General Overview of Diabetes and Food

What is diabetes?

Diabetes is a disease in which the glucose in the blood is higher than normal. High blood glucose is called hyperglycemia. Glucose is a type of sugar that comes from foods containing carbohydrates and is found in everyone's blood. Glucose is transported through the blood to all tissues and organs to be used for energy. Blood glucose should not be too low (hypoglycemia) or too high (hyperglycemia). The body usually keeps blood glucose within a certain range by using stored glucose when needed, or storing the glucose when it is not needed. The body is normally able to control blood glucose levels using a hormone called insulin. Insulin is released by the pancreas in response to increased levels of glucose in the blood. With diabetes, however, the body has trouble making or using insulin. For this reason, blood glucose levels rise and hyperglycemia occurs.

How does food turn into glucose?

To understand and manage diabetes well, you must know what happens to food when you eat. Food is made of

- Carbohydrates
- Proteins
- Fats
- Vitamins
- Minerals
- Water

Carbohydrates, proteins, and fats all contain calories, and can all be used for energy. Too many calories can cause weight gain. Weight gain usually also results in higher blood glucose levels because the body becomes less sensitive to insulin. Vitamins, minerals, and water do not contain calories, cannot be used for energy, and do not affect blood glucose.

Carbohydrates, proteins, and fats all contain calories

When we eat, carbohydrates, proteins, and fats are digested and broken into smaller parts. Once

broken down, these parts will affect blood glucose differently depending on how they are absorbed and how the body uses them. Almost all the carbohydrate eaten will be converted into glucose in the body. The only carbohydrates not changed to glucose are those that cannot be digested, like fiber.

So the amount of food that's eaten can affect blood glucose – too much can lead to weight gain, insulin resistance, and higher blood glucose levels. Carbohydrates affect blood glucose, because carbohydrates are digested and broken into smaller parts that are primarily glucose units.

Is glucose bad for people with diabetes?

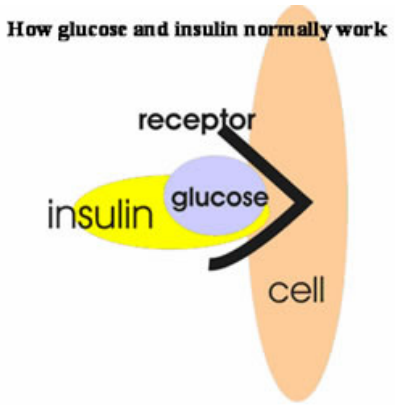
No, glucose is not bad for people with diabetes. Everyone, including people with diabetes, needs glucose for energy. We need energy to play, exercise, and work, but we also need it for everyday body functions, like breathing, digesting, and making blood cells. Most of the glucose in our body comes from eating carbohydrates. People without diabetes are able to keep their blood glucose levels in a normal range regardless of the amount they eat. For people with diabetes, it is harder to keep blood glucose in a normal range. For this reason, people with diabetes need to balance the amount of food that they eat (especially food that contains carbohydrates) with their medication and activity level.

Why do some people have high blood glucose levels?

Glucose primarily comes from the food we eat. Mainly foods containing carbohydrates are broken down into glucose and used for energy. Once food is broken down into glucose, it enters the blood and is carried to all the cells of the body. However, in order for glucose to enter the cell, a special helper and cell receptor are needed. The helper that glucose needs to enter the cell is called insulin. Insulin is a hormone made by the pancreas. Cell receptors are like doorways into a cell. A cell can have many receptors.

To imagine how glucose, insulin, and cell receptors work, think of your car. To park in your garage, you need a garage door and a garage door opener. Glucose is like your car, the cell receptor is like the garage door, and the insulin is like the opener.

If your body does not make enough insulin or if the insulin or the cell receptors do not work the way they should, glucose cannot get into your cells. Instead, glucose stays in your blood causing hyperglycemia. A complete lack of insulin results in type 1 diabetes. Insulin or cell receptors that do not work properly result in **type 2 diabetes**.



Are there different types of diabetes?

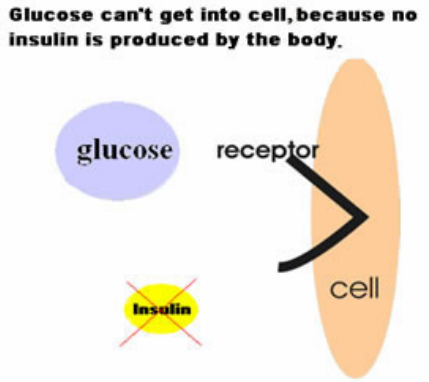
There are three main types of diabetes: type 1 diabetes, type 2 diabetes, and gestational diabetes.

Type 1 Diabetes

Type 1 diabetes can occur at any age, but is most often diagnosed early in life. Type 1 diabetes is called an autoimmune disease, because the immune system attacks the person's own cells. In this type of diabetes, cells in the pancreas that produce insulin are the target of the body's immune system and are eventually destroyed. For this reason, people with type 1 diabetes produce no insulin so glucose cannot get into the cells.

Symptoms of type 1 diabetes include:

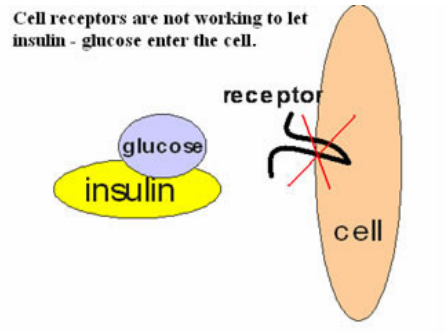
- Weight loss
- Thirst (polydipsia)
- Extreme hunger (polyphagia)
- Excessive urination (polyuria)
- Weakness or tiredness



Type 2 Diabetes

Type 2 diabetes is the most common form of diabetes. Ninety-five percent of the people who have diabetes have type 2. Although it was once thought that type 2 diabetes occurred only in adults, it is now known that people can develop type 2 diabetes at any age. With type 2 diabetes, the receptors on the cells become resistant to insulin and therefore cannot let glucose into the cell. Type 2 diabetes may also result if the body does not make enough insulin. Both problems with the cell receptor or with the amount of insulin produced, lead to high blood glucose levels. Being overweight and inactive increases the chance of developing type 2 diabetes.

Insulin resistance is a condition when normal insulin levels do not result in glucose entry into the cell. Higher than normal insulin levels in the blood occur in insulin resistance.



People who have insulin resistance are usually overweight or obese. They may have a normal blood glucose, be diagnosed as "pre-diabetes", or have type 2 diabetes. People who have a normal blood glucose may have no symptoms of insulin resistance but usually develop pre-diabetes. Those with pre-diabetes usually develop type 2 diabetes. The exception to this progression occurs when overweight or obese people lose weight, eat a healthy diet, and exercise regularly.

Not everyone who is obese or overweight will develop insulin resistance, although a lot of people will. Genetics, diet, and activity levels all can play an important role in how well insulin and glucose interact.

Symptoms of type 2 diabetes include:

- Frequent urination (polyuria)

- Thirst (polydipsia)
- Blurred vision
- Unintentional weight gain or weight loss, although little weight change may occur
- Fatigue
- Many people have no noticeable symptoms

Gestational Diabetes

Gestational diabetes is a form of diabetes that occurs during pregnancy. When a woman becomes pregnant there are many hormonal changes that take place. These changes, especially in the later stages of pregnancy, can affect the mother's sensitivity to insulin. When the mother becomes resistant to insulin, her cells do not let glucose in and her blood glucose levels rise. When blood glucose levels **rise above a certain level, gestational diabetes is diagnosed.** Doctors often check women's blood glucose levels during their pregnancy because high blood glucose levels can cause complications during the pregnancy or after the baby is born. These complications include infants of high birth weight, increased risk of cesarean delivery, infant respiratory distress syndrome, infant hypoglycemia following delivery, and infant jaundice. The presence of fasting hyperglycemia greater than 105mg/dl may be associated with increased risk of fetal malformations and death. Although gestational diabetes usually goes away after the baby's birth, women with this type of diabetes are at high risk for developing type 2 diabetes later in life.

How is diabetes diagnosed?

There are two types of tests that can be used to diagnose diabetes or pre-diabetes: a Fasting Plasma Glucose Test (FPG) or an Oral Glucose Tolerance Test (OGTT). This test should be performed by a doctor for a diagnosis to be made and often needs to be repeated on at least two occasions.

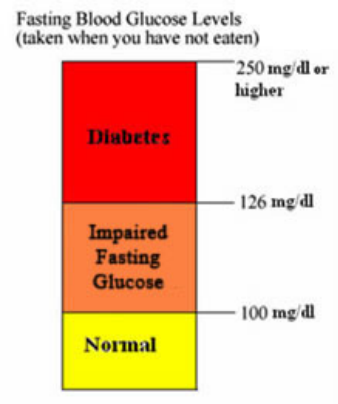
According to the American Diabetes Association, a FPG test that results in a fasting blood glucose level between 100 and 125 mg/dl signals pre-diabetes. A person with a fasting blood glucose level of 126 mg/dl or higher has diabetes.

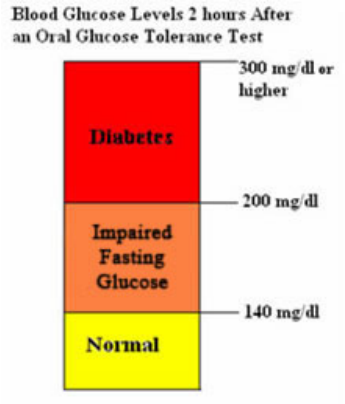
In the OGTT, a person's blood glucose level is measured after a fast and two hours after drinking a glucose-rich beverage. If the two-hour blood glucose level is between 140 and 199 mg/dl, the person tested has pre-diabetes. If the two-hour blood glucose level is 200 mg/dl or higher, the person tested has diabetes.

What is pre-diabetes?

Pre-diabetes occurs when blood glucose levels are higher than normal, but lower than levels used to diagnose diabetes. Other phrases sometimes used to describe pre-diabetes include "borderline diabetes" or "blood sugar a little high." People with pre-diabetes are said to have impaired glucose tolerance and/or impaired fasting glucose levels. The American Diabetes Association defines impaired glucose tolerance and impaired fasting glucose as:

Impaired Glucose Tolerance = A 2-hour value of an oral glucose tolerance test that is greater than or equal to 140 mg/dl but less than 200 mg/dl.
Impaired Fasting Glucose = A fasting blood glucose level of greater than or equal to 100mg/dl but less than 126 mg/dl.





Pre-diabetes puts people at high risk for developing diabetes, but also gives them a head start on preventing this disease. People told that they have pre-diabetes can often bring their blood glucose levels back down to normal by balancing a healthy diet with physical activity and weight loss.

Can people with diabetes prevent the complications of this disease?

Diabetes is a serious disease that can affect the heart, circulation, eyes, feet, kidneys, nervous system, teeth, and gums. Diabetes affects so many organs and systems, because blood travels throughout the whole body. When blood glucose becomes too high, it can damage the blood vessels of the body and lead to cardiovascular disease, retinopathy, amputations, kidney disease, neuropathy, and impotence. The risk of these complications can be greatly reduced by keeping blood glucose levels within the target range.
For this reason, it is important to check blood glucose levels every day, and share these values with a health care provider.

Treatment goals

There are certain goals set by the American Diabetes Association concerning the treatment of diabetes. They are:

1. Maintain a near-normal level of blood glucose. This can only be achieved by balancing the amount of food eaten with the amount exercise performed, and the amount of insulin available and effective. The insulin can be either what the body makes (endogenous) or be insulin injections (exogenous). Oral glucose-lowering medications and physical activity can also help maintain normal glucose levels.
2. Achieve and/or maintain optimal blood lipid levels.
3. Achieve and/or maintain optimal weight.
4. Prevent and/or treat complications of diabetes, such as retinopathy, kidney disease, neuropathy, and cardiovascular disease.

Health care providers also recommend achieving normal blood pressure levels as a treatment

goal.

Managing your diabetes

How does someone with diabetes make sure they get the right amount of glucose, carbohydrate, or energy without their blood glucose getting too high? Remember that the food you eat is the energy that has to be balanced with exercise, which uses energy. The food that is best for someone who has diabetes isn't magic or tasteless or unusual. It is regular food in the right amounts. Managing your diabetes will reduce your risk for complications of diabetes and help you feel better on a daily basis. The management of diabetes has three parts:

- Making healthy food choices
- Participating in physical activity
- Taking your prescribed medications

One way to see if you are managing your diabetes effectively is to monitor your blood glucose daily. Self-monitoring of blood glucose (SMBG) allows you to check your blood glucose level with a glucose meter and glucose testing strip and see if you are at, above, or below the normal blood glucose range. SMBG makes it easy for you to check your blood glucose wherever you are and whenever it is convenient for you. It is important to check your blood glucose level daily, but ask your doctor how many times a day you should check your blood glucose level for best monitoring.

Another way to measure how effectively you are managing your diabetes is with the glycosylated hemoglobin or HbA1c test. Unlike SMBG, the **HbA1**c test is performed by your doctor or health care provider. This test gives you an approximate average of your blood glucose levels over the last 2-3 months. This average is given as a percentage. The American Association of Endocrinologists recommends that the goal for most people with diabetes should be a **HbA1c** result of less than 6.5 percent. The risk for diabetes complications increases when **HbA1c** results are consistently 6.5 percent or above.

For more information, visit:

- American Association of Clinical Endocrinologists http://www.aace.com/
- American Diabetes Association http://www.diabetes.org/

Dietary Guidelines for Americans

http://www.healthierus.gov/dietaryguidelines/index.html

Everyone has different needs, and should have individual treatment plans. The approach to a healthy diet for those who have diabetes is the same for everyone else. Following is a shortened version of the **2005 Dietary Guidelines for Americans** developed by the Department of Health and Human Services (DHHS) and the United States Department of Agriculture (USDA). These guidelines may help with basic meal planning for a healthy diet.

Eat a variety of foods

- Choose foods from all the basic food groups.

Eat the right amount of foods

- Keep your weight in a healthy range.
- Keep an eye out for gradual weight gain over time.

Eat plenty of fruits and vegetables

- If you need about 2000 calories each day, you should include about 2 cups of fruit and 2 ½ cups of vegetables, with higher or lower amounts depending on your calorie level. Visit the website www.mypyramid.gov to find out how many servings of fruits and vegetables are appropriate for you.
- Choose a variety of fruits and vegetables each day. In particular, select fruits and vegetables with dark or intense color, because these may be particularly rich in antioxidants.

Eat plenty of foods from the grains group

- Eat 3 servings or more of whole-grain foods per day. In general, at least half the grains you eat daily should come from whole grains.

Eat plenty of foods from the dairy group

- Eat or drink 3 servings each day from the dairy group.

Choose lower fat foods

- Less than 10 percent of your calories should come from saturated fatty acids.
- Choose lower cholesterol foods so your dietary cholesterol is less than 300 mg/day.
- Choose foods with little or no trans fat.
- Keep total fat intake between 20 to 35 percent of calories, with most fats coming from sources of polyunsaturated and monounsaturated fatty acids, such as fish, nuts, and vegetable oils.
- When selecting meat, poultry, beans, and milk or milk products, make choices that are lean, low-fat, or fat-free.

Choose foods with lower added sugar or caloric sweeteners

- Choose and prepare foods and beverages with little added sugars or caloric sweeteners like natural applesauce, or non-sweetened ice tea or use sugar substitute.
- Remember to brush your teeth after eating or drinking sugary or sticky foods.

Choose foods that are lower in sodium

- Use less salt when you are cooking.
- Add less salt to your meal at the table.
- Choose lower sodium foods.

If you drink alcohol, don't drink too much

- If you drink alcohol do so in moderation; no more than one drink per day for women, two drinks per day for men. Some examples of one alcoholic drink are 12 ounces of beer, 1.5 ounces of hard liquor, or 5 ounces of wine.

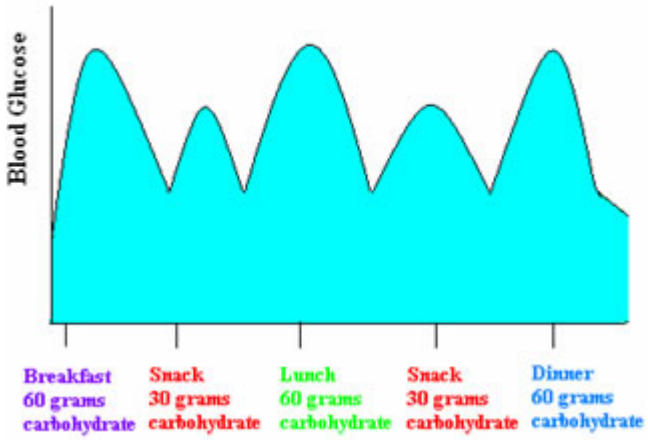
Remember to take the time to exercise

- Try to increase your physical activity gradually. A goal is 30 minutes of moderate-intensity physical activity, above usual activity, on most days of the week.
- If you are trying to lose weight, or not gain weight, you may need more exercise. Usually about 60 minutes of moderate-intensity to vigorous-intensity activity is needed on most days.
- Include aerobic exercise to raise your heart rate, stretching exercises for flexibility, and resistance exercises for muscle strength and endurance into your physical activity plan.
- Check with your doctor before starting any exercise program. People with diabetes already have the same risk for a first heart attack as someone without diabetes who has already had a heart attack. If you have any heart disease or high blood pressure you are at even greater risk.

Meal planning

The purpose of meal planning is to help you reach your personal blood glucose or weight goals. These goals should be discussed with your health care provider. How these goals are achieved will be different for everyone. Some may reach their goals by spacing their food intake and limiting portion sizes. Others benefit from a more specific meal plan. Serving sizes are always important when you plan your meals. Day-to-day variation in meals and snacks leads to uneven glucose pattern.

Eating meals and snacks spaced evenly throughout the day with the same amount of carbohydrates at each meal helps to keep blood glucose patterns even.



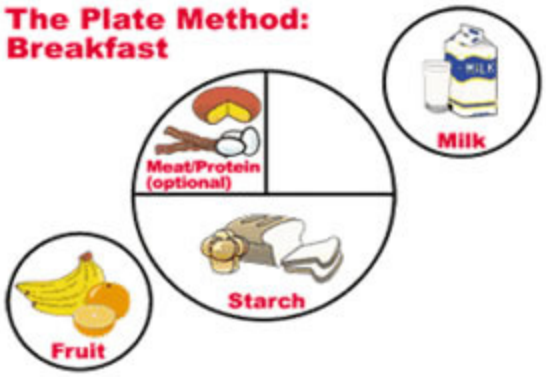
Four commonly used methods of meal planning include:

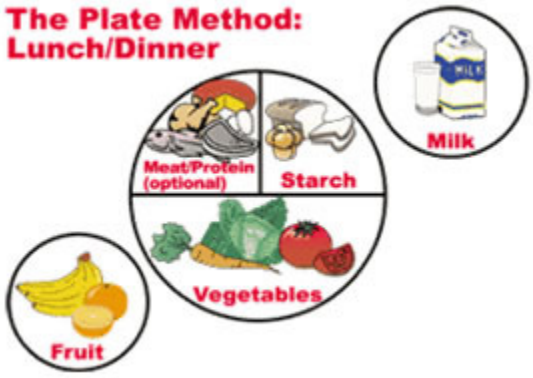
- The Plate Method
- The Food Guide Pyramid (MyPyramid.com)
- Exchange Lists
- Carbohydrate Counting

The Plate Method

The plate method is one way that meals can be planned. For breakfast, starch should take up half of the plate, and meat or non-meat protein may take up 1/4 of the plate if desired. In the lunch

and dinner plate method, vegetables should take up half of the plate, starch should take up 1/4 of the plate and meat or non-meat protein should take up another 1/4 of the plate. One serving of fruit and a cup of low-fat milk may accompany your meal. Although the plate method is relatively easy, portion sizes are still critical. The amount of food on your plate should vary according to the number of calories that you need each day. A recommended plate size is about 9 inches across (9 inch diameter). Try measuring your plates!





Starchy foods include: bread, rolls, rice, pasta, potatoes, yams, corn, lima beans, and cereals.

Vegetables include: lettuce, tomatoes, mushrooms, spinach, green beans, and broccoli.

Meat and non-meat protein foods include: chicken, beef, pork, fish, cheese, beans, tofu, and soy products that resemble meat or chicken.

Fruits include: oranges, applesauce, grapes, and peaches. More information on the plate method available at www.platemethod.com

Food Guide Pyramid

The Food Guide Pyramid is a tool used to show the type and the amount of food that you need daily. Recently modified to take into consideration the new Dietary Guidelines for Americans, the new Food Guide Pyramid was renamed MyPyramid, and now has six colored bands which represent food groups, and steps up the side to emphasize physical activity. Listed below are the foods groups that the colored bands of the pyramid represent:

- Orange – Grains
- Green – Vegetables
- Red – Fruit
- Yellow – Oils
- Blue – Milk
- Purple – Meat and Beans

By visiting the website www.mypyramid.gov, you can enter your age, gender, and physical activity level and learn the amount of foods from each group that you should be eating each day. This website also offers tips about the types of foods within each group that are particularly important to eat. For example, MyPyramid suggests that you:

- Make half your grains whole grains
- Vary your veggies
- Focus on fruit
- Get your calcium-rich foods
- Go lean with protein
- Find your balance between food and physical activity

Exchange Lists

Adapted from the American Dietetic Association www.eatright.org and the American Diabetes Association www.diabetes.org

The Diabetic Exchange List is a program that was developed by the American Dietetics Association and the American Diabetes Association. Exchange Lists are used to balance the amount of calories, carbohydrate, protein and fat eaten each day. The Exchange List book can be ordered from the American Diabetes Association website. To use the Exchange Lists, individuals must first talk with their doctor or dietitian about their dietary requirements and the number of calories that they need each day. Then the doctor or dietitian can explain how many servings from each group are needed to meet these daily requirements. Individuals can then use the Exchange Lists to determine what foods and in what amounts they need to eat each day.

There are six different Exchange List groups including the starch groups, the fruit group, the milk group, the non-starchy vegetable group, the meat and meat substitutes group, and the fat group. Each serving of food within an exchange group has about the same amount of carbohydrate, protein, fat, and calories as the other foods in that group. For this reason, foods within an exchange list group can be substituted for each other, but foods on one group list cannot be substituted for foods on another group list. For example, you may substitute eating a small apple for a small orange, because they are both one serving in the fruit group. However, you could not substitute eating a small apple for one slice of bread, because these foods are in different groups.

The amount and type of exchanges recommended each day are based on individual calorie needs, weight goals and the amount of physical activity performed daily

Exchange List Groups

The following are the six groups of the Diabetic Exchange Lists:

Starches List (Includes breads, cereals, grains and starchy vegetables)
One exchange from this group has 15 grams of carbohydrates, 3 grams of protein, and 0-1g of fat for a total of 80 calories per serving.

Examples of one serving from this group include 1 slice of bread, 1/3 cup cooked rice, or 1/3 cup cooked pasta.

Fruit List
One exchange from this group has 15 grams of carbohydrate for a total of 60 calories per serving. Foods in the fruit list do not contain any protein or fat.

Examples of one serving from this group include 1 small apple, 17 small grapes, or ½ cup of orange juice.

Non-starchy Vegetable List

One exchange from this group has 2 grams of carbohydrates, and 5 grams of protein for a total of 25 calories per serving. Non-starchy vegetables contain no fat.

Examples of one serving from this group include 1/2 cup cooked green beans, 1 cup raw lettuce, or 1/2 cup vegetable juice.

Milk List

Items on the milk list are divided into fat-free/low-fat milk, reduced-fat milk, and whole milk categories.

One fat-free/low-fat milk exchange has 12 grams of carbohydrates, 8 grams of protein, and 0-3g of fat for a total of 90 calories per serving. One reduced-fat milk exchange has 12 grams of carbohydrates, 8 grams of protein, and 5g of fat for a total of 120 calories per serving. One whole milk exchange has 12 grams of carbohydrates, 8 grams of protein, and 8g of fat for a total of 150 calories per serving.

Examples of one serving from the fat-free/low-fat milk exchange are 1 cup of non-fat skim or 1% milk, or 2/3 cup (or 6 ounces) of fat-free plain yogurt.

Meat and Meat Substitutes List

Meats are divided into very lean, lean, medium-fat, and high-fat lists based on the amount of fat they contain. High-fat exchanges should be eaten a maximum of three times a week.

One very lean meat exchange has 7 grams of protein, and 0-1 gram of fat for a total of 35 calories per serving. Examples of one very lean meat exchange are 1 ounce white meat chicken or turkey with no skin.

One lean meat exchange has 7 grams of protein, and 3 grams of fat for a total of 55 calories per serving. Examples of one lean meat exchange are 1 ounce lean beef or lean pork.

One medium-fat meat exchange has 7 grams of protein, and 5 grams of fat for a total of 75 calories per serving. Examples of one medium-fat meat exchange are 1 ounce dark meat chicken with skin, 1 egg, or 1 ounce of fried fish.

One high-fat meat exchange has 7 grams of protein, and 8 grams of fat for a total of 100 calories per serving. Examples of one high-fat meat exchange are 1ounce pork sausage, 1 ounce American cheese, or 1ounce of a hot dog.

items in the fat exchange list do not contain protein or carbohydrate.

Examples of one serving from this group include one teaspoon oil, one teaspoon butter, one teaspoon mayonnaise, or one tablespoon salad dressing.

Carbohydrate Counting

The Carbohydrate Counting method is similar to the Exchange List method in that they both use food groups. However, when you use Carbohydrate Counting, you keep track or "count" servings equal to 15 grams or 1 unit of carbohydrate The food groups that have carbohydrate and are counted are:

- The Starch and Starchy Vegetables Group
- The Fruit Group
- The Milk Group

One serving from any of these three groups would count as one carbohydrate unit. For example if you ate two pieces of buttered toast and an 8 ounce glass of milk for breakfast, you would count that breakfast as having three carbohydrate units. Carbohydrate Counting differs from the Exchange List in that the amount of protein and fats in foods is not taken into consideration. So the butter on the toast consumed at breakfast would not be counted, because butter is in the fat group and does not contain carbohydrate.

Some examples of one carbohydrate unit would be:

Starch and Starchy Vegetables Group – 1 slice of bread, 1/3 cup of cooked rice or pasta, 1/2 of a small bagel

Milk Group – 1 cup milk, 2/3 cup fat-free-yogurt, 3/4 cup low-fat yogurt

Fruit Group – 1 small piece of fruit, 3/4 cup berries, 1/2 cup apple juice

If you are planning to use the Carbohydrate Counting method, you and your health care provider should decide how many servings of carbohydrate you should consume each day and at each meal for optimal health.

A basic carbohydrate counting book can be purchased on the American Dietetic Association's website or on the American Diabetes Association website.

American Dietetic Association website: www.eatright.org