

## Chapter 12




# Food Management and Diabetes

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Food (mainly carbohydrate [“carb”]) is one of the major influences on blood sugar levels in people with diabetes. As discussed in Chapter 2, the body (particularly the liver) also makes sugar (internal sugar), which adds to the blood sugar. Other sugars (external sugars) come from the food we eat. Recommendations for the use of sugars for people with diabetes have changed. It has gone from avoidance to allowing sugar within the context of a healthy meal plan. As discussed in Chapter 11, the right amount and types of food are essential for normal growth and health. **TYPE 1 (INSULIN-DEPENDENT) DIABETES CANNOT BE TREATED WITH DIET ALONE.** In contrast, type 2 diabetes can sometimes be treated with diet and exercise alone.

## OBJECTIVES OF FOOD MANAGEMENT

*No matter which of the food plans are used, the objectives of food management are the same:*

-  to balance insulin and carb intake in order to keep the blood sugars as close to normal as possible
-  to keep the blood fats (cholesterol and triglycerides) and lipoproteins (LDL and HDL) at desired levels
-  to improve overall health by maintaining the best possible nutrition




### TEACHING OBJECTIVES:

1. Present the principles of food management related to diabetes.
2. Explain the significance of carbohydrates (carbs) in diabetes management.
3. Discuss types of meal planning approaches including carb counting.

### LEARNING OBJECTIVES:

Learners (parents, child, relative or self) will be able to:

1. List three objectives of food management.
2. Describe examples of carbohydrate (carb) containing foods and their effect on blood sugar levels.
3. Explain the type of food plan you will be using.

-  to help avoid long-term complications
-  to help attain normal growth and development for children and appropriate weight for everyone
-  to help prevent severe hypoglycemia

It is amazing how often we hear parents comment, “My child with diabetes is the healthiest in our family BECAUSE HE/SHE EATS THE BEST.” Although this is not proven, it may be true. Good nutrition for a person with diabetes is really just a healthy diet from which **all** people would benefit.

Views on food management for people with diabetes have changed considerably. There was a time when some diabetes care providers believed every family should rigidly be given an ADA exchange food program.

*In 1994, the Position Statement of the ADA stated:*

**“Today there is no one ‘diabetic’ or ‘ADA’ diet. The recommended food program can only be defined as a dietary prescription based on nutrition assessment and treatment goals. Medical nutrition therapy for people with diabetes should be individualized, with consideration given to usual eating habits and other lifestyle changes.”**

This has been the philosophy of the 11 editions of this book over the last 30 years.

The DCCT (Chapter 14) also contributed to our knowledge about food and diabetes. In the DCCT, six main nutrition factors were found that contributed to better sugar control (lower HbA<sub>1c</sub> levels, Chapter 14).

*The six main nutritional factors were:*

1. following some sort of a meal plan
2. avoidance of extra snacks
3. avoidance of over-treatment of low blood sugars (hypoglycemia)
4. prompt treatment of high blood sugars when found
5. adjusting insulin levels for meals
6. consistency of night snacks

The DCCT did **NOT** report that one type of meal plan was any more effective than another.

The major meal planning approaches we use to help people manage diabetes are discussed below. Most families start with a constant carb food plan. In recent years, carb counting has become more popular. We tend to emphasize this plan. Some families will change from one plan to another or use a combination of plans that works for them.

## TYPES OF MEAL PLANNING APPROACHES

Different types of meal planning approaches have been used for people with diabetes for about 4,000 years. They are talked about in an ancient scroll called the “Ebers Papyrus” which was written about 2000 B.C. In 1993 the DCCT showed that people with diabetes who followed a dietary program had better sugar control than those who didn’t. There are now many types of food management plans for people with diabetes. All food management plans require people to pay attention to carbs. Over 90 percent of carbs eaten are converted into blood glucose (sugar) over the next one to two hours. Meats (protein) and fat have very little conversion to blood sugar. All three of the food plans discussed below pay special attention to carbs.

*The two approaches used most commonly in our Clinic are:*

1. *Constant Carbohydrate (Carb) Meal Plan*
2. *Carbohydrate (Carb) Counting Meal Plan*

*A third approach, the Exchange Meal Plan, is sometimes used for type 2 diabetes.*

The clinic caring for the person with newly diagnosed diabetes may prefer one type of meal planning approach over another. It may be unnecessary to read about the other approaches, at least initially. The purpose of all meal plans is to achieve better control of blood sugar levels. The method that works best for one person may not be the best for someone else.

Any of the meal planning approaches can work. No single approach has been proven better than any other in achieving good blood sugar control. It is up to each healthcare team and family to eventually decide which approach works best for them. Some families will switch from one approach to another or combine parts of each to fit their needs. Many families initially use the constant carb food plan. They then move to adjusting rapid-acting insulin for carbs to be eaten (carb counting) as they gain confidence, knowledge and carb counting skills. It is important to meet with a registered dietitian to develop a meal plan that meets your lifestyle.

**CAREFUL MANAGEMENT OF CARB INTAKE MUST BE PART OF ANY OF THE PROGRAMS. IT IS IMPOSSIBLE TO EAT VARYING AMOUNTS OF CARBS (WITHOUT CHANGING THE INSULIN DOSAGE) AND KEEP THE BLOOD SUGAR FROM FLUCTUATING UP OR DOWN.** Knowing how many carbs are being eaten is important in any meal plan.

### **1. Constant Carbohydrate (Carb) Meal Plan**

In the constant carbohydrate meal plan, the amount of insulin (usually two or four shots per day) is kept relatively constant from day-to-day. This is done to match relatively consistent food intake. **The amount of carbs (types can vary) is kept about the same for each meal and each snack from one day to the next.** Often families begin by using the constant carb meal plan. They then move to adjusting insulin for carbs as they gain confidence and knowledge.

Labels must be read to know the grams (g) of carbs being eaten (see label reading, Chapter 11). The dietitian may give a range of carbs for each meal. This might be 45 to 60g/meal for a pre-teen. A teenage boy might have a range of 60 to 150g/meal. **CONSISTENCY IS THE KEY.** The constant carb meal plan is formed around the 10 principles discussed later in this chapter and is then individualized.

*The amount of food eaten at a meal or snack may vary with:*

- ✓ expected (or completed) exercise
- ✓ insulin taken
- ✓ blood sugar level

More carbs may be needed (without increasing insulin) for fun activities such as sports, hiking and biking. For work related activities such as ranching and farming, more carbs may also be needed. However, the normal eating pattern of the child and the family should stay the same as much as possible.

Families often ask, “How many carb choices are appropriate for me/my child?” They can count carbs even if insulin adjustments are not being made to match the carb intake. This helps to keep the carbs eaten at each meal consistent. The numbers of carb choices to be eaten at each meal can be estimated by looking at Table 4. Approximate numbers of calories needed per day can be calculated from the formula in the section on Calculating Calories in this chapter (or ask your dietitian). The usual number of carb choices for the level of calories per 24 hours can be seen in the dark print in Table 4. The formulas are a guide and each person’s calorie and carb needs can be different. We recommend consulting with a dietitian to establish a plan that works for you.

### **2. Carbohydrate (Carb) Counting Meal Plan**

Carb counting involves counting the grams of carbs that are to be eaten and giving a matching dose of insulin. It allows for greater freedom and flexibility in food choices. It is often used with intensified diabetes management. This can be with multiple daily insulin injections or with insulin pump therapy. It is not possible to count carbs without learning to read food labels (Chapter 11). Carb counting is both similar to and different from the constant carbohydrate meal plan.

#### Comparison to the Constant Carbohydrate Meal Plan:

Similarity ...

- ✓ It emphasizes carb intake and keeping protein and fat relatively consistent.

Difference ...

- ✓ It presumes that carb intake (and insulin dose) will vary, thus providing more flexibility and greater safety from hypoglycemia.
- ✓ It may involve more injections of insulin as extra rapid-acting insulin is taken to cover carbs eaten. Some people take rapid-acting insulin when 15g or more of carbs are consumed, while others cover even lower amounts (5g or 10g) of carbs. This should be discussed with your doctor.

#### Comparison to the Exchange Meal Plan:

Similarity ...

- ✓ similar-sized “exchanges” of carbs are used

Difference ...

- ✓ protein and fat exchanges are not used

Having the correct insulin dosage to cover meals and snacks is now receiving increased attention. One research study in adults with type 2 diabetes found that half of the elevation in HbA<sub>1c</sub> was due to the high blood sugars after meals.

Table 1 gives summaries of foods equaling one carb choice. One carb choice is the amount of each food equal to 15g of carb. It may be helpful to copy Table 1 initially and carry it in a wallet or purse.

Carb counting involves counting the grams of carbs to be eaten and taking a matching amount of insulin.

#### *Two Approaches:*

Some people prefer to just think of the number of grams of carbs.

1. When using an **I**nulin to **C**arb ratio (**I/C** ratio) one usually thinks in grams of carbs. Thus, the conversion to 15g choices is not really needed. An example of an I/C ratio is 1 to 15 (1/15). This refers to one unit of insulin per 15g of carbs eaten (or to be eaten). Carb counting was greatly aided by the food labeling laws (Chapter 11). They require the grams of total carbs be given on the label of most every food.

2. Others prefer to convert each 15g unit (10g in Canada) to one carb choice.

More detailed quantities of various foods equaling one carb choice (e.g., 15g of carb) are given in Table 2. The total grams of carbs to be eaten are divided by 15 to get carb choices (15g of carbs equals one carb choice). The units of rapid-acting insulin are then adjusted at every meal to match the carb choices (units of 15g of carb). The amount of exercise and the blood sugar level must also be considered.

#### **Getting Started (Restarted)**

If an I/C ratio has not been used previously, it is possible to “guesstimate” the value by dividing the total units of insulin used per day into 500 (the rule of 500). For example, if 33 units were taken per day, the I/C ratio would be 1 to 15 ( $500 \div 33 = 15$ ). This means one unit of rapid-acting insulin for every 15g of carbs to be eaten. If 50 units were taken per day, the I/C ratio would be 10 ( $500 \div 50 = 10$ ). This means one unit of insulin per 10g of carbs to be eaten. These are only estimates and steps must then be taken to more accurately determine the I/C ratio. These are:

#### **First:**

We ask families to keep precise food, insulin, blood sugar and activity records for at least three days. (See the Three-Day Food Record Form in the Appendix of Chapter 11. This page can be copied as desired.)

After completing the form (as accurately as possible), fax it to your dietitian for analysis. The dietitian, working with your doctor or nurse, will then make suggestions for **I**nulin to **C**arb (**I/C**) ratios. The more blood sugars you can do prior to meals and two hours after meals, the better the advice she/he can give. It is also important to include all doses of insulin or oral meds that were taken.

Every person is different in his or her need for rapid-acting insulin. The same person may even vary from one time of day to another.

- ✓ Some people can use one unit of rapid-



acting insulin per 15g of carb (one carb choice) for all meals and snacks. This is an **I/C** ratio of 1/15.

✓ Others might need:

- breakfast – one unit of insulin for each 15g of carb
- lunch – one unit of insulin for every 30g of carb (**I/C** ratio of 1/30 or 1/2 unit per 15g carb)
- dinner – one unit of insulin per 10g of carb (**I/C** ratio of 1/10 or 1.5 units per 15g carb)

✓ **Meal-Testing:**

The rapid-acting insulin dosages for meals are best adjusted by measuring blood sugar levels two hours after the meal. When testing/adjusting insulin to determine an **I/C** ratio, it may be helpful to eat a meal with known grams of carbs (e.g., a frozen meal with carbs on the label). The fat content should be less than 20g as higher fat delays stomach emptying and keeps sugar levels up longer. The “meal test” should be done for each of the three daily meals. It is common for **I/C** ratios to vary at different times of the day for the same person. Most people aim for a blood sugar below 140 mg/dl two hours after each meal. Others use the ranges suggested by age group in Chapters 7 and 21. You may want to discuss this with your doctor.

✓ **If the blood sugar value is consistently high**, more insulin is needed for the grams of carb in the **I/C** ratio. An example would be to change from 1/15 (1 unit/15g carb) to 1/10 [1 unit/10g carb]).

✓ **If the sugar level is below the lower limit** (often 70 mg/dl [3.9 mmol/L]), a lower amount of insulin is needed. An example would be to change from an **I/C** ratio of 1/15 (1 unit/15g carb) to an **I/C** ratio of 1/20 (1 unit/20g carb).

Call your healthcare provider to help you make adjustments.

**Second:**

After calculating the dose of insulin for the carb choices, the final rapid-acting insulin dose must be adjusted considering a correction factor (Chapter 21), exercise and any other factors (illness, stress, menses, etc.). Some people subtract one unit if the blood sugar is below 70 mg/dl (3.9 mmol/L) or add one unit if the blood sugar is above 200 mg/dl (11.1 mmol/L).

**Third:**

Careful record keeping for the first one or two weeks is essential (possibly using Table 4 in Chapter 26 to record the blood sugar, carb choices and insulin dose). Checking blood sugars two hours after meals allows one to see if the insulin to carb ratio used for a given meal resulted in the correct insulin dose.

**Fourth:**

It is then important to review the records with the dietitian and physician to decide the best **I/C** ratios to use at different meals.

**Fifth:**

Carb counting is most difficult for combination foods such as soups, casseroles and foods with many ingredients. The grams of carbs can be calculated from the amounts of each of the ingredients. (The amount is then divided by the number of servings.)

**Sixth:**

It may be necessary to estimate the grams of carbs when eating out. This could be done on the basis of the grams in the same food prepared at home. Obviously, this does not always work (some cooks add more sugar!). Doing a blood sugar two hours after the meal helps to make a better guess the next time.

The booklet, “*Nutrition in the Fast Lane*”, from Eli Lilly & Co. gives grams of carbs (and other nutrients) for over 1,000 menu items. It includes data on foods served by 30 of the top fast-food restaurants (see Carbohydrate Counting Resources in this chapter). The booklet, “*Fast Food Guide*”, from BD is also helpful for carb contents of foods in fast-food restaurants.

Some degree of thinking (just like the “thinking scales” in Chapter 21) is obviously necessary for carb counting. However, once the best dosages are determined, the process becomes very automatic. Most people who use an insulin pump use carb counting to determine the bolus of insulin to be taken with any food intake. Use of carb counting allows people to better observe the relationship between factors affecting the blood sugar and insulin dosage. In Canada and England (and the entire U.K.), carb counting (using 10g carb choices) has been used successfully for many years. A summary of 15g carb equivalents in foods frequently eaten is given in Tables 1 and 2. In addition, Table 3 gives carb-choices of foods that are high in carbs. The Appendix also lists carb “exchanges” (one carb exchange = one carb choice).

## How Many Carb Choices?

Table 4 lists carb choices (exchanges) for different numbers of calories eaten per day. If uncertain how many calories per day are needed, refer to “Calculating Calories” in this chapter or consult a dietitian. As the exchange diets used 15g carb exchanges, the numbers suggested in dark print for each of the different caloric diets would be similar for the carb-counting food plan. Thus, the “1” indicates 1 carb choice of 15g; the “2” equals 2 carb choices or 30g, etc. This table then shows the number of carb choices at each time of day for a given caloric intake.

**Table 1**  
**One Carbohydrate (Carb) Choice\***

**1 Starch = 1 Fruit = 1 Milk = 15g Carbohydrate = 1 CARB Choice**

Food Group	Carbohydrate Content	Portion Sizes
Starch/Grains	15g	1 slice bread 1 6” tortilla 1/3-1/2 cup cooked pasta 1/2 small or 1/4 large (1 oz) bagel 1/2 hamburger bun 1/2 cup peas or corn 1 small potato (3 oz) 1/3 cup rice 1/3 cup cooked dried beans
Fruit	15g	1 piece fruit (small) 1/2 cup canned fruit 1/2 cup fruit juice 1/4 cup dried fruit 1 cup berries or melon
Milk	12g	1 cup skim, 1%, 2% or whole milk 8 oz plain yogurt

\*These are not exact but are close enough for most people.

**NOTE:** THIS HALF-PAGE MAY BE COPIED AND CARRIED IN THE WALLET AS NEEDED.

**Table 2**

# Carbohydrate Content of Foods

Amount of Starches/Grains that equal 15g carbohydrate

Food	Serving Size
Bagel	1/2 small or 1/4 large (1 oz)
Beans, cooked, dried, canned	1/3-1/2 cup
Bread, white, whole wheat, rye	1 slice (1 oz)
Corn, cooked	1/2 cup
Crackers	4-6
English muffin	1/2
Graham crackers	3 squares
Hamburger bun	1/2 bun
Popcorn	3 cups
Pasta, cooked	1/3-1/2 cup
Peas, cooked	1/2 cup
Potato, baked	1 small (3 oz)
Potato, mashed	1/2 cup
Rice, cooked	1/3 cup
Roll (dinner, hard)	1 small
Squash, winter	1 cup
Tortilla (6" corn or 8" flour)	1

## Fruits

15g carbohydrate

Food	Serving Size
Apple, small	1 (4 oz)
Applesauce, unsweetened	1/2 cup
Banana	1 small banana or 1/2 large
Blueberries	3/4 cup
Canned fruit, light or juice packed	1/2 cup
Cantaloupe, melon	1 cup cubed
Cherries, sweet, fresh	12 (3 oz)
Fruit juice	1/2 cup (4 oz)
Grapefruit, medium	1/2
Grapes, small	17
Orange, small	1 (6 1/2 oz)
Pear, large, fresh	1/2
Raisins	2 Tbsp
Strawberries	1 1/4 cup whole berries
Watermelon	1 1/4 cup cubes

## Milk/Yogurt

12g carbohydrate

Food	Serving Size
Milk (skim, 1%, 2%, whole)	1 cup (8 oz)
Yogurt (see "Other Carbohydrates" list)	

## Other Carbohydrates

Food	Serving Size	Carbohydrate (g)
Brownie, small unfrosted	2" square	15g
Cake, unfrosted	2" square	15g
Cake, frosted	2" square	30g
Chicken noodle soup	1 cup (8 oz)	15g
Cookie, (sandwich or chocolate chip)	2 cookies	15g
Cookie, medium (homemade)	1 cookie	15g
Cupcake, frosted	1 small	30g
Doughnut, plain cake	1 medium (1.5 oz)	20g
Doughnut, glazed	3 3/4" (2 oz)	30g
French fries, thin	20-25	30g
Granola bar	1	20-25g
Ice cream (regular, light, fat-free)	1/2 cup	15-20g
Jam or jelly, regular	1 Tbsp	15g
Macaroni and cheese	1 cup (8 oz)	30-45g
Noodle casserole	1 cup (8 oz)	30g
Pie, fruit, 2 crusts	1/6 pie	45g
Poptart, unfrosted	1	35g
Potato chips	12-18 (1 oz)	15g
Pizza	1 slice (1/4 of 10")	30g
Pudding, regular	1/2 cup (4 oz)	25g
Syrup, light	2 Tbsp	15g
Syrup, regular	1 Tbsp	15g
Tomato soup (made with water)	1 cup (8 oz)	15g
Tortilla chips	6-12 (1 oz)	15g
Yogurt, light	1 cup (6-8 oz)	15g

\*The carbohydrate amounts listed on this handout are estimates. If the food you are eating has a food label check the Nutrition Facts for the accurate amount of carbohydrate in that product.

## Measurement Key

3 tsp = 1 Tbsp	4 ounces = 1/2 cup
4 Tbsp = 1/4 cup	8 ounces = 1 cup
5 1/3 Tbsp = 1/3 cup	1 cup = 1/2 pint

**Table 3**  
**Sugar Content of Some High-Carbohydrate Foods**

Food Item	Size Portion	Sugar Content* (teaspoons)	“Carb” Choices	Gram Carb
<b>Beverages</b>				
Cola drinks	12 oz can	10	3	50
Rootbeer	12 oz can	7	2	35
7-Up®*	12 oz can	9	3	45
Grape, orange, apple juice	6 oz can	5	1.5	25
<b>Dairy Products</b>				
Sherbet	1 scoop	9	3	45
Ice cream cone	1 scoop	3 1/2	1	17
Chocolate milk shake	10 oz glass	11	4	55
Milk	8 oz glass	3	1	12
Chocolate milk	8 oz glass	9 1/2	3	52
Fruit yogurt	8 oz cup	9	3	45
<b>Cakes and Cookies</b>				
Angel food cake	4 oz piece	7	2	35
Chocolate cake, plain	4 oz piece	6	2	30
Chocolate cake, w/frosting	4 oz piece	10	3	50
Sugar cookie	1	1 1/2	1/2	7
Oatmeal cookie	1	2	1	10
Donut, plain	1	4	1	20
Donut, glazed	1	6	2	30
<b>Desserts</b>				
JELL-O	1/2 cup	4 1/2	1 1/2	22
Apple pie	1 slice	7	2	35
Berry pie	1 slice	10	3	50
Chocolate pudding	1/2 cup	4	1	20
<b>Candies</b>				
Chocolate candy bar	1 1/2 oz	2 1/2	1	12
Chewing gum	1 stick	1/2	-	2
Fudge	1 oz square	4 1/2	1 1/2	22
Hard candy	1 oz	5	2	25
LIFE-SAVERS®	1	1/3	-	1 1/2
Marshmallow	1 piece	1 1/2	1/2	7
Chocolate creme	1 piece	2	1	10
<b>Miscellaneous</b>				
Jelly	1 Tbsp	3	1	15
Strawberry jam	1 Tbsp	3	1	15
Brown sugar	1 Tbsp	3	1	15
Honey	1 Tbsp	3	1	15
Chocolate sauce	1 Tbsp	3	1	15
Karo Syrup®	1 Tbsp	3	1	15

\*3 tsp = 1 Tbsp = 1 carb choice = 15g of carbs



### *Carbohydrate Counting Resources:*

For those wanting more detailed information on carb counting or on carb quantities in foods, there are now entire books written on these subjects.

1. *“Calories and Carbohydrates”* (11th Edition), by Barbara Kraus, Penguin Books, 1995
2. *“The Complete Book of Food Counts”* (4th Edition), by Corinne Netzer, Dell Publishing, 2003
3. *“Food Values of Portions Commonly Used”* (17th Edition), by Pennington and Church, Lippencott-Raven Publishers, 1998
4. *“The Diabetes Carbohydrate and Fat Gram Guide”*, by Lea Ann Holzmeister, 2000
5. *“Nutrition In the Fast Lane”* (condensed version), Eli Lilly and Co., 1999
6. *“Basic Carbohydrate Counting”* and *“Advanced Carbohydrate Counting”*. The American Diabetes Association and the American Dietetic Association, 2003 (1-800-232-3472 or 1-800-366-1655)
7. *“Fast Food Guide”*, Becton Dickinson Consumer Health Care, Franklin Lakes, NJ, 07417-1883 ([www.bd.com/diabetes](http://www.bd.com/diabetes))
8. *“Complete Guide to Carb Counting”*, H.S. Warshaw and K. Kulkarni, The American Diabetes Association and the American Dietetic Association, 2001 (1-800-232-3472 or 1-800-366-1655).
9. *“Exchanges for All Occasions”*, by Marion J. Franz, IDC Publishing, 2000
10. *“The Doctor’s Pocket Calorie, Fat and Carbohydrate Counter”*, by Allan Borushek, Family Health Publications, 2004
11. *“Carb Counting Made Easy”*, Marie McCarren, The American Diabetes Association and the American Dietetic Association, 2002 (1-800-232-3472 or 1-800-366-1655).

#### Website

[www.calorieking.com](http://www.calorieking.com)

### 3. EXCHANGE MEAL PLAN

If you/your child is newly diagnosed and your dietitian has already met with your family and recommended a different food management plan, it may not be necessary to spend time on this section.

In the exchange food program, foods are grouped into one of six food lists. Foods in each of the six lists have similar sources of calories. The foods within a group can be traded for one another as they have similar caloric, protein, carb and fat content.

The exchange diet and carb counting both consider 15g carb as one exchange or one carb choice. Exchange tables can be useful when counting carbs. Table 4 in this chapter gives common carb amounts for the three daily meals for different caloric intakes. (Calculation of caloric intake is described below under Calculating Calories.)

The exchange food program was initially developed for weight control and is still effective for this purpose. Some families, in which someone has just been diagnosed with diabetes, will initially learn the exchange food program. They are able to gain a feeling for how much of which foods to eat. As they feel more comfortable with this plan, they may then gradually change to the constant carb meal plan. In the exchange food program, the number of calories to be eaten each day is initially chosen. This type of meal plan is used more often with type 2 diabetes. It can help with weight as well as blood sugars. Examples of how many of each of the six types of exchanges to eat each day for the number of calories are shown in Table 4. A brief summary of the three food groupings (carbs, meat and fat) is given in the Appendix at the end of this Chapter. Foods in each sub-group contain similar numbers of calories and similar amounts of carb, protein and fat.

Table 4

## Examples of Foods (Exchanges) for Different Caloric Diets

**Note:** The *colored numbers* show the number of carbohydrate choices (15g amounts) for the number of calories/day for each of the three main meals and three snacks. The numbers not in dark print represent non-carb exchanges.

Calories/24 hrs.      1,200   1,500   1,800   2,000   2,200   2,500   2,700   3,000   3,500

### BREAKFAST

Meat	0	0	1	1	1	1	1	1	1
Bread	1	1	2	2	2	3	3	4	5
Fat	0	0	1	0	0	1	1	1	1
Fruit	1	2	2	2	2	2	2	2	2
Milk	1	1	1	1	1	2	2	2	2
	—	—	—	—	—	—	—	—	—
<i>Carb Choice Totals</i>	3	4	5	5	5	7	7	8	9

### LUNCH

Meat	1	1	1	2	2	3	3	3	5
Bread	2	2	2	3	3	3	4	4	6
Vegetable	0	0	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Fat	1	1	1	1	1	1	2	2	2
Fruit	1	1	2	2	2	2	2	2	2
Milk	1/2	1	1	1	1	1	1	1	1
	—	—	—	—	—	—	—	—	—
<i>Carb Choice Totals</i>	3.5	4	5	6	6	6	7	7	9

### DINNER

Meat	2	2	2	3	3	3	3	4	5
Bread	1	2	2	3	3	3	3	4	6
Vegetable	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3	1/3
Fat	0	1	1	1	1	1	1	1	2
Fruit	1	1	1	1	1	2	2	2	2
Milk	1/2	1	1	1	1	1	1	1	1
	—	—	—	—	—	—	—	—	—
<i>Carb Choice Totals</i>	2 1/2	4	4	5	5	6	6	7	9

Snacks (also included in the total calorie count)

10:00 a.m.              fresh fruit (small apple, orange, banana or half a medium banana)

3:00 p.m.                1,500-2,400 cal: 1 bread, 1 fruit  
2,500-3,500 cal: 2 bread, 1 fruit

9:00 p.m.                1,200-2,400 cal: 1 bread, 1 meat  
2,500-3,500 cal: 2 bread, 1 meat

*These plans are all 30 percent fat or less.*

## CALCULATING CALORIES

In the exchange food program, a caloric level that is appropriate for the age, size and activity of the person is prescribed. Most children under age 14 years need 1,000 calories per day plus 100 calories for each year of age. For example, a five-year-old would need 1,500 calories:

$$5 \text{ years} \times 100 = 500 \text{ cal/day}$$

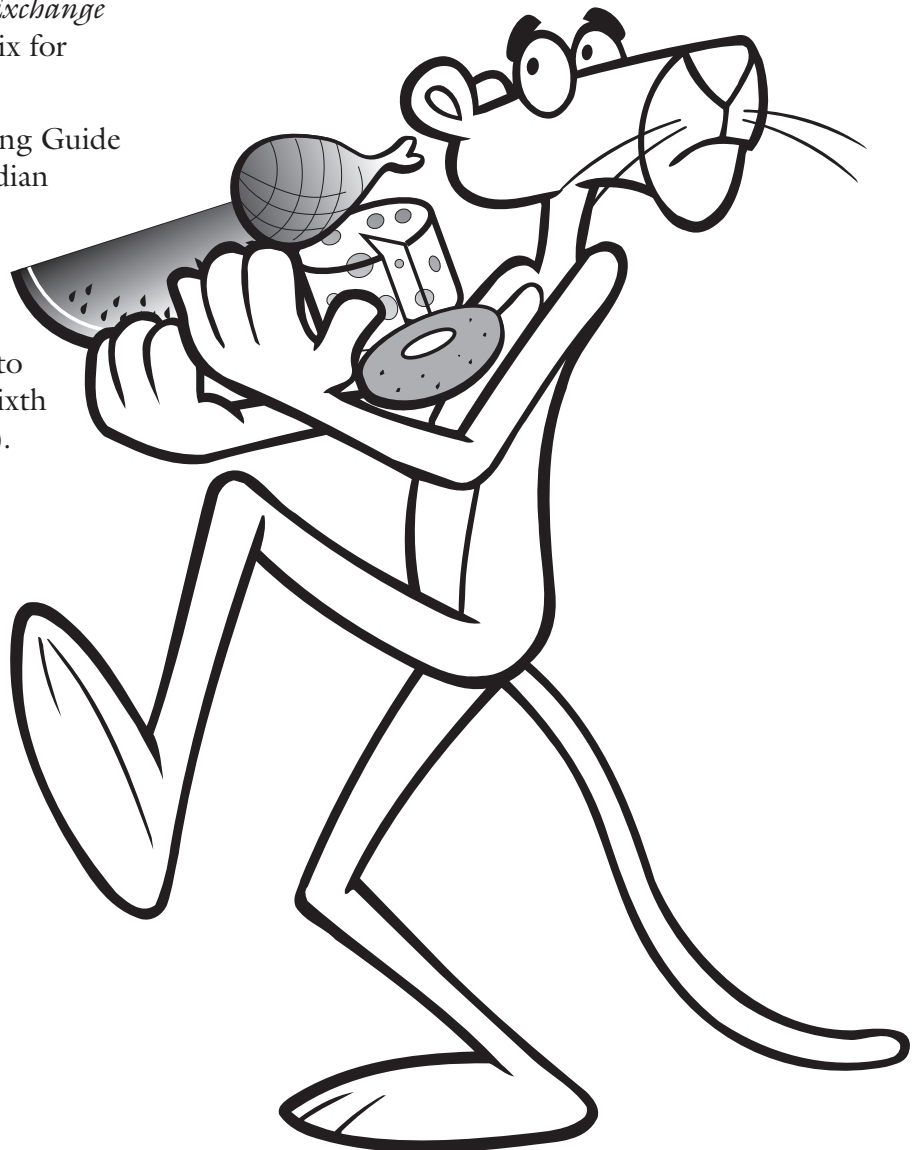
$$500 + 1,000 = 1,500 \text{ cal/day}$$

The dietitian changes the calories into exchanges. The exchanges are then divided into meals and snacks (Table 4). This meal plan allows both consistent carb intake and a variety of foods. In addition to working with a dietitian, buying the ADA booklet *“Exchange Lists for Meal Planning”* (see Appendix for ordering address) would be helpful.

In Canada, the Good Health Eating Guide (GHEG) was developed by the Canadian Diabetes Association to have six food groups. They are slightly different from the U.S. Fruits and vegetables are combined into one group and each serving is equivalent to 10g of carb and 1g of protein. The sixth food group are the extras (free foods).

## CHOOSING A MEAL PLAN APPROACH

One type of meal plan has not been shown to be better for people with diabetes than another. The best meal plan for your family is the one that fits your lifestyle. All three programs work. You could take parts of each program and develop a meal plan suitable for your eating habits and lifestyle. Many families change from one type of program to another to fit their needs at the time. **HOWEVER, THERE MUST BE SOME PROGRAM OF FOOD MANAGEMENT.** Initially, after evaluating your family’s eating patterns, it may be wise to let the dietitian help choose the best food program for your family.



# TEN PRINCIPLES OF FOOD MANAGEMENT FOR ALL FOOD PLANS

The ten principles listed below are important in all three plans. They would be helpful for any person to follow.

1. **Eat a Well-balanced Diet**
2. **Eat Meals and Snacks at the Same Time Each Day (variable depending on food plan being used)**
3. **Use Snacks to Prevent Insulin Reactions**
4. **Balance Carb Intake and Insulin Carefully**
5. **Avoid Over-treating Low Blood Sugars**
6. **Reduce Cholesterol and Saturated Fat Intake**
7. **Maintain Appropriate Height and Weight**
8. **Increase Fiber Intake**
9. **Avoid Foods High in Salt (Sodium)**
10. **Avoid Excessive Protein Intake**

## 1. Eat a Well-balanced Diet

A well-balanced meal plan is a step toward good health for everyone in the family. It is particularly important in supporting the growth of children. If you understand normal nutrition (Chapter 11), you can help your family have a well-balanced meal plan. Most people have a period of weight loss prior to being diagnosed with diabetes. Starting insulin treatment allows the body to regain weight. Usually the individual's appetite is ravenous for about one month. The body is returning to its usual growth pattern. The appetite then returns to normal. Most individuals can then self-regulate their caloric intake without a set number of

calories being prescribed for each day. The exchange food program can help in following a recommended caloric intake.

*A well-balanced meal plan is currently considered to contain:*

- ✓ 45-65 percent from carbs
- ✓ 20-35 percent of calories from protein
- ✓ 20-35 percent from fat

*Meals should be balanced and contain:*

- ✓ a rich source of carbs (fruits, vegetables and whole grains). At least four and one-half cups of fruits and vegetables are recommended daily for a 2,000 calorie intake. (This is generally an area children and teens need to increase.)
- ✓ a moderate amount of protein (milk, cheese, yogurt, meat, poultry, fish, egg white, nuts and seeds)
- ✓ a limited amount of fat (butter, egg yolk, animal fat, etc.)

An excess of animal fat may result in higher blood fats and a greater risk for heart disease later in life. A high-protein diet is harmful to the kidneys for people who have either early or advanced kidney damage from diabetes. Working with the dietitian will help assure intake of the recommended balance of foods.

## 2. Eat Meals and Snacks at the Same Time Each Day

For people following a constant carb or exchange program and using relatively constant insulin dosages, it is important to eat meals and snacks at the same time each day. Use of an insulin pump or Lantus insulin gives more flexibility. This is especially true when either is used with adjusting insulin for carb intake. Carb counting allows a person to take insulin to match carbs when they are eaten. There can be more flexibility in the timing of meals and snacks as well as in the number of carbs eaten.

### 3. Use Snacks to Prevent Insulin Reactions

Snacks help to balance the insulin activity. Peaks in insulin activity vary from person to person. You will learn from experience when you need a snack. It may be before lunch, in the late afternoon or at bedtime. Discuss your need for snacks at your clinic visits. Young children often have a mid- or late-morning snack. Teens and adults may not always need a morning snack. Mid- or late-afternoon snacks are eaten by most people with (or without) diabetes. Most children with diabetes need a bedtime snack, particularly if they have had heavy exercise that day. Some people use a bedtime snack only if their blood sugar is below 130 mg/dl (7.3 mmol/L). People with a pre-bedtime snack glucose level of below 130 are more apt to have a low sugar during the night. Once it is decided which snacks you need, **TRY TO BE CONSISTENT**. Suggestions for daytime and bedtime snacks are given in Tables 5 and 6.

The type of snack is also important. Fruits are good for a morning or afternoon snack. Proteins with fat, such as cheese or meat, delay absorption. **A SOLID SNACK CONTAINING PROTEIN, FAT and CARBS IS BEST FOR BEDTIME.** The solids take longer to digest. The fat delays stomach emptying. Uncooked cornstarch may be broken down slower than other carbs and helps some children prevent lows during the night. Two cornstarch recipes are given in Table 7. Your dietitian can suggest other cornstarch recipes, or you can buy cornstarch snack bars (usually \$1.00 each) from several companies.

### 4. Balance Carb Intake and Insulin Carefully

It is recommended that about half of the food we eat come from carbs. As insulin must be available to utilize most carbs, it is important to learn to balance your insulin with carb intake. Tables 1, 2 and 3 list the carb contents of different foods. It is known that the rise in blood sugar after eating is dependent upon the total amount of carbs eaten and not the form of

carbs. It has been pointed out that, “**a carbohydrate is a carbohydrate, is a carbohydrate...**”

*We know the most important factors are:*

- A. how much carb is eaten
- B. when the carb is eaten
- C. with what the carb is eaten
- D. having adequate insulin available when the carb is eaten. Each will be discussed in more detail.

#### A. How much carb is eaten

Some meals are much higher in carbs than other meals. At breakfast, a meal of eggs, bacon and toast would have fewer carbs than a plate of pancakes. Similarly, a meal of meat, vegetables and salad would have fewer carbs than one of spaghetti and garlic bread or of pizza. More insulin will be required to handle a meal high in carbs compared with one low in carbs.

#### B. When the carb is eaten

Large amounts of carbs should not be consumed between meals unless additional insulin is given. An extreme example is using a regular (sugar) pop (40g of carbs) as a morning or afternoon snack.

*One boy with diabetes brought a can of regular sugar pop (10 tsp of sugar, see Table 3) to our clinic with him, freely admitting that he still drank regular pop. We measured his blood sugar before drinking the pop (180 mg/dl or 10.0 mmol/L) and one hour later (450 mg/dl or 25.0 mmol/L). The liquid sugars cause the fastest rise in the blood sugar.*

When extra carbs are eaten, it is best to take extra rapid-acting insulin. The carb contents of some high carb foods are shown in Table 3.

#### C. With what the carb is eaten

A research project was done at our Center on children with diabetes. The children came in on four consecutive Saturday mornings for



breakfast. This project evaluated four different breakfasts varying in sugar or protein and fat content. The blood sugars peaked later and remained higher for a longer time when fat was added (whether extra sugar was added or not).

High fat meals (e.g., pizza, Chinese food, fast-foods) will delay the absorption of carbs and the blood sugar may stay elevated longer. When this is observed, extra rapid-acting insulin can be given the next time. **DIFFERENT FOODS AFFECT EACH PERSON DIFFERENTLY. EXPERIENCE IS THE BEST TEACHER.**

Research on the effects carbs have on blood sugar levels is often studied by giving the carb by itself. Then, blood sugar levels are measured to see how much the level rises in comparison to the increase in blood sugar caused by a reference food (“**glycemic-index**”). However, the effects of other foods are very important and it is rare that a carb is eaten all by itself. The best way to find out the effect of a given carb is to check the blood sugar, eat the food and/or meal and check the blood sugar again in two to three hours.

#### **D. Having adequate insulin activity when the carb is eaten**

Eating extra carbs is possible if extra rapid-acting insulin is added. Measuring the blood sugar two hours after the meal will determine if the insulin dose used was appropriate.

Most adults are good about taking extra insulin when snacks are consumed between meals. Diabetes is a high priority. Unfortunately, children are not as good about this. The “rule of thumb” is that if 15g of carbs are eaten insulin should be given. Having an insulin pump or an insulin pen may help make this more likely.

On special occasions, such as birthday parties, the person with diabetes can consume extra carbs. Extra sugar **will not make the person ill and will not cause acidosis**. Not taking extra insulin may result in higher than usual blood sugar and more frequent urination

as the sugar passes into the urine. Often the extra activity or excitement at a party balances the extra carb intake.

It is generally healthier to allow a person to fit in a sweet food on an “as-needed” basis. Allowing this can prevent the sneaking of candy or treats. This can be planned for a time when adequate insulin is available. We encourage the entire family to get used to eating foods without a “sugary” taste. **To allow for better nutrition, avoid having non-nutritional foods (Table 3) such as donuts, cookies, cake, etc. in the home. If they are there, they will be hard to avoid.** Most have no nutritional value except adding calories. This will result in better nutrition for the entire family.

There are several alternatives for handling holidays and parties where there are a great number of concentrated sweets. Halloween focuses on candy and is a special problem for young children.

*Some suggestions for Halloween trick-or-treating candy:*

- ✓ The child can select a few for his/her regular treats, and give or throw the rest away. If sweets are to be eaten, it is best to eat them when insulin is working. The dose of rapid-acting insulin for that meal can then be increased.
- ✓ Taking the treats to a sick friend or a child in the hospital is a nice option.
- ✓ Another option is to “sell” the candy to the parents. The money can then be spent to purchase something the child wants.

It is important not to become upset with a child if he/she does eat extra sweets. The stress of the parent being upset can raise the blood sugar more than the sweets (see Chapter 17 on Family Concerns). Instead, discuss the incident with the child and try to find compromises.

#### **5. Avoid Over-treating Low Blood Sugars**

Avoiding the over-treatment of low blood sugars (hypoglycemia) was one of the factors found in the DCCT to relate to better sugar

## Table 5 Healthy Daytime Snacks

Snacks, besides being fun to eat, help prevent low blood sugar levels and provide energy between meals. Typical snacks are usually 1-2 carb choices or 15-30g of carb. Below are some low-fat snack ideas to try.




### 15g of carb or one carb choice

1 small apple or orange	18 small pretzel twists
2 popcorn cakes	1/2 small bagel with fat-free cream cheese
8 oz or 1 carton light yogurt	3 cups air popped or low-fat microwave popcorn
1 1/2 graham crackers	4-5 vanilla wafers, 5-6 saltine crackers
1/2 cup low-fat ice cream	1 fruit juice bar
2 Tbsp raisins	1/2 cup unsweetened applesauce
1/2 cup sugar-free pudding	1 fruit roll-up

### 30g of carb or two carb choices

1 small bagel with fat-free cream cheese	1 oz baked tortilla chips with 1/4 cup salsa
1 low-fat granola bar	1 large banana or 2 pieces of fruit (small)
4 oz individual fruit cup and 1 cup skim milk	1 cup Cheerios® with 1/2 cup skim milk
2 caramel corn cakes	1/4 cup dried fruit
15 baked potato chips	1 cereal bar
2 fig cookies and 1 cup skim milk	14 animal crackers and 1/2 cup skim milk

### SPECIAL SUGGESTIONS

-  Encourage fresh fruit rather than juice as a routine snack (unless blood sugar is low)
-  Sugar-free flavorings (e.g., sugar-free cocoa or milk flavorings) can be added to milk
-  If the child is still hungry after the snack, offer water, popsicles made using diet pop or Kool-Aid or sticks of sliced fresh carrots or celery placed in a dish with cold water and ice cubes

### TWO GOOD SUMMER DAYTIME SNACKS

#### Yogurt creamsicles

Combine:  
 1/2 cup plain skim milk yogurt (1/2 carb)  
 1/2 cup fruit juice concentrate, undiluted (3 carbs)  
 Freeze in popsicle molds until solid.  
*The total mixture = 3 carb choices*

#### Fruit popsicles


Blend:  
 1 cup fresh fruit: berries, peaches or bananas (2 carbs)  
 1/2 cup apple juice concentrate, undiluted (3 carbs)  
 Freeze in popsicle molds until solid.  
*The total mixture = 5 carb choices*

**Table 6**  
**Possible Bedtime Snacks**

Bedtime snacks play an important role in blood sugar control for people with type 1 diabetes. A snack which includes food sources of carbohydrate and protein is helpful in maintaining blood sugar levels throughout the night. A typical snack includes 15g of carbohydrate and 7-8g of protein, but this can vary depending on age, blood sugar levels and activity throughout the day. Most protein also contains some fat, which results in food staying in the stomach longer. Examples of foods containing 15g of carbohydrate and 7-8g of protein are listed below:

15g of Carbohydrate	plus	7-8g of Protein
1 slice of bread		2 Tbsp peanut butter
1 – 6” tortilla		1/4 cup grated cheese
6 saltine crackers		1 string cheese
3 cups popcorn		1 oz of meat or 1 egg
12 small pretzels		2 Tbsp sunflower seeds
3/4-1 cup cereal		1/4 cup peanuts
5 vanilla wafers		1 cup milk*
		8 oz of no-sugar-added yogurt*

*\*Yogurt and milk provide about 15g of carbohydrate as well as protein.*

 We prefer some solid food at bedtime—which will “churn-around” in the stomach prior to passing to the intestine where most food is absorbed. Thus, milk or yogurt alone might pass rapidly through the stomach, but milk and cereal or yogurt and crackers might pass through more slowly.

Adjustments in carbohydrate amounts can be made based on what the blood sugar is at bedtime.

*Here are some guidelines to follow:*

- If blood sugar is 150-200 mg/dl (8.3-11.1mmol/L), have 15-20g of carbohydrate and 7-8g of protein.
- If blood sugar is 100-150 mg/dl (5.5-8.3 mmol/L), have 25-30g of carbohydrate and 7-8g of protein.
- If blood sugar is less than 100 mg/dl (5.5 mmol/L), have 30-45g of carbohydrate and 7-8g of protein.

*Table 7 gives possible recipes for cornstarch snacks.*

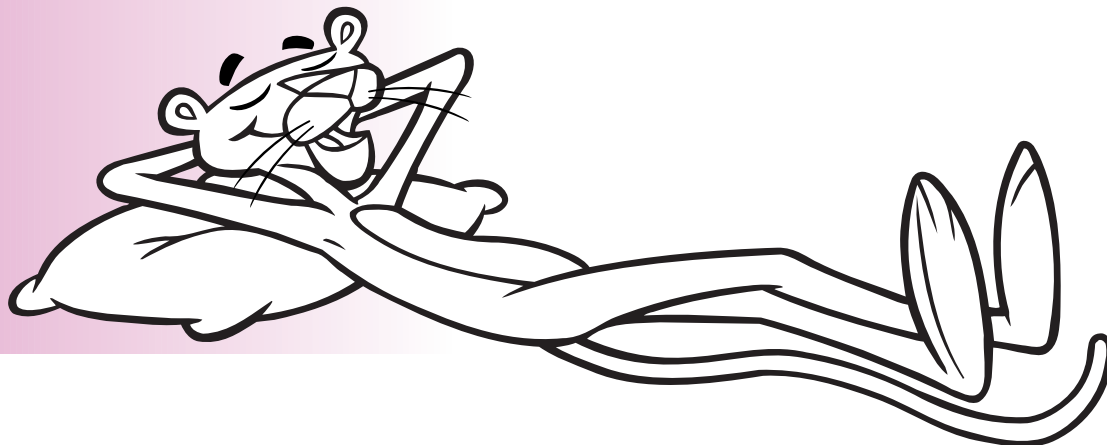


Table 7

## Two Cornstarch Recipes to Use for Bedtime Snacks\*

### Corny “O”s\*\*

- 1/2 stick butter or margarine
- 1/2 cup chocolate chips
- 1/2 cup peanut butter
- 5 cups Cheerios
- 1 cup cornstarch
- 1/2 cup powdered sugar

1. Melt butter and chocolate chips, add peanut butter
2. Pour mixture over Cheerios
3. In a paper sack, combine cornstarch and powdered sugar. Add Cheerios mixture and shake until Cheerios are completely covered.

<b>Quantity:</b>	<b>10 servings</b>
Serving size:	1/2 cup
Carb	34g/serving
Protein	5g/serving
Fat	14g/serving

### “Corny Cookies”

- 12 Tbsp (3/4 cup) peanut butter
- 3 Tbsp honey
- 1/4 cup cornstarch
- 2 cups cornflakes

1. Stir together peanut butter, honey and cornstarch
2. Form into balls, about 1 Tbsp size, and roll in crushed cornflakes
3. Flatten balls with a tumbler and chill

<b>Quantity:</b>	<b>1 dozen</b>
Serving Size	1 cookie
Carb	13g/1 cookie
Protein	4g/1 cookie
Fat	8g/1 cookie
Serving Size:	2 cookies
Carb	26g/2 cookies
Protein	8g/2 cookies
Fat	16g/2 cookies

\*Developed by Michelle Hansen, MS, RD, CDE

\*\* Not for children under 2 years old

control (a lower HbA1c level). The problem is how to accomplish this. Only a person who has had a truly low blood sugar can know the feeling of being “ravenously hungry” and wanting to eat everything in sight (and so the person does). For many years, people thought “rebounding” to be the cause of the high blood sugar after hypoglycemia. Only in recent years was it realized to be primarily due to excessive eating after the low blood sugar.

*Chapter 6 discusses the treatment of hypoglycemia and emphasizes:*

- A. checking the blood sugar to see how low the value is and repeating this at 10 minute intervals to see if the value is rising
- B. drinking one cup of milk (8-10 oz) or 1/2 cup of juice or four ounces of sugar pop
- C. or taking 1/2 tube of Instant Glucose or

four dextrose tablets (e.g., 15g of carb or one “carb” choice). Wait 10 minutes and do the second blood sugar level.

- D. if the value has **not** risen, repeat the process using 15g of carb or one “carb” choice every 10 minutes until a rise does occur
- E. if the blood sugar is rising after 10 minutes and is above 60 mg/dl (3.2 mmol/L)
  - ✓ eat solid food, such as two or three crackers with peanut butter or cheese
  - ✓ if it is close to mealtime, just eat the next meal

Not eating too much, but enough to raise the blood sugar, is tricky. It can vary from person to person or from one time to another for the same person. Careful monitoring of blood sugar levels is essential.

## 6. Reduce Cholesterol and Saturated Fat Intake; Reduce Total Fat Intake (see Chapter 11)

Cholesterol and triglyceride are two of the major fats present in our blood.

*Cholesterol is found in many foods, but it is particularly high in:*

- ✓ egg yolks
- ✓ organ meats
- ✓ large portions of high-fat red meat (e.g., prime rib)

Cholesterol is found in animal products only.

*There is no cholesterol in:*

- ✓ fruits
- ✓ vegetables
- ✓ cereals
- ✓ grains
- ✓ beans
- ✓ nuts
- ✓ seeds

The eating of saturated fat in animal products like meat, cheese and whole milk may raise blood cholesterol levels even more than eating high cholesterol foods. This is discussed in more detail in the previous chapter on Normal Nutrition. Blood cholesterol and triglyceride levels can also be high if blood sugar levels are too high.

The blood cholesterol and LDL cholesterol levels should be checked once a year. If your doctor has not checked these levels, you should request that this be done. Suggested levels for people with diabetes are given in Table 2 of Chapter 11. If a high level is found, the dietitian can make suggestions to help lower it. The average American now eats 400-450 mg of cholesterol per day. This should gradually be reduced to about 300 mg per day. Table 3 in Chapter 11 gives suggestions for reducing fat and cholesterol intake. Each egg has about 213 mg of cholesterol. Egg white is a good source of protein. Some people now just eat the whites, which have no cholesterol.

Triglyceride levels for a given person tend to be variable. They are related to the diabetes control at the time, the amount of exercise in the previous week and other factors. It is necessary to be fasting for accurate triglyceride and lipoprotein (LDL and HDL) determinations. Fasting is sometimes dangerous for people with diabetes (e.g., driving across town with no food intake). We now often draw a “lipid panel” once yearly when it has been at least three to four hours since the last meal (Chapter 11).

## 7. Maintain Appropriate Height and Weight

Normal growth is important for children and teenagers. An important part of clinic visits is to make sure the height and weight are increasing appropriately. Research has shown that if blood sugar control is poor during the teenage years, final adult height will be less.

About 30 percent of people with type 1 diabetes and 80 percent of people with type 2 diabetes are overweight. Preventing excessive weight gain by staying active and eating healthy is important. If you have questions about weight management, meet with a registered dietitian.

We discourage the use of quick weight loss diets and diet pills. They do not teach a person to eat correctly. When the fad diet is over, the weight is almost always regained. It is much wiser to work with a registered dietitian to learn healthy eating habits and to develop a plan to gradually reduce weight. It is important for parents to be careful not to be critical or to emphasize a child’s weight gain. It can make the problem worse and lead to eating disorders or missed shots. If a parent has concerns, it might be better to express them to the dietitian or to other diabetes team members.

## 8. Increase Fiber Intake

Fiber is the roughage in our food that is not absorbed into the body. Many of us don’t have enough fiber in our diets. Adding fiber may slow the rise in blood sugar levels for children with



diabetes. The blood sugar may not be as high two hours after eating an apple (one carb choice) as it is two hours after drinking 1/2 cup (four ounces) of apple juice (one carb choice). Extra fiber is good for people, particularly in helping to avoid constipation. Raw fruits, vegetables, legumes, high-fiber cereals and whole wheat breads are the most effective high-fiber foods.

## 9. Avoid Foods High in Salt (Sodium)

If a person has borderline high blood pressure, a high salt intake may bring out this tendency. People who eat at fast-food restaurants have a higher salt intake. Those who have early kidney damage seem to be more likely to have an increased blood pressure from high salt intake.

*Foods higher in salt are:*

- ✓ many canned soups
- ✓ frozen vegetables in sauces
- ✓ fast-foods
- ✓ many snack foods (especially chips)

The new Dietary Guidelines recommend that all people eat under 2,300 mg of sodium (1 tsp of table salt) each day.

Increased blood pressure is an important risk factor for both the eye and the kidney complications of diabetes as well as heart attacks. Therefore, it is important not to eat large amounts of salt. If the blood pressure is elevated even less may be recommended. This can be discussed with the dietitian.

## 10. Avoid Excessive Protein Intake

It is difficult to avoid an excess of protein when someone has been told not to eat excessive amounts of sugar, animal fat and salt. Many teenagers eat four to six times the quantity of protein needed. This is particularly true for those who frequently eat or snack at fast-food restaurants. Athletes should not consume protein (amino acid) supplements. Only exercise builds muscle - not protein supplements. Extra protein is bad when kidney damage is present, as it presents an extra load

for the kidneys. It is still unclear whether or not high protein intake contributes to the kidney complications of diabetes. The best method to reduce protein intake is to decrease portion size (e.g., smaller meat portions). Meats, eggs and cheese can be eliminated from breakfast and the morning and afternoon snacks. However, we recommend that the bedtime snack include carbs, protein and fat as they may help to keep the blood sugar at a reasonable level during the night.

## SUMMARY

The key to food management in diabetes is constant thinking and matching insulin to carb intake. The entire family must help with this.

*Important points:*

- ✓ There is no difference in the effect of a simple sugar compared with a starch in raising the blood sugar level.
- ✓ A person with diabetes can eat almost any food in moderation if it is worked into the meal plan.
- ✓ A person with diabetes can eat foods with simple sugars in them. The simple sugar should be eaten at a time when adequate insulin is present.
- ✓ Nutritious carb choices should be encouraged whenever possible.
- ✓ Frequent blood sugar testing (e.g., two hours after eating various foods) is encouraged to determine how a given food affects any individual.
- ✓ Blood sugar testing when an insulin reaction occurs is important in avoiding over-treatment of lows. The excessive eating with a hypoglycemic reaction (or just the psychological feeling of hunger) is a major concern in controlling blood sugar levels.

**Remember: Food management for people with diabetes does not mean a restrictive diet, but rather a healthy eating regimen that family and friends can also enjoy.**

## Appendix

# Summary of Exchange Lists

The purpose of this food list is to give examples of food exchanges and the concept of the “exchange food program.” A more complete reference is *“Exchange Lists for Meal Planning”*, 2004 update published by the **American Diabetes Association and the American Dietetic Association, P.O. Box 930850, Atlanta, GA 31193**. The cost is \$1.75, plus \$4.99 for shipping and handling (or less if purchased in quantities). In general, the idea of the exchange food program is to develop “equivalents” in each food group that are similar to each other in amounts of sugar and in calories. Nutrition instruction should be given by a dietitian or nutritionist. The food groups, with examples of foods that have similar values in each of the groups, are listed on the following pages.

### CARBOHYDRATE GROUP

**Starch/Bread List:** One bread exchange contains about 15g of carbohydrate and 3g of protein (80 calories).

*Examples are:*

- ✓ one slice of bread
- ✓ 1/2 hamburger or hot dog bun
- ✓ 3/4 cup of unsweetened cereal
- ✓ 1/3 cup cooked noodles
- ✓ three cups popcorn
- ✓ crackers (six small saltines, two squares of graham crackers, three of most other crackers)
- ✓ one pancake or waffle (5”)
- ✓ 15 potato or corn chips

*The vegetables included in the bread exchanges are:*

- ✓ corn (1/2 cup or one ear)
- ✓ white potato (one 3 oz baked or 1/2 cup mashed)
- ✓ yam or sweet potato (1/4 cup)
- ✓ green peas (1/2 cup)
- ✓ squash (1/2 cup)
- ✓ lima beans (1/2 cup)

**Fruit List:** One fruit exchange contains about 15g of carbohydrate (60 calories) and essentially no fat or protein.

*Examples of one fruit exchange are:*

- ✓ grape juice (1/3 cup)
- ✓ apple or pineapple juice (1/2 cup)
- ✓ orange or grapefruit juice (1/2 cup)
- ✓ one small apple, orange, pear or peach
- ✓ 1/2 banana
- ✓ 1 cup berries
- ✓ 1/3 of a small cantaloupe
- ✓ one cup of watermelon

**Milk List:** One milk exchange is the quantity equal to about 8g of protein or 32 calories, and 12g of carbohydrate or 48 calories (with a trace of fat for a total of 90 calories).

*Examples of one milk exchange are:*

- ✓ one cup of skim or non-fat milk
- ✓ one cup of 1% milk (also includes 1/2 fat exchange)
- ✓ one cup yogurt made from skim milk
- ✓ one cup of yogurt from 2% milk (also includes one fat exchange)
- ✓ one cup 2% milk (also includes one fat exchange)

**Vegetable List:** One-half cup of most vegetables (cooked or raw) has about 5g of carbohydrate and 2g of protein (25 calories).

*Examples are:*

- ✓ one-half cup of most vegetables (cooked)
- ✓ one cup raw vegetables

Raw lettuce may be taken in larger quantities, but salad dressing usually equals one fat exchange. Some raw vegetables are higher in carbohydrate, equal to 15g carbohydrate and 2g protein, and should be considered equivalent to one bread exchange in quantity. These include corn and potatoes and are listed in the Bread Exchanges.

## MEAT AND MEAT SUBSTITUTE GROUP

*The three groups are:*

1. **Very Lean and Lean** meat – one ounce of the lean meats contains 7g of protein and 3g of fat (55 calories).

*The best of the **Lean Meat** groups are:*

- ✓ poultry (chicken and turkey without the skin)
- ✓ fish
- ✓ lean pork
- ✓ USDA Select or Choice grades of lean beef
- ✓ 1/2 or 1% fat cottage cheese

2. **Medium Fat** Meat group - one ounce equals 7g of protein and 5g of fat (75 calories).

*Some examples are:*

- ✓ one ounce of ground beef
- ✓ most cuts of beef, pork, lamb or veal
- ✓ one ounce of low-fat cheese
- ✓ one egg

3. **High Fat** Meat group - one ounce equals 7g of protein and 8g of fat (100 calories).

*This group includes:*

- ✓ sausages
- ✓ spare ribs
- ✓ most regular cheeses
- ✓ processed sandwich meats

## FAT GROUP

Fat is necessary for the body and is particularly important during periods of fasting (overnight), when it is very slowly absorbed. One fat exchange contains 5g of fat (45 calories).

*This group includes:*

- monosaturated and polyunsaturated fats are better for us than saturated fats.

*One exchange includes:*

- ✓ 1 tsp margarine or 1 tsp of any vegetable oil (except coconut)
- saturated fat

*One exchange includes:*

- ✓ 1 tsp butter
- ✓ one strip of bacon
- ✓ 1 Tbsp of cream

## DEFINITIONS

**ADA:** American Diabetes Association.

**“Carb choice”:** Fifteen gram equivalent of carb used to determine the units of rapid-acting insulin to be taken.

**Carbohydrate (carb) counting:** A meal plan in which counting the grams of carb to be eaten (and considering the blood sugar level and any planned exercise) is used to adjust the dosage of rapid-acting insulin prior to meals.

**Cholesterol:** One of the two main blood fats. High levels are related to a greater chance for heart attacks later in life.

**Constant carbohydrate diet:** A meal plan in which the amount of carb is kept consistent from day-to-day to match a relatively consistent dose of insulin.

**DCCT:** Diabetes Control and Complications Trial, which ended in June, 1993. It showed that good glucose control helped to prevent eye, kidney and nerve complications of diabetes.

**Exchange diet:** A meal plan in which foods are grouped into one of six food lists having similar nutritional composition. Caloric intake and number of exchanges are set, but foods within a food group can be exchanged with one another.

**Glycemic index:** A ranking of foods based on the rise in blood sugar when that food is given alone (with no other food).

**Tablespoon (Tbsp):** A measure of 15cc (ml) or three teaspoons. It is equal to 15g (1/2 oz) of water.

**Teaspoon (tsp):** A measure of 5cc (ml). It is also equal to 5g of water.

**Triglyceride:** One of the two main blood fats. High levels are believed to be related to a greater risk for heart attacks later in life for people with diabetes.

## QUESTIONS AND ANSWERS FROM NEWSNOTES

**Q** Is there any way to know if the pop received at fast-food restaurants, theaters and other places is truly “sugar-free” or the regular sugar-containing pop?

**A** This question is asked frequently and the answer is “yes.” Probably the cheapest way to test is by using the Test-Tape®, a roll of yellow tape from which a piece can be dipped into the pop. It turns green if there is sugar in the pop. The Diastix® (the sugar-only part of KetoDiastix), or the distal sugar block on KetoDiastix will also change color if there is sugar present. Unfortunately, it is more common for the wrong pop to be served than most people realize, probably in the range of 20 percent of the time (one glass in five). As sugar pop is one of the most concentrated sources of sugar (approximately 10 tsp per can), it usually raises the blood sugar level to the 200-400 mg/dl (11.1-22.2 mmol/L) level. This is especially true if it is consumed without other foods, which slow the absorption of the sugar, or at a time when a rapid-acting insulin is not taken to allow the sugar to enter the cells.

**Q** How important is a diet in relation to my HbA<sub>1c</sub> and my blood sugar control?

**A** The best answer to this comes from the DCCT data (*“Diabetes Care”* 16:1453, 1993). They found that patients in their intensive treatment group (mean HbA<sub>1c</sub> = 7.1 percent) who followed a meal plan over 90 percent of the time had an average HbA<sub>1c</sub> level that was 0.9 percent lower than those who followed a meal plan less than 45 percent of the time. As the HbA<sub>1c</sub> difference in the intensive treatment group was 1.8 percent (7.1 percent vs. 8.9 percent), this suggests that half of the difference was related to following a food plan.

*Other factors that were important in relation to a lower HbA<sub>1c</sub> level were:*

- doing a prompt correction when a high blood sugar was found
- adjusting the insulin for meal size
- not eating extra snacks
- avoiding over treatment of low blood sugars (hypoglycemia)

Our Clinic always has registered dietitians available at the time of clinic visits. Our preference in food management at this time is the use of carb counting. Since we know carbs are the nutrients that are converted to blood sugar, patients need to learn how to match insulin dosage with carb intake. We even offer a Friday afternoon class once a month just on carb counting. We ask that all families meet with a dietitian at least once a year. If a family has not done this, they can request to do so at their clinic visit.

