

## **TYPE 2 DIABETES MANAGEMENT OVERVIEW**

Diet and physical activity are critically important in the management of the ABCs (**A**1c, **B**lood pressure and **C**holesterol) of type 2 diabetes.

To effectively manage A1C (hemoglobin A1C) and blood sugar levels, it is important to understand how to balance food intake, physical activity, and medication. Making healthy food choices every day has both immediate and long-term effects. With education, practice, and assistance from a dietitian and/or a diabetes educator, it is possible to eat well and control diabetes.

**WHY IS DIET IMPORTANT?** — Many factors affect how well diabetes is controlled. Many of these factors are controlled by the person with diabetes, including how much and what is eaten, how frequently the blood sugar is monitored, physical activity levels, and accuracy and consistency of medication dosing. Even small changes can affect blood sugar control.

Eating a consistent amount of food every day and taking medications as directed can greatly improve blood sugar control and decrease the risk of diabetes-related complications, such as coronary artery disease, kidney disease, and nerve damage. In addition, these measures impact weight control. A dietitian can help to create a food plan that is tailored to a person's medical needs, lifestyle, and personal preferences.

**TYPE 2 DIABETES AND MEAL TIMING** — Consistently eating at the same times every day is important for some people, especially those who take long-acting insulin (eg, NPH) and oral medications that decrease blood sugar levels (sulfonylureas or meglitinides). If a meal is skipped or delayed while on these regimens, you are at risk for developing low blood glucose.

People who use intensive insulin therapy (those on multiple daily injections) and people who take other types of oral diabetes medications (eg, insulin sensitizers such as [metformin](#)) have more flexibility around meal timing. With these regimens, skipping or delaying a meal does not usually increase the risk of low blood sugar.

Foods or meals that are high in fat (eg, pizza) may be eaten occasionally, although blood sugar levels should be monitored more closely. High-fat meals are broken down more slowly than low-fat meals. When using rapid acting insulin before a meal, the blood sugar level may become low shortly after eating a high fat meal and then rise hours later.

**Weight loss** — Many people with type 2 diabetes are overweight. Losing even a small amount of weight (5 to 10 percent of total body weight) can help the body to produce and use insulin more efficiently. In fact, eating fewer calories can reduce blood sugar levels even before the first pound is lost.

There are several strategies that can aid in weight loss, including eating fewer calories, exercise, weight loss medications, and weight loss surgery. These treatments are discussed in detail in separately.

**Recommended calorie intake** — The number of calories needed to maintain weight depends upon your age, sex, height, weight, and activity level. In general:

- Men, active women - 15 cal/lb
- Most women, sedentary men, and adults over 55 years - 13 cal/lb
- Sedentary women, obese adults - 10 cal/lb
- Pregnant, lactating women - 15 to 17 cal/lb

To lose 1 to 2 pounds per week (a safe rate of weight loss), subtract 500 to 1000 calories from the total number of calories needed to maintain weight.

As an example, an overweight man who weighs 250 lbs would need to eat 2500 calories per day to maintain his weight. To lose 1 to 2 pounds per week, he should eat 1500 to 2000 calories per day. As weight is lost, the recommended calorie intake should be recalculated.

**TYPE 2 DIABETES, DIET, AND WEIGHT** — Your weight is a direct reflection of how much you eat and how active you are. Eating a consistent number of calories every day can help to control blood glucose levels and maintain body weight. In people who are overweight or obese, losing weight by eating fewer calories or increasing activity levels can improve blood sugar control, and lower blood pressure and cholesterol levels.

**Avoiding weight gain** — Weight gain is a potential side effect of intensive insulin therapy in type 2 diabetes. Weight gain is also a side effect of some oral medications used for people with type 2 diabetes. To avoid weight gain, the following tips are recommended.

- Measure your weight on a regular basis (eg, once weekly). Weight gains of more than 2 to 3 pounds indicate a need to decrease the amount you eat or increase activity. Do not wait until weight increases by 10 or more pounds to take action.
- As blood glucose control improves, it may be necessary to decrease your calorie intake by 250 to 300 calories per day to avoid weight gain.
- If blood glucose levels are frequently low at a particular time of day, decrease the insulin dose or medication dose rather than add a snack.

**Exercise** — Exercising regularly can help to lose weight and keep it off. The recommended amount of exercise is 30 minutes per day most days of the week.

People who take insulin or oral medications that lower blood sugar levels should check their blood glucose level before and after exercising. If exercise is vigorous and prolonged (more than 30 minutes), check the blood glucose every 15 minutes (if the exercise regimen is new and will be

used again). Frequent monitoring can help to get a sense of what effect exercise has on the blood glucose level.

If your blood sugar level becomes low during exercise, eat a snack according to the guidelines below.

- If the blood glucose is 51 to 70 mg/dL (2.8 to 3.8 mmol/L), eat 10 to 15 grams of fast-acting carbohydrate (eg, 1/2 cup fruit juice, 6 to 8 hard candies, 3 to 4 glucose tablets).
- If the level is less than 50 mg/dL (2.7 mmol/L), eat 20 to 30 grams of fast-acting carbohydrates.

Retest after 15 minutes and repeat treatment if blood glucose is still too low. If your next meal is more than an hour away, eat an additional 15 grams of carbohydrate and 1 ounce of protein (for example, crackers with cheese or one-half of a sandwich with peanut butter). It is important not to eat too much because this can raise blood sugar levels above the target level and lead to weight gain over the long term.

**Adjusting insulin dose for exercise** — People who take oral diabetes medications usually do not need to adjust the dose of these medications for exercise.

If you take insulin, it may be possible to reduce your insulin dose before exercising to avoid developing low blood glucose. A physician, diabetes educator, dietitian or exercise physiologist can help to determine the best way to adjust your insulin dose before, during, and after exercising.

**TYPE 2 DIABETES AND ALCOHOL** — Drinking a moderate amount of alcohol (up to 1 serving per day for women, up to 2 servings per day for men) with food does not affect blood glucose levels significantly. Alcohol may cause a slight rise in blood glucose, followed hours later by a decrease in the blood glucose level. As a result, it is important to monitor blood glucose response to alcohol to determine if any changes in insulin doses are needed.

Mixers, such as fruit juice or regular cola, can increase blood glucose levels and increase the number of calories consumed in a day. Also, calories from alcohol have little nutritional value and may interfere with efforts to lose weight or contribute to weight gain. If you take oral diabetes medications, you will not need to adjust your medication, as long as you drink the alcohol in moderation and with food.

**TYPE 2 DIABETES AND CARBOHYDRATE CONSISTENCY** — Carbohydrates are the main energy source in the diet, and include starches, vegetables, fruits, dairy products, and sugars. Most meats and fats do not contain any carbohydrates.

Carbohydrates have a direct impact on the blood glucose level whereas proteins and fat have little to no impact. Eating a consistent amount of carbohydrates at each meal can help to control

blood glucose levels, especially in people who take oral diabetes medications or long-acting insulin (eg, NPH).

People with type 2 diabetes should focus on reducing calories and increasing physical activity, especially when newly diagnosed or if the pancreas is still producing some insulin. People who have type 2 diabetes and are lean or not interested in losing weight could consider a focus on maintaining their weight with carbohydrate counting. Carbohydrate counting may also be helpful for those who are on multiple daily injections.

**Carbohydrate counting** — A dietitian usually helps to determine the number of carbohydrates you need at each meal and snack, based upon an individual's usual eating habits, diabetes medications, body weight, nutritional goals, and activity level. In most people, between 45 and 65 percent of the day's total calories should come from carbohydrates. The way carbohydrates are divided up for each meal or snack is based upon personal preferences, meal timing and spacing, and type of diabetes medications.

The number of carbohydrates in a food can be determined by reading the nutrition label, consulting a reference book or website, carrying a database on a personal digital assistant (PDA), or using the Exchange system. Restaurants usually have this information available upon request.

It is important to note the serving size and grams of fiber when calculating carbohydrates. Eating more than one serving will increase the number of calories consumed and the dose of insulin needed to cover the meal. For example, some pre-packaged snacks contain two or more servings. To calculate the carbohydrate content of the entire package, multiply the number of servings by the number of carbohydrates per serving.

When a serving of food has more than 5 grams of fiber, the grams of fiber should be subtracted from the grams of carbohydrates to calculate the insulin dose.

**Exchange planning** — With exchange planning, all foods are categorized as either a carbohydrate, meat or meat substitute, or fat. In this system, one serving of a carbohydrate (eg, one small apple) can be exchanged for any other carbohydrate (eg, 1/3 cup cooked pasta), because both portions contain about 15 grams of carbohydrate. You can also easily determine the carbohydrate content of your meals and snacks using the Exchange system.

The exchange lists also identify foods that are good sources of fiber, and foods that have a high sodium content. A dietitian can help you determine how many servings of each group should be eaten at each meal and snack and the typical carbohydrate content of each meal and snack.

**Intensive insulin therapy** — People who take multiple injections of rapid-acting insulin per day can adjust their pre-meal insulin dose based upon the number of carbohydrates they plan to eat and their pre-meal blood glucose. This requires the person to perform basic arithmetic.

The pre-meal insulin dose is calculated by dividing the number of carbohydrates to be consumed by the number of carbohydrates covered by one unit of insulin (insulin-to-carbohydrate ratio). This dose is then adjusted based upon the pre-meal blood glucose reading (see below).

- **Insulin-to-carbohydrate ratio** — An insulin-to-carbohydrate ratio is determined by a dietitian or diabetes educator. This allows the person to calculate the dose of rapid-acting insulin needed to cover a meal or snack.

For example, if the insulin-to-carbohydrate ratio is 1 to 10, the person would give 1 unit of insulin for every 10 grams of carbohydrate consumed. If the person ate a meal with 70 grams of carbohydrates, the dose of rapid-acting insulin would be 7 units.

- **Correction factor** — The pre-meal insulin dose can also be adjusted based upon the pre-meal blood glucose level; this is called a correction factor. The correction factor can be determined by a dietitian or diabetes educator.

For example, let's assume that the correction factor is 30. If the pre-meal blood glucose was 240 mg/dL and the goal BG was 120 mg/dL, take 240 minus 120 = 120. Then 120 divided by 30 = 4 extra units of insulin to correct the high blood glucose level.

**WHAT SHOULD I EAT?** — While protein and fat do not affect blood glucose levels significantly, they do contribute to the number of calories consumed. Eating a consistent number of calories every day can help to maintain body weight. An individual's recommended calorie intake is discussed below.

**General recommendations** — The American Diabetes Association recommends the following to help manage the ABCs (**A**1c, **B**lood pressure and **C**holesterol) and promote good health:

- Between 25 and 35 percent of calories per day should be from fat, and less than 7 percent of calories per day should be from saturated fat; there should be minimal trans fat. Saturated and trans fats are found in solid fats like cheese, red meats, butter, margarine, and shortening. People with diabetes are at increased risk for heart disease and stroke, and eating a diet low in saturated and trans fats and cholesterol can help to reduce cholesterol levels and decrease these risks.
- Total cholesterol intake should be less than 200 mg per day. The main sources of cholesterol in the diet are foods such as organ meats and egg yolks. Shrimp and squid are also moderately high in cholesterol but can be included in your diet occasionally because they are low in fat.
- Between 15 and 20 percent of calories should be from protein, except in people with certain kidney problems (chronic kidney disease or CKD). People with CKD are sometimes advised to eat a low-protein diet.

- A diet that is high in fiber (25 to 30 grams per day) may help to control blood glucose levels.
- A diet that is low in sodium (less than 1500 mg per day) and that is high in fruits, vegetables, and low fat dairy products, is recommended and can help manage blood pressure. For people with diabetes and heart failure, a low sodium diet may reduce symptoms.
- Artificial sweeteners do not affect blood glucose levels and may be consumed in moderation. The US Food and Drug Administration (FDA) has tested and approved five artificial sweeteners: aspartame (Equal, NutraSweet), saccharin (Sweet'N Low, Sweet Twin), acesulfame-K (Sunnet, Sweet One), neotame, and sucralose (Splenda). Stevia (sometimes called Rebaudioside A or rebiana) comes from the stevia plant and is now generally recognized as safe by the FDA as a food additive and table top sweetener. When something is generally recognized as safe by the FDA, it means that experts have agreed that it is safe for use by the public in appropriate amounts.

Sugar alcohols ([sorbitol](#), xylitol, lactitol, [mannitol](#), and maltitol) are often used to sweeten sugar-free candies and gum, and increase blood glucose levels slightly. When calculating the carbohydrate content of foods, one-half of the sugar alcohol content should be counted in the total carbohydrate content of the food. Eating too much sugar alcohol at one time can cause cramping, gas, and diarrhea.

- Previously, people with diabetes were told to avoid all foods with added sugar. This is no longer recommended, although sugar should be eaten in moderation. If you take insulin, you should calculate your dose based upon the total number of carbohydrates in the food, which includes the sugar content, as described above.
- Products that are "sugar-free" or "fat-free" do not necessarily have a reduced number of calories or carbohydrates. Read the nutrition label carefully and compare it to other similar products that are not sugar- or fat-free to determine which has the best balance of serving size and number of calories, carbohydrates, fat, and fiber.

Some sugar-free foods, such as diet soda, sugar-free gelatin, and sugar-free gum, do not have a significant number of calories or carbohydrates, and are considered "free foods." Any food that has less than 20 calories and 5 grams of carbohydrate is considered a free food, meaning that they do not affect body weight or require additional medication.

**WHERE TO GET MORE INFORMATION** — Your healthcare provider is the best source of information for questions and concerns related to your medical problem.