Carbohydrate Counting for Children with Diabetes: Why, What and How?

By Gail Spiegel, MS, RD, CDE

Why Do Children with Diabetes Count Carbohydrates (Carbs)?

Since carbohydrate is the nutrient that the body converts to blood sugar, families of children with diabetes are taught how to balance their insulin or oral medication with the amount of carbs their child is eating. The American Diabetes Association recommends that monitoring carbs by carb counting, exchanges, or experience-based estimation, is a key means of achieving optimal blood glucose control (Bantle et al., 2006). In the past, meal planning for diabetes was much less flexible and many times students were prescribed a rigid meal plan using "exchange lists" to match insulin dosing. Today, diabetes healthcare professionals teach families to match their child's insulin to their nutritional intake. Most diabetes centers around the country use carbohydrate counting as the main form of meal planning for children with diabetes.

What Foods Have Carbs?

Most people think of foods like bread, pasta, and potatoes as the main carb sources in food. Those foods do contain **starch**, which is one form of carbohydrate. Starch is found in all grains and starchy vegetables, including peas, corn and potatoes, as well as beans and lentils. **Sugar** is the other form of carbohydrate in food that converts to blood glucose. Sugars are found in fruits, milk and yogurt and are added to sweets, such as cake, cookies, candy and ice cream. Vegetables that are non-starchy, like lettuce and broccoli, a small amount of carbohydrate. While children with diabetes can eat foods that have added sugars, those foods should form only a small part of their daily meal plan (as is recommended for children without diabetes). Regular sodas, juices and other sugary drinks contain large amounts of carbs, raise the blood glucose very quickly and are hard to balance with insulin. Most diabetes healthcare professionals recommend that children with diabetes avoid "liquid" carbs, unless they use one to treat a low blood glucose level.

How Do Children with Diabetes Count Carbs?

There are two main methods of meal planning using carb counting:

1. Following a **consistent carb** meal plan;
2. Adjusting insulin for **changing carb** intake or using an **insulin-to-carb** ratio.

Which method a child uses will depend on the insulin regimen that the child is on and the family's skill level.

Consistent Carb Meal Plan. Many families start with a consistent carb meal plan. With this method of meal planning, the child with diabetes eats a set amount of carbs at each meal and snack. This amount is usually determined with the help of a registered dietitian (RD), physician, or diabetes educator and is individualized to the needs of the child. The amount of rapid-acting insulin (meal insulin) the child takes only changes for the blood glucose level. This method of carb counting is often used for children with type 1 diabetes who are on conventional insulin therapy and children with type 2 diabetes who need to limit their portions. Conventional insulin therapy usually consists of two shots per day, including NPH, an intermediate-acting insulin, which is given in the morning. NPH starts working midmorning and peaks in the

TABLE 1. SNACK EXAMPLES

15-20 gm carb snacks	20-30 gm carb snacks
1 small apple or orange	1 granola bar
8 animal crackers	1 packet of sandwich crackers
4-5 vanilla wafers	1 pudding cup
½ cup applesauce	1 large banana

TABLE 2. MEAL CARBOHYDRATE AMOUNTS BY AGE

	5-12 years old	Teens
Boys	45 to 60 grams of carb at each meal	60 to 75+ grams of carb at each meal
Girls	45 to 60 grams of carb at each meal	45 to 75 grams of carb at each meal

The student's RD or healthcare provider will help determine the amount of carb that is right for each individual child at each meal.

afternoon, balancing with the carbs at morning snack, lunch, and afternoon snack. Carb amounts at those times need to stay consistent to help keep blood glucose within the target range. Snacks for most school-age children are 15–30 gm carb. Sample carb ranges for meals and snacks are listed in Tables 1 and 2. Following a consistent schedule is also important with this regimen to match the action of the intermediate-acting insulin.

Adjusting Insulin for Carbs. Families who want more flexibility with eating, or are using intensified diabetes management, are taught how to adjust insulin for changing carb intake. Many children are now using a more intensified insulin regimen. Intensified insulin management includes doing multiple daily injections (MDI) of a rapid-acting insulin (Humalog, Novolog or Apidra) with a basal or flat insulin (Lantus or Levemir), or using an insulin pump. These children will have an insulin-to-carb ratio and a blood glucose correction factor for dosing of their rapid-acting insulin. The RD, physician, or diabetes educator determines how much rapid-acting insulin the child needs to cover carbs (insulin-to-carb ratio) and how much rapid-acting insulin is needed to lower blood glucose to target range (blood glucose correction factor). Insulin-to-carb ratios vary from child to child. For example, a 5-year-old may use an insulin-to-carb ratio of 1 unit per 30 to 45 grams of carb, while teenagers may use 1 unit for 7 to 15 grams of carb. Table 3 shows an example of a dosing calculation using an insulin-to-carb ratio and blood glucose correction. With MDI and pump therapy the child does not have to follow a fixed schedule for meals and snacks.

TABLE 3. EXAMPLE OF HOW TO CALCULATE AN INSULIN DOSE USING AN INSULIN-TO-CARB RATIO AND BLOOD GLUCOSE CORRECTION

Insulin-to-carb ratio = 1 unit of rapid acting insulin per 15 gm carb*

Blood glucose correction = 1 unit of rapid acting insulin per 50 mg/dL over 150 mg/dL blood glucose*

Sample School Lunch

6 baked chicken nuggets	15 grams of carb
½ cup mashed potatoes	15 grams of carb
½ cup green beans	5 grams of carb
½ cup canned fruit in natural juices	15 grams of carb
1 carton 2% white milk	12 grams of carb
Total =	**62 grams of carb**

Premeal Blood Glucose = 250

Total Carb = 62 grams

Insulin needed for carbs = 62÷15= 4 units

Insulin needed to lower blood glucose to target level= 250-150 (target) = 100÷ 50 = 2 units

Total Dose = 4+2= 6 units

*Insulin-to-carb ratios and blood glucose corrections are individualized for each child. *This example should not be used as a recommendation for dosing.*

How do you figure out how much carb is in foods?

In order to carb-count accurately, children and their families are taught how to read the "Nutrition Facts" on food labels for total carb grams. Families

should measure or weigh foods periodically in order to estimate portion sizes and carbs accurately. Most families should have a book or reference list that they can refer to for unlabeled foods. In the school setting, if carb content of school lunch foods is not available, carb counting can be difficult. The food service director should be able to help provide information on carb amounts in the school lunch or breakfast. It is also helpful to keep a book with carb content of foods on hand. (Resources on carb counting and diabetes are listed on the following page.)

Summary

Carbohydrates are an important part of a healthful diet. With type 1 or 2 diabetes, balancing insulin or medication with carbs and emphasizing carbs from fruits, vegetables, whole grains and low-fat milk and yogurt is key. Families should learn how to follow a consistent carb meal plan or adjust insulin for carbs to help keep their child's blood glucose close to target levels. The family's RD or healthcare team can help them decide which meal planning method is best for their child.

RESOURCES

Web sites

National Diabetes Education Program (NDEP): www.ndep.nih.gov/diabetes/youth/youth.htm (free resources)

www.calorieking.com (free nutrition information)

Books

Borushek, A. (2008). *The Doctor's Pocket Calorie, Fat & Carbohydrate Counter.* Costa Mesa, CA: Family Health Publications.

Brackenridge, E.P. & Rubin, R. R. (2002). *Sweet Kids: How to Balance Diabetes Control and Good Nutrition with Family Peace, 2nd edition.* American Diabetes Association.

Chase, H.P. (2006). *Understanding Diabetes, 11th edition.* Denver: The Children's Diabetes Foundation.

Spiegel, G. & Penkilo, M. (2008). *Carbohydrate Counting for Children with Diabetes.* Eli Lilly and Company (free resource).

Warshaw, H.S. & Kulkarni, K. (2004). *Complete Guide to Carb Counting, 2nd edition.* Alexandria, Va.: American Diabetes Association.

Choose Your Foods: Exchange Lists for Diabetes. (2007). American Diabetes Association and American Dietetic Association.

REFERENCES

Bantle, J.P., Wylie-Rosett, J., Albright, A.L., Apovian, C.M., Clark, N.G., Franz, M.J., Hoogwerf, B.J., Lichtenstein, A.H., Mayer-Davis, E., Mooradian, A.D., Wheeler, M.L. (2006). Nutrition recommendations and interventions for diabetes—2006: a position statement of the American Diabetes Association. *Diabetes Care, 29,* 2140-2157.

Evert, A. & Gerken, S., (2006). Children with diabetes: birth to adolescence. *On The Cutting Edge, 27* (4), 4-8.

ABOUT THE AUTHOR

Gail Spiegel, MS, RD, CDE is a member of the National Diabetes Education Program's Diabetes in Children and Adolescents Work Group and Manager of Nutrition Services/Diabetes Educator at the Barbara Davis Center for Childhood Diabetes, University of Colorado at Denver and Health Sciences Center.