

This is general information and not specific medical advice for you, your child, or loved one. Always consult your doctor or other healthcare provider if you have any questions or concerns. Call 911 or go to the nearest emergency department in case of an urgent concern or emergency.

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Diabetes Education Train the Trainer Series: Carbohydrate Counting

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Diabetes Education

Reflection

As you go through this video, please pause to review the content and think about how you would apply this information to your school setting.



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Introduction

This training video is intended for Georgia School Nurses who

- Have students in their school with diabetes, either type 1 or type 2
- Are responsible for calculating insulin for both carbohydrates eaten and to correct high or low blood sugars
- Focuses on the role that carbohydrate counting plays in managing the health of children with diabetes



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Objectives

This course will show you:

- How to identify carbohydrate containing foods
- How to use tools such as food labels and food lists to count grams of carbohydrates in serving sizes of foods and drinks
- How to use an insulin to carbohydrate ratio to calculate how much insulin to give for food
- How to use a correction factor or sliding scale to correct hyperglycemia
- How to calculate the total meal insulin dose



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Medical Nutrition Therapy (MNT)

Our goals for medical nutrition therapy for children with diabetes are:

- Promote growth and development, physically and cognitively
- Improve health through foods high in nutrients and physical activity
- Address individual needs and cultural preferences



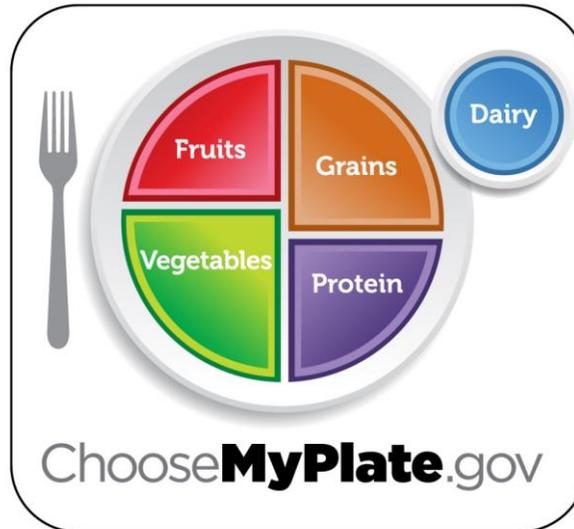
Ultimately, our goal is to achieve blood sugar levels close to normal range.

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Building a Better Plate



<https://www.choosemyplate.gov>

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How Nutrients Affect Blood Sugars

There are three major nutrient food groups:

Carbohydrates

- Greatest affect - almost 100% of carbohydrates we eat are converted to glucose

Protein

- Little affect on blood sugar, not part of carbohydrate count unless breaded or carbohydrates added

Fat

- Slows down digestion and absorption, but not considered in carbohydrate count

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Nutrient Food Sources

Carbohydrates	
<ul style="list-style-type: none"> • Bread • Cereal • Pasta • Rice/Noodles 	<ul style="list-style-type: none"> • Fruit • Juices • Milk • Yogurt
<ul style="list-style-type: none"> • Potatoes • Corn • Beans • Peas 	<ul style="list-style-type: none"> • Dessert Foods • Snack Foods • Sugar/Jelly • Syrup



Nutrient Food Sources

Proteins	
<ul style="list-style-type: none"> • Chicken • Turkey • Beef • Pork • Fish/Shrimp 	<ul style="list-style-type: none"> • Hot Dogs/ Sausages • Lunchmeats • Egg • Cheese • Peanut Butter



Nutrient Food Sources

Fats	
• Butter	• Sour Cream
• Margarine	• Nuts
• Cream Cheese	• Seeds
• Oils	• Olives
• Mayonnaise	• Peanut Butter
• Salad Dressings	• Avocado
• Cream	• Bacon



How to Count Carbohydrates



Counting Carbohydrates is very important for optimizing blood sugar control. This method gives children with diabetes freedom to choose foods they enjoy while keeping blood sugar under control.



Ways to Count Carbohydrates

- Reading food labels
- Serving sizes from the food lists
- Nutrition Websites:



Counting carbohydrates is based on the principle that 15 grams equals one carbohydrate serving.

<https://www.myfitnesspal.com/>

<http://nutritiondata.self.com/>

<http://ndb.nal.usda.gov/>

- School Nutrition Program Nutrient Count Lists (varies by county)



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Label Reading

Nutrition Facts labels provide the carbohydrate information needed to calculate the dose of rapid acting insulin.

What to look for:

- **Serving Size:** All information on the label is based on this serving size. If you double the serving size, the nutrients are doubled.
- **Number of servings:** Find the total number in the whole package of food.
- **Total Carbohydrate Grams:** Use this number to calculate carbohydrate choices and insulin

Nutrition Facts	
Serving Size 3.5 oz (98g/about 1/4 Box) (Makes about 1 cup)	
Servings Per Container about 4	
Amount Per Serving	
Calories 310	Calories From Fat 90
% Daily Value*	
Total Fat 10g	15%
Saturated Fat 2.5g	13%
Trans Fat 0g	
Cholesterol 15mg	5%
Sodium 890mg	37%
Total Carbohydrate 45g	15%
Dietary Fiber 1g	4%
Sugars 3g	
Protein 12g	24%

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Label Reading

1. Look for **Serving Size**

2. Find **Number of Servings** in a whole package

3. Determine **Total Carbohydrate Grams**
Note: The grams of sugar and dietary fiber listed under Total Carbohydrates are included in the Total Carbohydrates figure

Nutrition Facts	
Serving Size 3.5 oz (98g/about 1/4 Box) (Makes about 1 cup)	
Servings Per Container about 4	
Amount Per Serving	
Calories 310	Calories From Fat 90
% Daily Value*	
Total Fat 10g	15%
Saturated Fat 2.5g	13%
Trans Fat 0g	
Cholesterol 15mg	5%
Sodium 890mg	37%
Total Carbohydrate 45g	15%
Dietary Fiber 1g	4%
Sugars 0g	
Protein 12g	24%

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Portion Sizes: Measuring Devices



One fist clenched = 8 fluid ounces
 • Cold and hot beverages



Two hands, cupped = 1 cup
 • Breakfast cereal • Soup • Green salads (lettuce or spinach)
 • Mixed dishes (chili, stew, mac & cheese) • Chinese food



One hand, cupped = ½ cup
 • Pasta, rice • Hot cereal (oatmeal, farina) • Fruit salad, berries, applesauce • Tomato or spaghetti sauce
 • Beans (cooked or canned) • Cole slaw or potato salad • Mashed potatoes • Cottage cheese • Pudding, gelatin



Palm of hand = 3 ounces
 • Cooked meats (hamburger patty, chicken breast, fish fillet, pork loin) • Canned fish (tuna, salmon)



Two thumbs together = 1 tablespoon
 • Peanut butter • Salad dressing • Sour cream • Dips • Whipped topping • Dessert sauces • Margarine
 • Cream cheese • Mayonnaise

This is only a guide. The amounts of foods in your meal plan may be different.

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Carbohydrates: Foods That Raise Blood Sugars

Bread, cereal, rice, pasta



Fruit and fruit juice



Milk and yogurt



Dessert and treats



Starchy vegetables



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What is a carbohydrate serving?

Ways to count carbohydrates

One Carbohydrate serving is equal to 15 grams of carbohydrate.

You will need to learn what a single portion size is for a variety of foods.

Food Lists are the lists of food amounts that equal about one carbohydrate choice or 15 grams of carbohydrate.



All carbohydrates are counted to determine rapid acting insulin dose

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Carbohydrate Food Lists

Breads, Cereals, and Crackers

1 serving = 15 grams carbohydrate

- 1 slice bread
- ½ hamburger or hot dog bun
- 1 small dinner roll or bread stick
- ½ cup grits or oatmeal, cooked
- ¾ cup unsweetened cereal (ex. Regular Cheerios)
- ½ cup sweetened cereal (ex. Honey Nut Cheerios)
- 1 small, 2 ½ in. biscuit
- 4 in. frozen pancake or waffle
- 6-7 crackers (Saltine or Round)
- 3 graham crackers squares



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Carbohydrate Food Lists

Grains and Starchy Vegetables

1 serving = 15 grams carbohydrate

- 1/3 cup pasta, rice or noodles (note smaller serving)
 - ½ cup = 22 grams of carbohydrates
 - 1 cup = 45 grams of carbohydrates
- ½ cup mashed potatoes
- ½ cup potato rounds
- ½ cup corn, peas (green peas, black-eyed peas) or beans (pintos)
- 10-12 french fries
- 10-12 tater tots
- 1/3 cup Baked beans



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Carbohydrate Food Lists

Fruit and Fruit Juice

1 serving = 15 grams carbohydrate

- Small apple or orange (4oz) tennis ball size
- ½ medium banana (4 oz.)
- ½ cup grapes (15-17 pieces)
- ½ cup canned fruit, light syrup
- 1 ¼ cup strawberries
- 1 ¼ cup watermelon
- ½ cup fruit juice (4 oz.)



Fiber improves blood sugar control by slowing absorption

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Carbohydrate Food Lists

Milk and Yogurt

1 serving = 12 grams carbohydrate

- 1 cup (8 oz.) milk - skim, 1%, 2%, whole
- 6 oz. light yogurt
- ½ cup sweetened soy milk
- 1 cup flavored milk: chocolate, strawberry, vanilla
- TrueMoo brand = 20 grams carbohydrate



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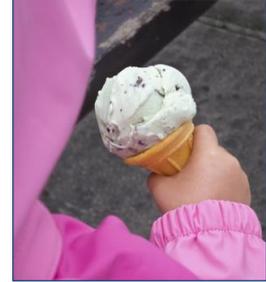
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Carbohydrate Food Lists

Sweets and Desserts

1 serving = 15 grams carbohydrate

- ½ cup ice cream
- ½ cup sugar free pudding
- 7 animal crackers
- 5 vanilla wafers
- 2 small cookies (Oreos®, Chips Ahoy®)
- 1 school cookie (oatmeal or chocolate chip)
- 1 mini ice cream sandwich or frozen fruit bar
- 1/8 slice M&M cookie cake (16 in. round) = 75 grams
- 1 frosted cupcake (standard size) = 30 - 40 grams
- 1 school brownie = 23 grams



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Carbohydrate Food Lists

Candy, Spreads, and Syrups

1 serving = 15 grams carbohydrate

- 3 mini candy bars
- 3 pieces hard candy
- 15 Skittles®
- 8 individual Sweet Tarts®
- 3 packs Smarties® candies
- 1 pack fruit snacks, gushers, or fruit roll up
- 1 Tablespoon sugar, jelly, honey, pancake syrup



Hidden sources of sugars:

- 8 oz. regular sports drink (Gatorade® type)
- 4 oz. regular energy drink (½ cup)

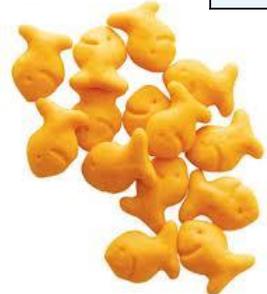


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Carbohydrate Food Lists: Snacks

	Doritos®	1.5 grams per chip	
	Potato chips (15 chips)	15 grams (1 gram per chip)	
	Cheese Curls (15 curls)	15 grams (1 gram per curl)	
	Pretzel sticks (30 sticks)	15 grams	
	Pretzel Tiny Twists	1.5 grams per twist	
	Goldfish® ½ cup	45 pieces = 15 grams	






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Carbohydrate Food Lists

Combination Foods

School carbohydrate lists may be requested each year from the county's nutrition director

1 larger slice school pizza	45 grams
1 smaller slice school pizza	35 grams
5 chicken nuggets	15 grams
1 chicken Caesar wrap	40 grams
1 corn dog	30 grams
1 cup spaghetti with meat sauce	50 grams
1 beef taco	20 grams

Estimates listed above are averages for combination foods across county school systems.



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Free Foods (Foods that do not raise blood sugars)

A Free Food has 5 grams of carbohydrate or less per serving.



Non-starchy veggies



Fats and oils



Meats and proteins



Cheese and eggs

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Types of Free Food

1 free serving is = 5 grams carbohydrate or less

- Non-starchy veggies:
 - Green beans, broccoli, carrots, green salad
- Protein foods
- Fats
- Sugar free drinks
 - zero carbohydrate and zero calorie sugar substitutes, spices, seasonings, sugar free foods
- 1 packet sugar free jelly
- 2 Tbsp sugar free syrup
- 1 sugar free popsicle
- 1 Tbsp ketchup (2 packs)
 - if more eaten, count all



If the carb ratio is 1:5 grams, then a ½ cup serving of foods such as green beans or carrots would not be free. The carbohydrates must be counted.

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Artificial Sweeteners & Sugar Alcohols

Remember to look at:

- Portion size
- Servings per container
- Total carbohydrate grams



**They are NOT free foods.
You must count carbohydrates.**

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Time to Practice



You will need blank paper and a pen or pencil

Scenario

1

Count the number of carbohydrates

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Scenario 1- Example 1

Count carbohydrates eaten

Sally Student is about to eat a typical school lunch and will need insulin. In this example, you will count the number of carbohydrate grams in Sally's lunch.

Chicken nuggets (5)	= <u>15</u> grams carbohydrate
Potato rounds (1/2 cup)	= <u>15</u> grams carbohydrate
Chilled peaches (1/2 cup)	= <u>15</u> grams carbohydrate
Green beans (1/2 cup)	= <u>0</u> grams carbohydrate
Chocolate milk (8 oz)	= <u>20</u> grams carbohydrate
Total	= <u>65</u> grams carbohydrate

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Scenario 1 – Example 2

Count carbohydrates eaten

Sam Student is about to eat a typical school lunch and will need insulin. In this example, you will count the number of carbohydrate grams in Sam's lunch.

Spaghetti w/meat sauce (1cup)	= <u>50</u> grams carbohydrate
Breadstick	= <u>15</u> grams carbohydrate
Salad w/ranch dressing	= <u>0</u> grams carbohydrate
Apple wedges (1/2 cup)	= <u>15</u> grams carbohydrate
Oatmeal cookie	= <u>15</u> grams carbohydrate
Milk 2% (8 oz)	= <u>12</u> grams carbohydrate
Total	= <u>107</u> grams carbohydrate

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Part 2

Calculating Insulin Doses



Calculating Total Mealtime Insulin Dose

There are three steps to complete to calculate the total mealtime insulin dose.

Step 1. Calculate Food Insulin Units

- Total carbohydrate grams eaten
- Insulin to carbohydrate ratio

Step 2. Calculate Correction Insulin Units

- Before-meal blood sugar level
- Correction formula or sliding scale

Step 3. Calculate Total Mealtime Insulin Dose

- Total Meal Insulin Dose = *(Step 1)* Food Insulin Units + *(Step 2)* Correction Insulin Units



The Insulin to Carbohydrate Ratio

The insulin to carbohydrate ratio is the formula that expresses the number of carbohydrate grams covered by 1 unit of fast acting insulin (Humalog, Novolog, Apidra) used at mealtimes.

1:10 means 1 unit of insulin moves 10 grams of sugar out of the blood and into the cells.

Common Insulin: Carbohydrate Ratios

1 Unit: 10 grams carbohydrate

1 Unit: 15 grams carbohydrate

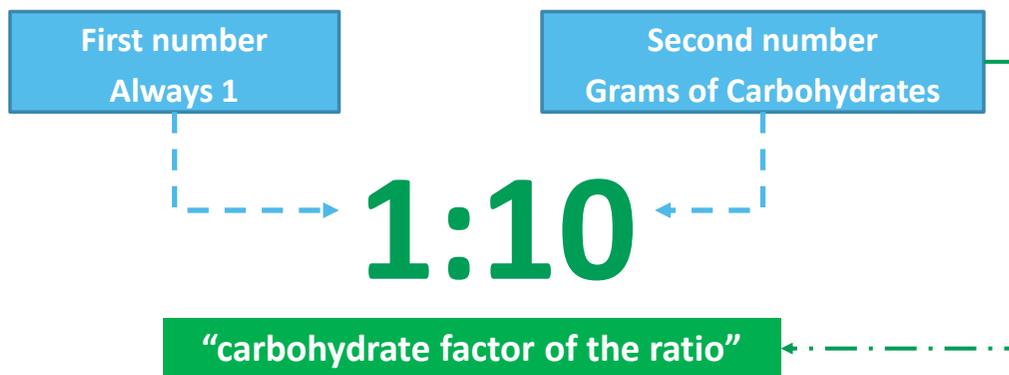
1 Unit: 30 grams carbohydrate

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Insulin to Carbohydrate Ratio



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What is the Correction Formula?

A formula used to calculate the amount of insulin needed to bring high blood sugar into target range.

Diabetes Plan BG-100 / 50	
$\frac{\text{Pre-meal Blood Sugar} - \text{Target Blood Sugar}}{\text{Correction (aka Sensitivity) Factor}}$	=
	Amount of insulin needed to correct high blood sugar

- How many points each unit of insulin lowers blood sugar
 - Ex: CF of 50 (or SF of 50), means 1 unit of rapid acting insulin will lower blood sugar 50 points
- Common correction factors: 25, 50, 100

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What is a Sliding Scale Correction?

Another method of calculating the amount of insulin needed to correct high blood sugar

- Replaces doing the math (with correction/sensitivity factor)



This method also uses 1 unit of fast acting insulin to lower blood sugars 50 points.

Example:

- Blood Sugar 200 – 299 add 2 Units Humalog, Novolog, or Apidra Insulin
- Blood Sugar 300 – 399 add 4 Units Humalog, Novolog, or Apidra Insulin
- Blood Sugar over 400 add 6 Units Humalog, Novolog, or Apidra Insulin

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Calculating Total Meal Insulin Dose

The three steps to calculate the total meal bolus insulin dose.

Step 1. Calculate **Food Insulin Units**

Step 2. Calculate **Correction Insulin Units**

Step 3. Calculate **Total Mealtime Insulin Dose**

- Total Meal Dose = (Step 1) Food Insulin Units + (Step 2) Correction Insulin Units

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Calculating Total Meal Insulin Dose - Example

Step 1. Calculate Food Insulin Units [for carbohydrates (food)]

70 g (carbohydrate grams eaten)

1:10 (Insulin to carbohydrate ratio)

$$70\text{g} / 10 = 7 \text{ food insulin units}$$

Step 2. Calculate Correction Insulin Units [for blood sugar high out of range]

320 = Pre-meal blood sugar level

$$320 - 100 = 220$$

220 / 50 (correction factor)

(BG - 100) / 50 (correction formula)

$$220\text{g} / 50 = 4.4 \text{ Correction Insulin Units}$$

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Calculating Total Meal Insulin Dose (continued)

Step 3: Total Mealtime Dose

If the blood sugar is out of range:

Food Insulin Units + Correction Insulin Units = Total Meal Dose



If the blood sugar is NOT out of range:

Food Insulin Units = Total Dose of Meal Bolus Insulin Dose



Points to Remember

When determining the amount of insulin, always check the meals.

- Look at portion sizes of carbohydrate foods and make "best estimate" of carbohydrates
- For best meal time "coverage" insulin should be injected just prior to eating (exceptions - very young or picky eaters)
- Check snacks for carbohydrates, timing, and if insulin is needed. Refer to the DMMP.
- Allow 2 hours between an insulin dose and a blood sugar correct. (Follow the child's school plan for specific instructions.)



Time to Practice

Scenario

1

Calculate Total insulin using an insulin to carbohydrate ratio and a correction formula

Scenario

2

Calculate Total insulin using an insulin to carbohydrate ratio and a sliding scale



You will need blank paper and a pen or pencil

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Scenario 1

Calculate Total insulin using an insulin to carbohydrate ratio and a correction formula.

Sally student is about to eat a typical school lunch and will need insulin. Sally has prescribed Insulin to carbohydrate ratio of 1 unit of insulin: 15 grams carbohydrate. However, Sally's blood sugar is already at 258 so she'll also need a correction amount of insulin using the correction formula of BG -100/50 for correction.

In this scenario, you will calculate:

- Step 1: The amount of food insulin needed based on the lunch carbohydrates
- Step 2: The amount of correction insulin needed based on the pre-meal blood sugar reading
- Step 3: The total amount of insulin Sally needs in this scenario

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Scenario 1

Step 1: Calculate Food Insulin units

Chicken nuggets (5)	= _____ grams carbohydrate
Potato rounds (1/2 cup)	= _____ grams carbohydrate
Chilled peaches (1/2 cup)	= _____ grams carbohydrate
Green beans (1/2 cup)	= _____ grams carbohydrate
Chocolate milk (8 oz)	= _____ grams carbohydrate
Total	= _____ grams carbohydrate



**How much food insulin
is needed using a 1:15 ratio?**

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Scenario 1 – Step 1

Chicken nuggets (5)	= <u>15</u> grams carbohydrate
Potato rounds (1/2 cup)	= <u>15</u> grams carbohydrate
Chilled peaches (1/2 cup)	= <u>15</u> grams carbohydrate
Green beans (1/2 cup)	= <u>0</u> grams carbohydrate
Chocolate milk (8 oz)	= <u>20</u> grams carbohydrate
Total	= <u>65</u> grams carbohydrate

**How much food insulin
is needed using a 1:15 ratio?**

$$\frac{\text{Total grams}}{\text{The carbohydrate factor in the ratio}} = \text{Food Insulin Units}$$

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Scenario 1 – Step 1

Chicken nuggets (5)	= <u>15</u> grams carbohydrate
Potato rounds (1/2 cup)	= <u>15</u> grams carbohydrate
Chilled peaches (1/2 cup)	= <u>15</u> grams carbohydrate
Green beans (1/2 cup)	= <u>0</u> grams carbohydrate
Chocolate milk (8 oz)	= <u>20</u> grams carbohydrate
Total	= 65 grams carbohydrate

How much food insulin
is needed using a 1:15 ratio?

$$\frac{65}{15} = \text{Food Insulin Units}$$

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Scenario 1 – Step 1

Chicken nuggets (5)	= <u>15</u> grams carbohydrate
Potato rounds (1/2 cup)	= <u>15</u> grams carbohydrate
Chilled peaches (1/2 cup)	= <u>15</u> grams carbohydrate
Green beans (1/2 cup)	= <u>0</u> grams carbohydrate
Chocolate milk (8 oz)	= <u>20</u> grams carbohydrate
Total	= 65 grams carbohydrate

How much food insulin
is needed using a 1:15 ratio?

$$\frac{65}{15} = 4.3 \text{ Food Insulin Units}$$

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Scenario 1

Step 2: Calculate Correction Insulin

- Sally's pre-meal blood sugar = 258



Only do this step when the blood sugar is out of range!

Correction Formula

$$(BS - 100) / 50 = \text{Correction Insulin Units}$$

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Scenario 1 – Step 2

Sally's pre-meal blood sugar = 258

Correction Formula

$$(BG - 100) / 50 = \text{Correction Insulin Units}$$

$$158 / 50 = 3.2 \text{ Correction Insulin Units}$$

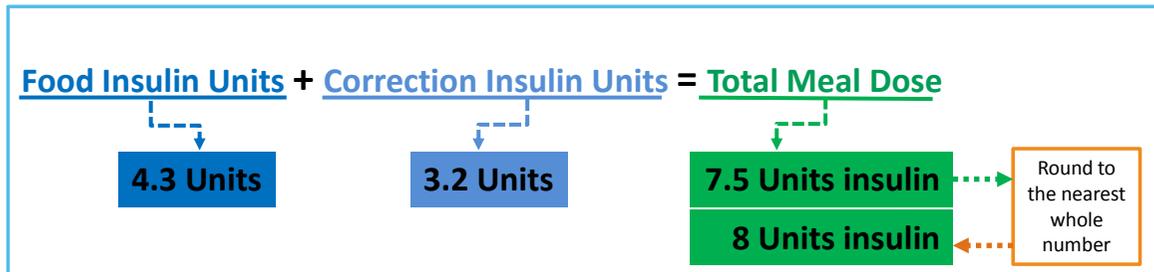
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Scenario 1

Step 3: Calculate Total Insulin



Scenario 2

Calculate Food Insulin Units

Sam Student is about to eat a typical school lunch and will need insulin. Sam's blood sugar is 312. He has a prescribed Insulin: carbohydrate ratio of 1 unit of insulin: 10 grams carbohydrate. He'll need a correction amount of insulin using the sliding scale for correction.

In this scenario, you will calculate:

- Step 1. The amount of food insulin needed based on the lunch carbohydrate grams
- Step 2. The amount of correction insulin needed based on the pre-meal blood sugar reading using the sliding scale correction
- Step 3. The total amount of insulin Sam needs in this scenario



Scenario 2 – Step 1

Spaghetti w/meat sauce (1cup)	= <u>50</u> grams carbohydrate
Breadstick	= <u>15</u> grams carbohydrate
Salad w/ranch dressing	= <u>0</u> grams carbohydrate
Apple wedges (1/2 cup)	= <u>15</u> grams carbohydrate
Oatmeal cookie	= <u>15</u> grams carbohydrate
Milk 2% (8 oz)	= <u>12</u> grams carbohydrate
Total	= <u>107</u> grams carbohydrate



**How much food insulin
is needed using a 1:10 ratio?**

$$\frac{\text{Total grams}}{\text{The carbohydrate factor in the ratio}} = \text{Food Insulin Units}$$

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Scenario 2 – Step 1

Spaghetti w/meat sauce (1cup)	= <u>50</u> grams carbohydrate
Breadstick	= <u>15</u> grams carbohydrate
Salad w/ranch dressing	= <u>0</u> grams carbohydrate
Apple wedges (1/2 cup)	= <u>15</u> grams carbohydrate
Oatmeal cookie	= <u>15</u> grams carbohydrate
Milk 2% (8 oz)	= <u>12</u> grams carbohydrate
Total	= <u>107</u> grams carbohydrate

**How much food insulin
is needed using a 1:10 ratio?**

$$\frac{107}{10} = \text{Food Insulin Units}$$

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Scenario 2 – Step 1

Spaghetti w/meat sauce (1cup)	= <u>50</u> grams carbohydrate
Breadstick	= <u>15</u> grams carbohydrate
Salad w/ranch dressing	= <u>0</u> grams carbohydrate
Apple wedges (1/2 cup)	= <u>15</u> grams carbohydrate
Oatmeal cookie	= <u>15</u> grams carbohydrate
Milk 2% (8 oz)	= <u>12</u> grams carbohydrate
Total	= <u>107</u> grams carbohydrate

**How much food insulin
is needed using a 1:10 ratio?**

$$\frac{107}{10} = \mathbf{10.7 \text{ Food Insulin Units}}$$

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Scenario 2

Step 2: Calculate Correction Insulin

Sam Student is about to eat a typical school lunch and will need insulin.

Sam's blood sugar is 312. He has a prescribed Insulin: carbohydrate ratio of 1 unit of insulin: 10 grams carbohydrate. He'll need a correction amount of insulin using the sliding scale for correction.

Sliding Scale for Correction is:

200-299 = 2 Units

300-399 = 4 Units

>400 = 6 Units

Correction Insulin Units = 4

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Scenario 2

Step 3: Calculate Total Insulin

Food Insulin Units + Correction Insulin Units = Total Meal Dose

10.7 Units

4 Units

14.7 Units insulin

15 Units insulin

Round to the nearest whole number



Some smaller children may use half unit syringes and have a different method of rounding numbers.

Please refer to the DMMP and verify orders with the parents.

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Summary

Now that we have:

- Used tools such as food labels and food lists to count carbohydrates
- Completed the steps to calculate the total mealtime dose of insulin

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Diabetes Train the Trainer Series

For more information visit:

www.choa.org/medical-services/diabetes

- Diabetes 101
- Carbohydrate Counting
- Physical Activity
- The Diabetes Medical Management Plan
- Taking Type 1 Diabetes to School

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Resources

- Community website for tips, chat rooms, etc. - www.childrenwithdiabetes.com
- Helping students with diabetes succeed - www.betterdiabetescare.nih.gov
- American Diabetes Association tips and tools - www.diabetes.org
- For more information on any of the Train the Trainer topics visit - www.choa.org
- Children's Healthcare of Atlanta direct line - (404)-785-KIDS

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For more information on any of the Trainer the Trainer topics:

- Visit us at: www.choa.org
- Call us at: (404) 785-KIDS



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