

## Nutrition Management Tools and Techniques for Working with Students with Diabetes

By Alison Evert, RD, CDE

**M**edical nutrition therapy (MNT) is an integral component of any treatment plan for a child with type 1 or type 2 diabetes, but often is the most difficult part of the treatment plan to implement successfully. The American Diabetes Association's (ADA's) position statement, "Evidence-Based Nutrition Principles and Recommendations for the Treatment and Prevention of Diabetes and Related Complications," (2002) includes a section on nutritional recommendations for children and adolescents.

Many children and adolescents with diabetes, especially those with type 2, will not receive an individualized MNT prescription from a dietetic professional or a diabetes educator who is experienced with pediatric populations. These children may actually receive their only nutrition education from a school nurse.

This article provides school nurses with information and tips for working with children with type 1 and 2 diabetes as well as a list of nutrition education tools and resources. Although physical activity, medications, and self-monitoring of blood glucose are equally important components of diabetes self-management, they are not addressed in this article.

### Nutritional Goals for Students with Diabetes

The nutrient requirements for children and adolescents with type 1 or type 2 diabetes appear to be similar to other same-age children and adolescents without diabetes, with an important difference: the food plan must be balanced with optimal glycemic control, physical activity, and possibly diabetes medications to promote normal linear growth.

Growing children who do not receive adequate calories will not grow to their height potential. Table 1 summarizes the nutrition goals for children with type 1 or type 2 diabetes (Holzmeister, 1997; Mazze et al., 2002).

For the nutrition component of the overall diabetes treatment plan to be effective, children and their families need to be given realistic goals that are tailored to their unique needs. Youth typically cannot or will not follow "diet prescriptions" or strict calorie-controlled meal plans that do not incorporate foods they like and that their peers eat. Healthcare professionals working with children should make an effort to avoid the term "diet" when discussing changes in food choices. "Diet" implies a temporary solution and not a lifelong change (Howelett et al., 1999). The nutrition recommendations can be referred to as a food plan or a meal plan.

Healthcare professionals, including school nurses working with children and adolescents, need to strive to design food plans that balance treatment goals with realistic lifestyle choices. The food plans currently developed for children with diabetes are not as restrictive as they used to be. However, this does not mean that children with diabetes can or should eat unlimited quantities of foods that traditionally had been restricted in a diabetes meal plan. Children with or without diabetes should choose nutritious healthful foods.

### Meal Planning for Children with Type 1 Diabetes

Most children with type 1 diabetes use either the basic carbohydrate counting or the advanced carbohydrate counting meal planning approach for their diabetes food plan.

### Basic Carbohydrate Counting

Carbohydrate counting is a simple approach that can be used successfully with children. The carbohydrate counting approach to meal planning is based on the premise that carbohydrates are the main source of blood glucose. A majority of the dietary carbohydrate consumed at meal or snack-time enters the bloodstream as glucose within 15 minutes to 2 hours. Therefore, a fairly accurate determination of the carbohydrate content of the meal or snack is an important factor in achieving desirable blood glucose levels.

As part of their education about meal planning, children and their caregivers are taught how to determine the carbohydrate choices and/or grams of carbohydrate in foods. One carbohydrate choice is equal to 15 grams of carbohydrate. Information about carbohydrates can be obtained from *Exchange Lists for Meal Planning* (see References on page 16) and from the Nutrition Facts panels on packaged food labels.

When children and caregivers are educated on reading food labels, they are encouraged to look at the "Nutrition Facts" sections (see Figure 1). They are educated to determine how many total grams of carbohydrate are found in foods, not the grams of sugar. The grams of sugar listed on food labels are only one component of the total grams of carbohydrate. They also must be aware of the serving size and the number of servings, since many packaged foods contain more than one serving.

Physical measurement of commonly consumed carbohydrate foods also is recommended so that fairly accurate determination of the carbohydrate content can be

achieved. For example, it is important to measure breakfast cereals because one cup of cereal can vary from 25 grams for a puffed cereal to 90 grams for a cup of granola. The capacity or volume of beverage containers also should be determined. Depending on the size of the glass used by the child, one glass of milk could contain anywhere from 8 to 16 ounces, which would result in a carbohydrate content of 12 to 24 grams. In addition, instruction is provided on determining the carbohydrate content of home-prepared foods such as pasta, rice, and mashed potatoes.

Carbohydrate counting allows for increased flexibility in meal planning while keeping the amount of carbohydrate consistent from day to day. Foods from the protein and fat groups contain no carbohydrate and therefore are not tracked in this approach. Registered dietitians or certified diabetes educators can develop individualized food plans, ideally based on a thorough nutritional assessment, to fit the unique nutritional needs of each child.

The amount of carbohydrate in the meal plan will vary based on the needs of each child, factoring in growth and energy needs, amount of physical activity, and the insulin regimen. Many younger school-age children will consume two to four carbohydrate choices per meal (30 to 60 grams of total carbohydrate), and older children and adolescents may consume four to six carbohydrate choices per meal (60 to 90 grams of total carbohydrate). Refer to Table 2 for sample carbohydrate contents of school lunch menus for elementary school children. Older children who are more physically active will require more carbohydrate choices than younger, less active children. Most children also consume one to two carbohydrate choices for between-meal snacks (15 to 30 grams of total carbohydrate) such as 40 small fish crackers, a granola bar, fruit leather, or a small piece of fresh fruit. Depending on the type of insulin plan a child is following, snacks may or may not be necessary.

### Advanced Carbohydrate Counting

The advanced carbohydrate meal planning approach allows the greatest flexibility in the timing of meals and the amount of carbohydrate consumed. The focus is on adjusting insulin doses to match

variable carbohydrate intake rather than on carbohydrate constancy or restriction (Evert & Mauseth, 2004.)

The ability to estimate or count the carbohydrate content of meals and snacks allows for matching the action of the insulin to the anticipated post-meal rise in blood glucose after eating carbohydrate foods. This is based on the premise that the action of the rapid-acting insulin will have an onset in approximately 0 to 30 minutes after it is injected with a peak action of 30 minutes to 3 hours. The action of the rapid-acting insulin will then “match” the blood glucose-raising effect of the carbohydrate foods consumed at meals. Children and their caregivers need to realize, however, that just because they can determine and “cover” the carbohydrate content of their meals or snacks does not mean they can sacrifice the principles of good nutrition and eat whatever they want whenever they want.

Most children using insulin pump therapy will use this type of meal planning approach.

An insulin-to-carbohydrate ratio is used to help calculate the amount of insulin needed to “cover or match” the carbohydrate consumed at the meal. For example, it may be determined that based on the child’s age, weight, and food intake the child needs to take one unit of rapid-acting insulin to “cover or match” every 15 grams of carbohydrates eaten. Therefore, the child would need to take 3 units of rapid-acting insulin if he/she consumed 45 grams of carbohydrate. Very young children may have to take one unit of rapid-acting insulin per every 20 to 40 grams of carbohydrate. School-age children may take one unit of insulin per 15 to 20 grams of carbohydrate. Adolescents may take one unit of insulin per 10 grams of carbohydrate, whereas overweight teens may need one unit of insulin per 5 grams of carbohydrate.

CONTINUED ON PAGE 14

**TABLE 1. NUTRITION GOALS FOR CHILDREN AND ADOLESCENTS WITH DIABETES**

Type 1 Diabetes	Type 2 Diabetes
<ul style="list-style-type: none"> <li>■ Maintenance of age-appropriate glucose levels in desirable ranges by balancing food intake with insulin and activity levels</li> <li>■ Provision of adequate calories for normal growth, weight, and development</li> <li>■ Achievement of lipid levels in desirable ranges</li> <li>■ Prevention, delay, or treatment of nutrition-related risk factors and complications</li> <li>■ Improvement of overall health through optimal nutrition (Holzmeister 1997)</li> </ul>	<ul style="list-style-type: none"> <li>■ Development of a positive approach to meal planning focusing on healthy food choices and portion control</li> <li>■ Improvement in life skills that will continue into adulthood, decreasing disturbed eating patterns and focusing on appropriate growth and development</li> <li>■ Development of healthy lifelong eating and exercise habits while preserving social, cultural, and psychological well-being</li> <li>■ Cessation of excessive weight gain with normal growth and near-normal fasting blood glucose and hemoglobin A1c results.</li> <li>■ If weight reduction is desired, development of realistic goals for gradual weight loss (American Diabetes Association 2000, American Association of Diabetes Educators, 2002)</li> </ul>

Advanced carbohydrate counting builds on the skills and concepts taught in the basic carbohydrate counting meal planning approach such as:

- food label reading skills
- ability to determine carbohydrate content of home-prepared foods by actually weighing and measuring portions
- math skills, including addition, multiplication, and division.

Children or their caregivers should also have an understanding of how fat can delay the emptying of the stomach. High-fat meals can result in prolonged elevations in blood glucose. This means that the action of rapid-acting insulin administered prior to a high-fat meal may actually be finished before the fatty meal has emptied from the stomach several hours later. This is an especially important concept for adolescents, who typically consume many high-fat foods and snacks.

### Exchange Lists for Meal Planning

*Exchange Lists for Meal Planning*, published by the American Dietetic Association and the American Diabetes Association (see References), is an entire meal planning approach. It is a bit more complicated to teach to younger children because it involves six different food group lists instead of the three main groups (carbohydrate, protein, and fat) used with basic

carbohydrate counting. Despite its complexity, it is still used effectively by many professionals working with children.

### Meal Plans and Insulin: Putting it all together

*Conventional or split-mixed insulin delivery plans (two to three shots per day)*

This type of insulin delivery plan typically consists of two shots per day with an intermediate-acting insulin such as NPH or Lente insulin. The intermediate-acting insulin is typically mixed with either rapid-acting (Humalog® or Novolog®) or with short-acting insulin (Regular).

The onset of action of rapid-acting insulin will start in approximately 0 to 30 minutes with a peak action of 30 minutes to 3 hours to “match” the blood glucose raising effect of the carbohydrate foods consumed at breakfast. If Regular insulin is used, it typically starts working in 30 to 45 minutes and the peak blood glucose lowering effect is 1 to 5 hours. The action of the intermediate-acting insulin injected before breakfast will be peaking to “match or cover” the carbohydrate foods consumed at lunch, so the child usually does not have to take a lunch time injection of insulin.

Some children will have a lunchtime injection of rapid-acting insulin prescribed by their healthcare provider to treat an elevated blood glucose level at lunchtime. Prior to the evening meal, the child will take a second injection of insulin. The child will take either rapid- or short-acting insulin mixed with the intermediate-acting insulin. If the child experiences episodes of early morning hypoglycemia, the dinnertime shot may be broken up into two injections. The rapid- or short-acting insulin will be given before dinner and the intermediate-acting insulin will be injected at bedtime.

Children and teens following a conventional or split-mixed insulin plan will need to keep the prescribed amount of carbohydrate more consistent at meals and snacks from day to day. The main determinant of post-meal rise in blood glucose is the amount of carbohydrate consumed at a meal or snack. Therefore, if children are taking “fixed” or set doses of insulin, it is recommended that the carbohydrate content of their meals and snacks be consistent better to match the action of their insulin.

Conventional or split-mixed insulin delivery plans often require a more predictable schedule for meal and snack times. More consistent carbohydrate intake at more consistent meal and snack times should ultimately result in more predictable blood glucose levels.

*Multiple daily insulin injection delivery plans (more than four shots per day or insulin pump)*

A more intensive insulin plan, consisting of background or basal insulin (such as the long-acting insulin Lantus®) and pre-meal or bolus insulin (such as the rapid-acting insulin Humalog® or Novolog®), allows for more flexibility in timing and frequency of meals, in the amount of carbohydrate eaten at meals and snacks, and in management of physical activity. The long-acting insulin Lantus® is usually given only once a day at bedtime.

Children using these types of insulin will be prescribed an individualized *insulin to carbohydrate ratio* and a *blood glucose correction factor* that will be used to determine their pre-meal or bolus insulin injection. The advanced carbohydrate meal planning approach is the method of choice to be used in conjunction with this type of insulin delivery plan. The *blood glucose correction factor* is used to correct an elevated pre-meal blood glucose level to the child’s prescribed target or goal blood glucose level.

Snacks are typically not necessary with this type of plan, although they can be included if children choose to eat them. If snacks include more than 10 to 15 grams of carbohydrate, an additional injection of rapid-acting insulin will be needed to control the resulting rise in blood glucose following the snack.

During the school day, older school-age children and teens may need to determine their pre-meal or bolus insulin doses on their own, based on instructions from the student’s personal healthcare provider. The caregivers, healthcare provider, and the school nurse can work out a variety of strategies in advance to assist younger children with their insulin dose calculations.

School nurses may have students with diabetes who are using the basic or advanced carbohydrate counting or exchange list meal planning approaches that are not totally independent of this

**FIGURE 1. FOOD LABEL: NUTRITION FACTS**

Nutrition Facts	
Serving Size 1 cup (228g)	
Servings Per Container 2	
Amount Per Serving	
<b>Calories 260</b>	Calories from Fat 120
% Daily Value*	
<b>Total Fat 13g</b>	<b>20%</b>
Saturated Fat 5g	25%
Trans Fat 2g	
<b>Cholesterol 30mg</b>	<b>10%</b>
<b>Sodium 660mg</b>	<b>28%</b>
<b>Total Carbohydrate 31g</b>	<b>10%</b>
Dietary Fiber 0g	0%
Sugars 5g	
<b>Protein 5g</b>	
Vitamin A 4%	Vitamin C 2%
Calcium 15%	Iron 4%
* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:	
Calories:	2,000 2,500
Total Fat	Less than 65g 80g
Sat Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9	Carbohydrate 4 Protein 4

diabetes self-management activity. If so, they will need to review the students' medical management plans and help ensure that the students' meal and snack plans are being followed during the school day.

### Meal Planning for Children and Adolescents with Type 2 Diabetes

Since school nurses may have more frequent contact with children or teens with diabetes than their personal healthcare professionals, nurses are in a unique position to provide on-going nutrition education. Young people with type 2 diabetes typically are overweight or obese. Therefore, nutrition education for them most often focuses on strategies for attaining a healthy weight. When working with children on dietary changes, concentrate on only one or two nutrition behavior-change goals at a time. Try not to label foods as "good" or "bad" (e.g., regular soda is "bad" and water is "good"); instead, try to use terms such as "everyday foods" or "once-in-a-while" foods.

Ideally, nutrition behavior-change goals should be developed based on information obtained from food and activity records. If possible, have children or their caregivers complete a food, beverage, activity, and medication record (if applicable) for 3 or 4 days. These records can provide a wealth of information about typical food and beverage choices, portion sizes, snacking habits, food preparation techniques, meal and snack times, and meals and snack locations (i.e., home, school, fast-food restaurants, or friends' houses).

Food records can help the school nurse quickly identify a few foods or beverages that may be contributing significant calories or excessive carbohydrates to children's food intake on a daily basis. As with all education sessions, assessing the cultural, environmental, and personal circumstances of the children and families will help the school nurse develop individualized goals for the child or teen with diabetes. Understanding the child's family, friends, and social environment will prove crucial to the success of behavior-change goals and to attaining family involvement and support.

*School nurses can work with students and their families to reinforce the following nutrition education behavior-change strategies:*

- Reduce consumption of sugary beverages that are high in "empty" calories. Children and teens can choose from many types of sugar-free or "diet" beverages to substitute for higher-calorie versions. They also should be encouraged to drink water when they are thirsty. If children still want to consume regular sugar-containing beverages, suggest smaller servings to be consumed less frequently.
- Reduce consumption of high-calorie and high-fat foods. Work with children and teens to choose acceptable alternatives that are lower in calories, fat, and sugar. Frequently, children are unaware of the caloric content of the foods and beverages they regularly consume. Be mindful, however, that children and teens can be overwhelmed or turned off by too many dietary facts.
- Encourage adoption of healthful snacking strategies. Suggest that children and teens try not to eat snack foods right out of the box or bag. Putting snacks on a plate or in a bowl helps control portions. Try to encourage young people to eat in designated areas such as at the kitchen table, instead of in front of the television or computer or in their bedroom. This can help reduce mindless over-indulging.
- Increase intake of whole fruits and vegetables. The recommended number of servings for fruits and vegetables is five per day. The typical child in the United States, however, consumes only one to

two servings daily. School nurses can try to encourage consumption of these healthful foods by children and the rest of the family. Children typically model their eating behaviors after the eating habits of older family members, so it is especially important to have older siblings and parents eat these foods, too. Suggest fruits or vegetables as snack alternatives.

- Encourage children to eat slowly and wait 15 minutes before taking second helpings. This allows the body enough time to process foods already eaten and send fullness cues to the brain.
- Reduce trips to fast-food restaurants and choose healthier alternatives. Review children's favorite foods when dining out and provide options to decrease or replace unhealthful choices. Condiments should be reviewed and healthier options suggested. Educate children on appropriate portion sizes for both food and drink choices in restaurants.
- Suggest strategies for school lunches. Children should be encouraged to bring healthful lunches from home or to purchase low-fat, lower-calorie choices from the school cafeteria.

Other topic areas for helping students and their families make dietary changes might include helping with meal and snack time food selections, participating in grocery shopping, preparing low-fat meals, and ways to increase physical activity.

In summary, the meal plan for children with diabetes needs to be updated periodically and it needs to grow with the child. It is also important to remember

**TABLE 2. SAMPLE CARBOHYDRATE CONTENT OF ELEMENTARY SCHOOL LUNCH MENUS**

Chicken Noodle Soup (7g)	Cheeseburger (30g)	Teriyaki Chicken Dippers with Dipping Sauce (6g)
Deli Sandwich (36g)	Potato Wedges (26g)	Steamed Rice (30g)
Crisp Baby Carrots (5g)	Cucumber Coins (5g)	Green Beans (5g)
Juicy Orange Wedges (15g)	Pudding Cup (25g)	Chilled Pineapple (15g)
Low-fat Milk (12g)	Low-fat Milk (12g)	Fortune Cookie (6g)
Total Carbohydrate (75g)	Total Carbohydrate (93g)	Low-fat Milk (12g)
		Total Carbohydrate (74g)

that bigger bodies do not just need more food. The insulin prescription will need to be adjusted over time as well. Elevated blood glucose levels do not always signal non-compliance with a meal plan. It often means that the child's food and/or insulin requirements have changed.

## Nutrition Education Materials for Children with Diabetes

School nurses can play an important role in helping students manage the nutrition component of their diabetes treatment plan during the school day. They can provide nutrition education counseling as opportunities arise and they can collaborate with food service personnel to help ensure that students are able to follow their meal and snack plans. The following list of tools and resources provide additional information on diabetes and nutrition education. Many school districts employ a registered dietitian or a food service manager. These individuals often have determined the nutritional analysis of the school lunch and breakfast menus. These individuals can be a great resource to the school nurse.

### Pamphlets and Booklets

The following pamphlets and booklets are available for purchase from the American Diabetes Association (<http://store.diabetes.org>) or the American Dietetic Association ([www.eatright.org](http://www.eatright.org)):

- Basic Carbohydrate Counting
- Advanced Carbohydrate Counting
- Exchange Lists for Meal Planning
- The First Step in Diabetes Meal Planning
- Eating Healthy With Diabetes
- Healthy Food Choices

### Web-based Handouts

The following basic and advanced carbohydrate counting information handouts can be downloaded from the Internet at no charge: <http://www.dce.org/publications/slicks.htm>

- Ready, Set, Start Counting: How to Use Carbohydrate Counting to Keep Your Blood Glucose Healthy
- Carbohydrate Counting: Focus on Consistency for People Who Use Diabetes Pills and Basic Insulin Regimens [http://www.bddiabetes.com/us/download/staying\\_on\\_target/Carb\\_Counting.pdf](http://www.bddiabetes.com/us/download/staying_on_target/Carb_Counting.pdf)

### Web-sites that provided nutrition information

[www.calorieking.com](http://www.calorieking.com)  
[www.childrenwithdiabetes.com](http://www.childrenwithdiabetes.com)  
[www.jdrf.org](http://www.jdrf.org)  
[www.diabetesada.org](http://www.diabetesada.org)

### Books

Warshaw HS, Kulkarni K. *Complete Guide to Carbohydrate Counting*. 2nd ed. Alexandria, VA: American Diabetes Association. 2004.

Brackenridge BP, Rubin RR. *Sweet Kids: How to Balance Diabetes Control and Good Nutrition with Family Peace*. Alexandria, VA: American Diabetes Association. 2002.

Holzmeister LA. *The Diabetes Carbohydrate and Fat Gram Guide*. Alexandria, VA: American Diabetes Association, American Dietetic Association. 2000.

Borushek A. *The Doctor's Pocket Calorie, Fat, & Carbohydrate Counter*. Costa Mesa, CA: Family Health Publications. 2003.

### Nutrition Education Materials for Children With Type 2 Diabetes and Their Families

- The NDEP's Diabetes in Children and Adolescents Work Group has developed four tip sheets: "Eat Healthy Foods," "Stay at a Healthy Weight," "Be Active," and "What Is Diabetes?" These tip sheets focus on key components of a personal diabetes plan. Written at the sixth-grade reading level and field-tested with young people representing a variety of ethnic groups, they are bright, colorful, and geared toward school-age children. Download copies of the tip sheets from the NDEP website, [www.ndep.nih.gov](http://www.ndep.nih.gov), or call 1-800-438-5383.
- *Eating Healthy Rocks*, published by the International Diabetes Center ([www.internationaldiabetescenter.org](http://www.internationaldiabetescenter.org))
- *Helping Your Overweight Child and Take Charge of Your Health! A Teenager's Guide to Better Health*. Published by the Weight Control Information Network (WIN), a service of the National Institute of Diabetes and Digestive and Kidney Diseases. WIN assembles and disseminates information on weight control, obesity, and nutritional

disorders to health professionals and the general public ([win.niddk.nih.gov](http://win.niddk.nih.gov))

Consensus statements and treatment guidelines for the medical management of type 1 and type 2 diabetes in children have been published by the American Diabetes Association (ADA) (Tamborlane et al., 1998; American Diabetes Association, 2000). These publications outline the current recommendations and treatment goals for this special population with diabetes. 🍷

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