change this level. Ask your diabetes care provider what value is too low for you.

Hypoglycemia can be caused by any of the following:

- Taking too much diabetes medicine, such as insulin
- Eating too little or delaying a meal
- Unplanned or extra physical activity
- Drinking alcohol, especially when your stomach is empty

Signs or Symptoms of Low Blood Glucose

There are several signs of low blood glucose you can look for, including:

- Shakiness or sweating
- Blurred vision
- Confusion
- Heart pounding or racing
- Difficulty concentrating
- Impaired judgment
- Nausea
- Feeling irritable or “not right”
- Extreme hunger
- Headache



Treatment: Follow the Rule of 15

An easy way to remember how to treat low blood glucose is called the Rule of 15. Following this rule can help you treat a low blood glucose level with enough food or drink, without eating or drinking too much. Follow these steps:

1. If your blood glucose level is:
 - Less than 70 mg/dL—eat or drink 15 grams of carbs.
 - Less than 50 mg/dL—eat or drink 30 grams of carbs.
2. Check your blood glucose again after **15 minutes**.
3. If it is still less than 70 mg/dL, eat or drink another **15 grams** of carbs.

What Counts as 15 Grams of Carbs?

	AMOUNT	AMOUNT OF CARBS	CALORIES
Glucose tablets (1 tablet = about 4 grams of carbs; check the label)	4 tablets	16 grams	60
Glucose bits (1 tablet = 1 gram of carbs)	15 tablets	15 grams	60
Fruit juice, not light or sugar-free	½ cup	15 grams	60
Soft drinks (sodas), not diet	½ can (6 fl oz)	20 grams	70
Sugar, white or brown (1 teaspoon = 4 grams of carbs)	3 teaspoons	12 grams	50
Sport drinks (not sugar free)	1 cup	15 grams	60
Milk, fat-free (skim) or low-fat (1%)	1 cup (8 fl oz)	12 grams	90 to 105
Skittles (1 piece = 0.9 grams of carbs)	15 pieces	15 grams	60
Raisins	2 tablespoons	15 grams	60

Notes:

- Do **not** treat with high-fat foods (such as cookies, ice cream, or chocolate/candy bars). These types of foods are high in calories, and the added fat may slow your recovery time from the low blood glucose level.
- Talk about your specific hypoglycemia treatment plan with your diabetes care provider. Be sure to tell your diabetes provider if you have had severe or frequent low blood glucose levels.

What about Driving?

Low blood glucose can be a side effect of using insulin. The following are tips to reduce the chance of having hypoglycemia while driving:

- Talk with your diabetes care provider about what your blood glucose level should be before you drive.
- Always check your blood glucose before driving.
- Always have some carbs available in your car to treat hypoglycemia (see chart on page 15).
- If your blood glucose is less than 70 mg/dL, eat a snack before driving. Talk to your diabetes care provider about when to eat a snack and how much to eat when you will be driving.

Using Glucagon to Treat Very Low Blood Glucose

When low blood glucose is not treated, it can lead to severe or very low blood glucose. In these cases, you will likely need help from family or friends. You will not be able to swallow safely, but you will need something to raise your blood glucose.

Glucagon is a hormone that can be injected during emergencies to raise your blood glucose level quickly. Your diabetes care provider should teach a family member or friend how to inject glucagon.

If you use insulin to manage your diabetes, you should get a prescription for a glucagon kit. A glucagon kit contains a small syringe filled with liquid and a vial of powder. The liquid in the syringe is used to dissolve the powder. Be sure to check the expiration date on the glucagon kit from time to time and replace it before it expires.