Chapter 19 : Nutrition for Patients with Diabetes Mellitus

Risk factors

Type I	Type II
• Autoimmune • Genetic • Environmental	• Obesity • First-degree relative with diabetes • Physical inactivity • high-risk ethnic group • History of gestational diabetes • Hypertension • HDL 35 mg/dL and/or triglyceride level 250 mg/dL

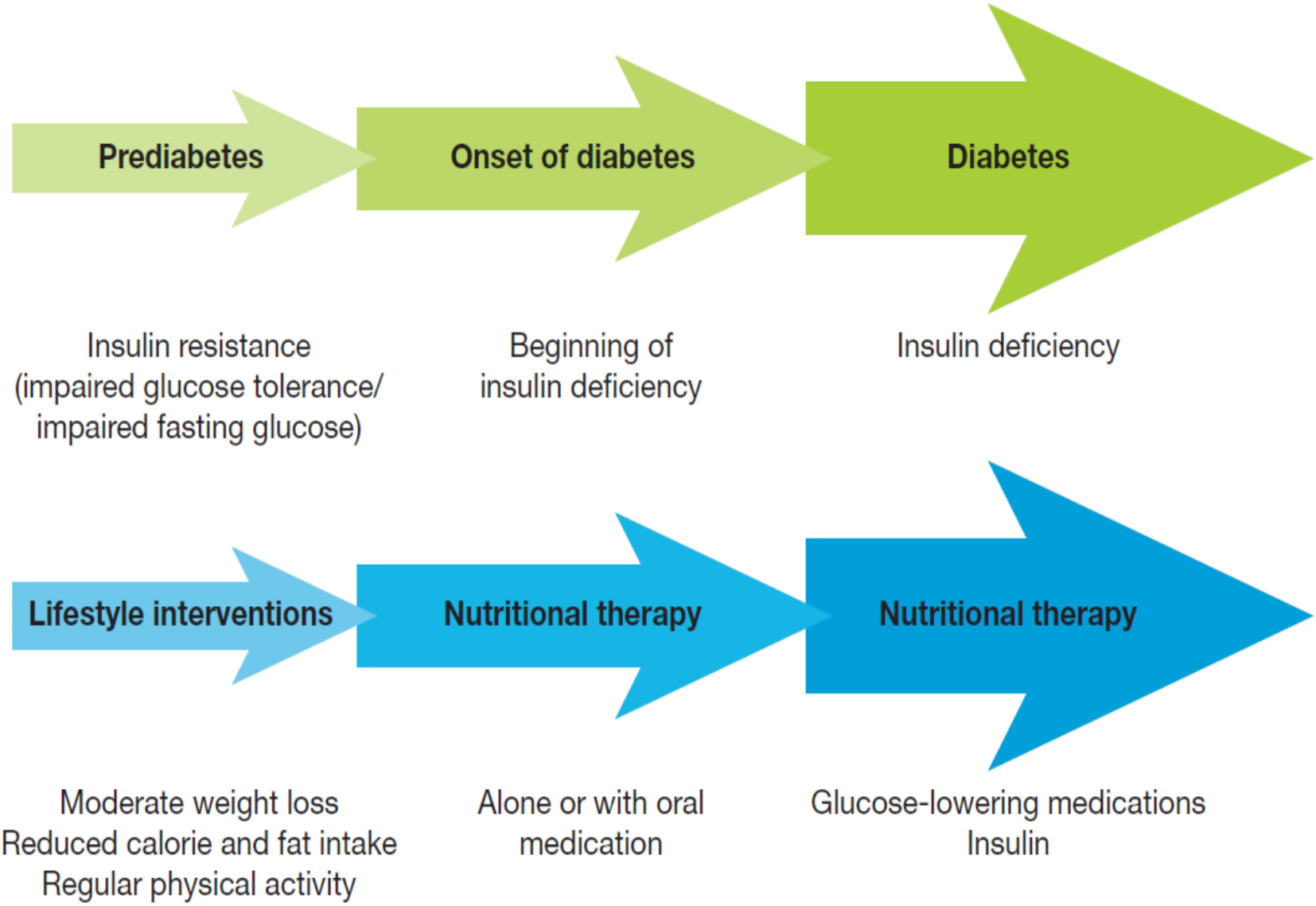


FIGURE 19.1 The progression of type 2 diabetes.

Metabolic Syndrome (MetS)

- A group of interrelated risk factors including:
  1. Central obesity
  2. Hypertension
  3. Altered blood lipid levels (especially low high-density lipoprotein [HDL] cholesterol and high triglycerides)
  4. Altered glucose/insulin metabolism

Metabolic Syndrome (MetS)

- **Twice** as likely to develop heart disease
- **Five times** as likely to develop diabetes

  compared to those without MetS

- Initial therapy for MetS → Weight loss

DIABETES MANAGEMENT

- **Type 1** diabetes is managed by a coordinated regimen of nutrition therapy and insulin

- **Type 2** diabetes is managed by Lifestyle interventions—namely diet and exercise
  - If lifestyle interventions fail to achieve glycemic control→ oral medications and/or insulin are added to the regimen

Management of Diabetes

- Goals and interventions are specified for three levels of prevention:
  - Primary prevention
  - Secondary prevention
  - Tertiary prevention

Levels of Prevention

Primary prevention	Work on modifiable risk factors (obesity, lifestyle,…)
Secondary prevention	Managing Diabetes
Tertiary prevention	Controlling Diabetes Complications

Primary prevention

- Most preventable risk factor :
  - **obesity and overweight**
- Moderate weight loss (5% of body weight) in people with type 2 diabetes improves:
  - Insulin resistance
  - Glycemic control
  - Lipid levels
  - Blood pressure

1. Weight loss diet

- Standard weight loss diets that provide 500 to 1000 fewer calories than usual daily intake
- Can promote a weight loss of as much as 10% in 6 months
- Support and follow up to prevent weight regain !!

Overweight and obesity

- Very low calorie diets (800 cal/day)
- Produce
  - substantial weight loss
  - rapid improvements in blood glucose and lipid levels in people with type 2 diabetes
- But weight gain is common after the diet stops

2. Weight loss medications

- Are useful for people with prediabetes or type 2 diabetes
- Only for BMI ≥ 27

- Combined with lifestyle changes!

- They can promote a 5% to 10% weight loss.

4. Bariatric surgery

- For people with a BMI ≥ 35

- Can lead to :
  - substantial weight loss
  - **complete resolution of type 2 diabetes**
  - improvement in cardiovascular risk factors

Preventing Diabetes

1. Weight Loss through a combination of healthy eating and exercise is the primary focus of diabetes prevention
   – (7% of body weight).
2. Consume the Dietary Reference Intakes for fiber
3. Moderate alcohol intake may lower the risk for diabetes
   – but recommendations to consume alcohol are not supported

Preventing Diabetes

- The type of fat consumed may also influence diabetes risk
  - Low saturated fat intake may reduce the risk for diabetes by
    - improving insulin resistance
    - promoting weight loss

Preventing Diabetes

- Increased intake of whole grains and fiber
- Whole grains correlate to improved insulin sensitivity, regardless of body weight

Secondary Prevention: Managing Diabetes

- Goals of management :
  - Primary goal → is to keep blood glucose levels as near normal as possible
  - Attain and maintain control of blood lipid levels and blood pressure
  - Prevent or delay the development of complications
  - Maintain the pleasure of eating by not limiting any foods unless indicated by scientific evidence

Nutrition recommendations for diabetes management

- Because coronary heart disease (CHD) is the leading cause of death among people with diabetes→
- nutrition recommendations are **similar** to recommendations put for the primary and secondary prevention of CHD

Total Carbohydrates

- 45% to 65% of total calories.
- Carbohydrates from fruits, vegetables, whole grains, legumes, and low-fat milk are part of a healthy diet
- Glycemic control is dependent on matching carbohydrate intake with the action of insulin or other medication

Glycemic Control

- low glycemic index diet may provide a modest benefit in controlling postprandial hyperglycemia when used in place of a high glycemic index diet

Sweetners

- When sucrose is **isocalorically** substituted for starch, there is no difference in glycemic control in either type 1 or type 2 diabetes

- Sucrose and sucrose-containing foods are not restricted but should be substituted for other carbohydrates in the meal plan, not eaten as "extras."

They are usually nutrient poor and may be high in fat

Sweetners

- **Sugar alcohols and nonnutritive sweeteners**
  - They are safe to use
  - Does not produce weight loss or improve glycemic control

Hypoglycemia

- Treated with 15 to 20 g of glucose

- Pure sugars are better than items like candy bars, which contain fat that slows the gastric emptying time and delays the rise in blood glucose

Fiber

The recommendations are the same for the general population

Fat

- Diabetics are advised to:
  - limit their intake of saturated fat to less than 7% of total calories
  - minimize their intake of trans fat
  - consume less than 200 mg of cholesterol daily

Fat

- Two or more servings of **fish** per week are recommended for their omega-3 fatty acid content →lower adverse CVD outcomes

- **Plant sterols/stanols** lower LDL cholesterol

Protein

- If kidneys are functioning normally → no need to alter protein intake

Alcohol

- Light to moderate use of alcohol by diabetics is associated with a lower risk of CVD

Vitamins and Minerals

- Requirements are not different from those of the general population
- chromium has been studied for its possible role in the prevention and treatment of diabetes.
  - It promotes glucose uptake by cells, possibly by increasing the number and activity of insulin receptors on the cells

Vitamins and Minerals

- **No need** to chromium supplementation

QUICK BITE

Sources of chromium:

Whole grains	Some dried peas and beans
Nuts	Yeast
Mushrooms	Organ meats
Broccoli	Pork
Egg yolks	

Tertiary Prevention: Controlling Diabetes Complications

1. **Microvascular diabetes complications** modified by
   - Improving glycemic control
   - Reduce protein intake to 0.8 to 1.0 g/kg for people with early stage chronic kidney disease;
   - lower to 0.8 g/kg for later stages of diabetic kidney disease.

Tertiary Prevention: Controlling Diabetes Complications

2. **Treatment and management of CVD risk**
   - Control A1c
   - Whether normotensive or hypertensive, lower sodium intake to 2300 mg/day and eat a diet rich in fruits, vegetables, and low-fat dairy products to lower blood pressure.

Meal – Planning Approaches

1. Exchange lists for meal planning system

2. CHO counting system

Exchange Lists

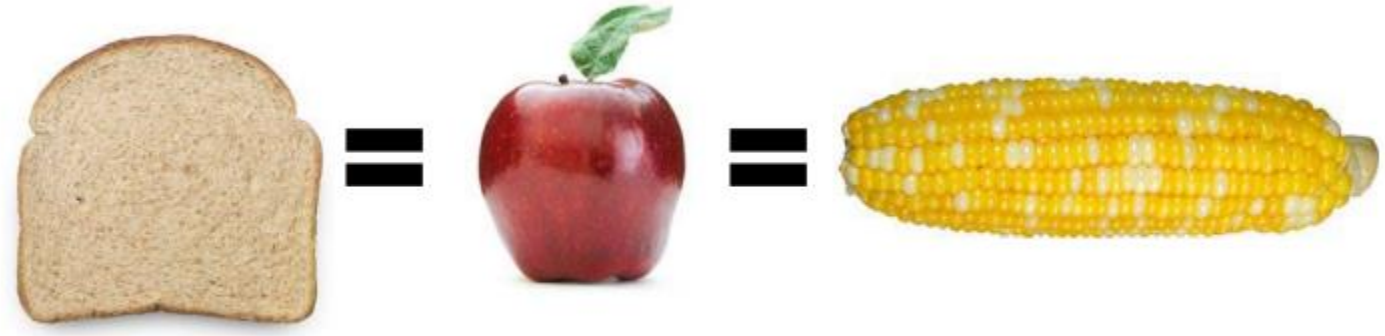
Foods are grouped into lists that have similar contents of CHO, protein, fat, and calories (for a given serving size)

Exchange Lists

- Three major categories :
  1. Carbohydrates
  2. Meat and meat substitutes
  3. Fats

Exchange Lists

Any food (in the serving size specified) can be exchanged for any other within each list.



Exchange Lists

- 1. sample meal plan designed for client

- 2. number of **exchanges** from each list

Carbohydrates Group

List and Representative Foods	Serving Sizes	CHO (g)	Protein (g)	Fat (g)
Starch		15	0–3	0–1
Bread	1 slice			
Cereals and grains	½ cup cooked cereal or grain; 1 oz ready-to-eat cereal ⅓ cup cooked rice or pasta			
Starchy vegetables	½ cup cooked			
Crackers and snacks	¾ to 1 oz of most snack foods (may have extra fat)			
Beans, peas, and lentils	½ cup			
Fruit		15	0	0
Canned fruit, fresh fruit, or unsweetened fruit juice	½ cup			
Fresh fruit	1 small fruit			
Dried fruit	2 tbsp			
Milk				
Fat-free and low-fat milk and yogurt	1 cup milk; ⅔ cup plain or artificially sweetened yogurt	12	8	0–3
Reduced-fat milk and yogurt	1 cup milk; ⅔ cup plain yogurt	12	8	5
Whole milk and yogurt	1 cup milk; 8 oz yogurt	12	8	8

Sweets, Desserts, and Other Carbohydrates		15	Varies	Varies
Cranberry juice cocktail	½ cup			
Gingersnap cookies	3			
Regular pancake syrup	1 tbsp			
Ice cream, sherbet, or frozen yogurt	½ cup			
Nonstarchy Vegetables		5	2	0
Cooked vegetables (fresh, canned, or frozen)	½ cup			
Vegetable juice	½ cup			
Raw vegetables (excludes salad greens, which are on the Free Food List)	1 cup			

Meat and Meat Substitutes Group

List and Representative Foods	Serving Sizes	CHO (g)	Protein (g)	Fat (g)
Lean meat and meat substitutes		—	7	0–3
Lean meat, poultry, pork, veal; fish, shellfish, game	1 oz			
Egg whites	2			
Cottage cheese	¼ cup			
Medium-Fat Meat and Meat Substitutes		—	7	4–7
Cheese with 4–7 g fat per ounce	1 oz			
Egg	1			
Fried fish	1 oz			
Prime grades of beef, chicken with skin, veal cutlet	1 oz			
High-Fat Meat and Meat Substitutes		—	7	8+
Pork bacon	2 slices			
Regular cheese	1 oz			
Hot dogs	1			
Processed sandwich meats and sausage with 8 g of fat or more per ounce	1 oz			
Plant-Based Proteins		Varies	7	Varies
Soy bacon	3 strips			
Nut butters (e.g., almond butter, cashew butter, peanut butter)	1 tbsp			
Refried beans, canned	½ cup			
Hummus	⅓ cup			

Fats Group

List and Representative Foods	Serving Sizes	CHO (g)	Protein (g)	Fat (g)
Monounsaturated Fats		—	—	5
Avocado	2 tbsp			
Nut butters	1½ tsp			
Nuts	2–16, depending on the type			
Canola, olive, and peanut oil	1 tsp			
Olives	8–10			
Polyunsaturated Fats		—	—	5
Low-fat margarine	1 tbsp			
Regular mayonnaise	1 tsp			
Corn, soybean, sunflower oil	1 tsp			
Reduced-fat salad dressing	2 tbsp			
Saturated Fats		—	—	5
Bacon	1 slice			
Chitterlings, boiled	2 tbsp			
Half and half cream	2 tbsp			
Salt pork	¼ oz			
Regular sour cream	2 tbsp			

Advantages

- Eliminates the need for daily calculations
- Ensures a relatively consistent intake
- Emphasizes important nutrition principles such as limiting and modifying fat, increasing fiber, and controlling sodium intake.

Disadvantages

- Confusing terminology (carbohydrate choice versus grams of carbohydrates).
- Some items on some lists are counted as more than just one choice or one exchange
  - black-eyed peas, which are counted as one starch plus one lean meat.
- Some items appear on more than one list and in different amounts
  - 1 tablespoon of peanut butter on the plant-based protein list and 1 ½ teaspoon of peanut butter on the monounsaturated fat list.
- less flexible than carbohydrate counting and may not be appropriate or acceptable for all age, ethnic, and cultural groups.

Carbohydrate Counting

- Clients are given an individualized meal pattern that specifies the number of carbohydrate “choices” for each meal and snack

- 1 choice = 15 g carbohydrate

For most adults

- 3-5 CHO choices per meal
- 1-2 CHO choices per snack

depending on their calorie needs

One carbohydrate choice equals (15 g carbohydrate):

- 1 serving from the bread, cereal, rice, and pasta group
- 1 serving of fruit
- 1 serving from the Milk group
- 1 serving from the sweets and desserts
- 3 servings of nonstarchy vegetables (because they are so low in carbohydrates and are "healthy," oftentimes people are encouraged to eat these as desired)

The diet should also include

- 4 to 6 oz of lean meat or meat substitutes per day
- Healthy fats

Carbohydrate Counting

- Advantage :
  - focusing on a single nutrient (carbohydrates) rather than all the energy yielding nutrients

- Disadvantages :
  - protein and fat cannot be disregarded, especially if weight is a concern

Step 1: Identify the serving size. The nutrition content is based on this serving size.

Example: 1 serving = 3/4 c

Step 2: Find the grams of total carbohydrates. 1 carbohydrate choice = 15 g CHO, with a range of 11–20 counted as 1 choice.

g total carbohydrate	# CHO choices
6–10	1/2
11–20	1
21–25	1 1/2
26–35	2
36–40	2 1/2
41–50	3

The grams of sugar are part of the total carbohydrate and do not require special attention.

Example: 1 serving = 1 1/2 carbohydrate choices

Step 3: Check on the grams of total fiber per serving. If a serving provides >5 g total fiber, subtract 1/2 the total grams of fiber from the grams of carbohydrates (because fiber is relatively nondigestable and provides less than 4 cal/g) to get the total carbohydrate grams.

Example: 1 serving has 10 g fiber
10 g ÷ 2 = 5 g fiber
25 g total carbohydrate – 5 g fiber =
20 g carbohydrate
This counts as 1 carbohydrate choice.

Step 4: If a serving provides more than 5 g of sugar alcohols, subtract 1/2 the grams of sugar

Nutrition Facts

Serving Size 3/4 cup (33 g/1.2 oz.)
Servings Per Container About 11

Amount Per Serving

Calories 110 Calories from Fat 15

	% Daily Value**
Total Fat 1.5 g*	**2%**
Saturated Fat 0 g	**0%**
Trans Fat 0 g	
Cholesterol 0 mg	**0%**
Sodium 90 mg	**4%**
Potassium 100 mg	**3%**
Total Carbohydrate 25 g	**8%**
Dietary Fiber 10 g	**18%**
Soluble Fiber 2 g	
Insoluble Fiber 5 g	
Sugars 5 g	
Other Carbohydrate 10 g	
Protein 4 g	

Vitamin A 25% (25% DV as beta carotene)
Vitamin C 50% * Calcium 0%
Iron 10% * Vitamin E 100%
Vitamin B_6 100% * Folic Acid 100%
Vitamin B_{12} 100% * Zinc 10%

* Amount in cereal. One half cup of fat free milk contributes and additional 40 calories, 65 mg sodium, 6 g total carbohydrates (6 g sugars), and 4 g protein.
** Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

	Calories:	2,000	2,500
Total Fat	Less than	65 g	80 g

Step 2: Find the grams of total carbohydrates. 1 carbohydrate choice = 15 g CHO, with a range of 11–20 counted as 1 choice.

g total carbohydrate	# CHO choices
6–10	1/2
11–20	1
21–25	1 1/2
26–35	2
36–40	2 1/2
41–50	3

The grams of sugar are part of the total carbohydrate and do not require special attention.

PHARMACOLOGICAL MANAGEMENT OF DIABETES

Type 1 Diabetes

Insulin: Types, Onset of Action, Peak Activity, and Duration of Activity

Insulin	Onset of Action	Peak Activity	Duration of Activity
Rapid Acting: lispro aspart	15 minutes	30 minutes to 2 hours	4–5 hours
Short Acting: regular	30 minutes	3–4 hours	6–8 hours
Intermediate Acting: lente NPH	1–1.5 hours	5–12 hours	10–16 hours
Very Long Acting: Glargine	2–4 hours	Flat	24 hours

Carbohydrate-to-Insulin Ratio

- The amount of carbohydrate that can be handled per unit of insulin

- Usually 15 g CHO requires about one unit of rapid- or short-acting insulin.

EXERCISE : for insulin users !

- Has not been shown to improve glycemic control among people with type 1 diabetes

  - Improves cardiovascular fitness
  - Promotes bone strength
  - Enhances the sense of well-being.

Exercise lowers the glucose levels

If diabetes is uncontrolled, exercise may worsen hyperglycemia

Without sufficient insulin

Muscle cannot use glucose

Liver compensate

Produce or release stored glucose

Hyperglycemia !!!

Exercise : type 1 diabetes

1. Reducing the insulin dose before planned exercise

2. Eat a carbohydrate snack if the blood glucose level is less than 100 mg/dL before exercise begins

Exercise : type 1 diabetes

- Exercise should occur within 2 hours of eating because beyond that time hypoglycemia is more likely to occur.

Exercise in Type 2 Diabetes

1. Improves blood glucose control independent of weight loss
2. Reduces insulin resistance
3. Improves blood lipid levels
4. Improves blood pressure
5. Enhances sense of well-being

Prevention of hypoglycemia

- Monitor their blood glucose levels
- Exercise within 2 hours after eating
- Stop activity if signs and symptoms of hypoglycemia develop.

Children and Adolescents with Diabetes

- The same nutrient needs as their age-matched peers.
- More frequent adjustments in insulin and food intake are necessary to compensate for growth and activity needs

- No food withholding !!!!
- No eating when not hungry !!!

DIABETIC DIETS

- There is no single meal plan or specified nutrient composition for diabetic diet

- Specific calorie level diet that was composed of specific percentages of carbohydrate, protein, and fat
- based on the exchange lists

consistent carbohydrate diet

- calories are not specified but carbohydrate intake is consistent
  - such as 4 carbohydrates for every meal with 1-2 for an evening snack
- range from 1500 to 2000 calories, with adjustments made for special needs (fat, cholesterol,…)