Chapter 5

Fats, Oils, and Other Lipids
Objectives for Chapter 5

1. Describe the three classifications of lipids.
2. Explain the differences in the structure of triglycerides, phospholipids, and cholesterol.
3. Describe how fat is digested and absorbed in the body.
4. Explain how fat is transported in the blood.
5. Describe the functions of fat in the body.
Objectives for Chapter 5

6. Define the dietary recommendations for total fat, the essential fatty acids, cholesterol, and *trans* fat.

7. Identify the major food sources of the different types of fats, including the essential fatty acids, saturated fats, and *trans* fats.

8. Compare the different fat substitutes currently used in food products.

9. Describe the development of atherosclerosis, including its role in the risk of heart disease.

10. Explain how lifestyle factors can affect the risk for heart disease.
What Are Fats and Why Do You Need Them?

**Lipids**: category of compounds containing carbon, hydrogen, and oxygen that are hydrophobic (insoluble in water)

**Fat** is the common name for just one type of lipid, known as a triglyceride

- Fats serve multiple functions in foods:
  1. Give flaky texture to baked goods
  2. Make meats tender
  3. Provide flavor and aromas
  4. Contribute to satiety
What Are Fats and Why Do You Need Them?

Fats and other lipids perform important functions in the body:

1. Energy storage
2. Insulation
3. Transport of proteins in blood
4. Cell membrane structure

Three types of lipids found in foods and in your body:

- Triglycerides (fats), phospholipids, and sterols
- Basic unit of triglycerides and phospholipids = fatty acids
Structure (2 parts) of a Fatty Acid

Acid Group

Chain of Hydrogen and Carbon Atoms
Fatty Acids Are Found in Triglycerides and Phospholipids

**Fatty acids:** chain of carbon and hydrogen atoms with acid group (COOH at one end)

- Over 20 different fatty acids
- Can vary by:
  1. length of chain
  2. whether carbons have double or single bonds between them
  3. total number of double bonds
Saturated vs. Unsaturated Fatty Acids

(a) Stearic acid, a saturated fatty acid
(b) Oleic acid, a monounsaturated fatty acid
(c) Linoleic acid, a polyunsaturated, omega-6 fatty acid
(d) Alpha-linolenic acid, a polyunsaturated, omega-3 fatty acid

Double bond in carbon chain creates a bend
3 double bonds create 3 bends
2 double bonds create 2 bends

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Fatty Acids Vary in Length and Structure

- **Saturated fatty acids**: all carbons bonded to hydrogen
  - Example: stearic acid, 18 carbons, solid at room temperature

- **Unsaturated fatty acids**: one or more double bond between carbons (less saturated with hydrogen)
  - More liquid at room temperature

- **Monounsaturated fatty acids**: one double bond
  - Example: Oleic acid, 18 carbons (olive oil)

- **Polyunsaturated fatty acids**: more than one double bond
  - Example: essential fatty acids linoleic and alpha-linolenic acids (soybean oil)
Saturated and Unsaturated Fatty Acids Help Shape Foods

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Sources of Fats

Animal (saturated)
Exception is coconut or palm oil

Vegetable (unsaturated)
Poly-unsaturated
Mono-unsaturated

Can be hydrogenated into “trans fatty acids”

Double Bonds
Triglycerides Contain Three Fatty Acid Chains

**Triglyceride**: three fatty acids connected to glycerol “backbone”

- Most common lipid found in foods and body
- Referred to as **fats**
  - Saturated fats have mostly saturated fatty acids
  - Unsaturated fats have mostly unsaturated fatty acids
Structure of a Triglyceride

Glycerol backbone

Three fatty acids

Palmitic acid
Oleic acid
Stearic acid

A fat (triglyceride) + 3 H—O—H Water
Phospholipids Contain Phosphate

**Phospholipids:** have glycerol backbone but two fatty acids and a phosphorus group

- Phosphorus containing head is **hydrophilic**
- Fatty acid tail is **hydrophobic**
- Cell membranes made of **phospholipid bilayer**
  - Major phospholipid in cell membrane is lecithin
  - **Lecithin** used as emulsifier in foods such as salad dressings to keep oils and water mixed together
Keeping a Salad Dressing Blended
Structure of a Phospholipid

Glycerol (backbone) + Two fatty acids = Phospholipid

- Phosphate group
- Polar head (attracts water)
- Nonpolar tail (repels water)
Phospholipids’ Role in Cell Membranes

1. Because the phosphorus-containing head is polar, it attracts charged particles, such as water located both outside and inside your cells.

2. Its fatty acid-containing tail is nonpolar, so it minglees and lines up with other nonpolar molecules such as the fatty acid-containing ends of other phospholipids.

3. This creates a two-layer membrane that surrounds the cell and acts as a barrier, allowing certain substances to enter the cell but keeping others from leaving.

Figure 5.6
Sterols Have a Unique Ring Structure

Sterols are comprised mainly of four connecting rings of carbon and hydrogen

- Example: cholesterol
  - Important role in cell membrane structure
  - Precursor of important compounds in body
  - Not required in diet since body makes all cholesterol that is needed
Structure of a Sterol
## The Three Types of Lipids

<table>
<thead>
<tr>
<th>Lipid</th>
<th>Structure</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglycerides</td>
<td>Glycerol</td>
<td>Saturated fat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsaturated fat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Trans fat</td>
</tr>
<tr>
<td>Phospholipids</td>
<td>Phosphate head</td>
<td>Lecithin</td>
</tr>
<tr>
<td>Sterols</td>
<td></td>
<td>Cholesterol</td>
</tr>
</tbody>
</table>

![Diagram of lipids structures](image)
Animation: Fats in Food
Animation: Lipid Absorption
What Happens to the Fat You Eat?

- **Mouth:** chewing, lingual lipase
- **Stomach:** *gastric lipase*: di-glyceride and one fatty acid
- **Small intestine:**
  - **Bile acids:** emulsify fat
  - **Pancreatic lipase:** two fatty acids and glycerol
  - **Lecithin** in bile packaged with **monoglycerides** and fatty acids to create **micelles** for absorption
  - Short-chain fatty acids enter bloodstream and travel to liver
  - Long-chain fatty acids enter lymph and need transport carriers
Digesting and Absorbing Fat

1. Mouth
   Chewing or mechanically breaking down fatty foods begins in your mouth.

2. Stomach
   Fat digestion continues in the stomach with the aid of the enzyme gastric lipase.

3. Small intestine
   Bile acids in bile secreted from the gallbladder help emulsify the fat into smaller globules, enabling pancreatic lipase to break it down more easily.

4. Absorption
   By-products of fat digestion travel through your intestinal cells. Short-chain fatty acids enter your bloodstream directly. Long-chain fatty acids are reformulated into fats and need transport carriers, called chylomicrons, which travel in your lymph before entering your blood.

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Figure 5.10
Animation: Fat Digestion
What Happens to the Fat You Eat?

**Lipoproteins** transport fat through the lymph and blood

- **Chylomicrons**: carry digested fat through lymph into bloodstream
- **Very low-density lipoproteins (VLDL)**: deliver fat made in liver to cells
- **Low-density lipoproteins (LDL, “bad” cholesterol)**: deposit cholesterol on walls of arteries
- **High-density lipoproteins (HDL, “good” cholesterol)**: remove cholesterol from body and deliver to liver for excretion
Lipoproteins & Atherosclerosis

Video
Chylomicron

- Phospholipid
- Cholesterol
- Protein
- Fat droplet (triglycerides)
Lipoproteins

Figure 5.12
Roles of Lipoproteins

- **Liver**
  - **a** VLDLs deliver fatty acid made in the liver to the cells.
  - **c** HDLs transport cholesterol from the body cells and deliver it to the liver for disposal.
  - **b** LDLs transport cholesterol to the cells, in some cases into the arterial lining.

**Figure 5.13**
How Does Your Body Use Fat and Cholesterol?

Fat

- An energy-dense source of fuel: 9 calories per gram
  - Glucagon also stimulates release of fat from fat cells to fuel the heart, liver, and skeletal muscle
- Is needed for absorption of fat-soluble vitamins A, D, E, K, and carotenoids
- Insulates body to maintain body temperature
- Cushions bones, organs, nerves
How Does Your Body Use Fat and Cholesterol?

Two polyunsaturated fatty acids, **linoleic acid** (an omega-3 fatty acid) and **alpha-linolenic acid** (an omega-6 fatty acid), are essential

- **Eicosanoids**: hormone-like substances involved in inflammation, blood clotting, blood pressure. ([Learn more](#))
- The essential fatty acids help maintain healthy skin cells, nerves, and cell membranes.
- **Eicosapentaenoic acid (EPA)** and **docosahexaenoic acid (DHA)**: two omega-3 fatty acids that are heart healthy.
How Does Your Body Use Fat and Cholesterol?

- Cholesterol plays several vital roles:
  - Part of cell membranes
  - Serves as a precursor for:
    1. Vitamin D
    2. Bile acids
    3. Sex hormones
Essential Fatty Acids

Polyunsaturated fatty acids

Omega-6 fatty acids
Linoleic acid
(an essential fatty acid)

Arachidonic acid

Omega-3 fatty acids
Alpha-linolenic acid
(an essential fatty acid)

Docosahexaenoic acid
(DHA)

Eicosapentaenoic acid
(EPA)

Figure 5.14
How Much Fat Do You Need Each Day?

You need to consume a specific percentage of your daily calories from fat

- **AMDR of DRI:** 20 to 35 percent of total daily calories should come from fat
- Remember that dietary fat has more than twice the calories per gram (9/gram) of carbohydrates or protein
- For heart health, you should consume less than 10 percent of your calories from saturated fats
How Much Fat Do You Need Each Day?

- You need to consume a specific amount of essential fatty acids daily
  - Between 5 and 10 percent of the total calories in your diet should come from linoleic acid
  - Alpha-linolenic acid should make up 0.6 to 1.2 percent of your total calories
How Much Fat Do You Need Each Day?

- You should minimized saturated fat and *trans* fat in your diet
  - Consuming too much saturated fat can lead to higher levels of the “bad” LDL cholesterol carrier
  - *Trans* fats are created by food manufacturers through the process of hydrogenation
  - *Trans* fats are just as worse for heart health than saturated fat
How Much Fat Do You Need Each Day?

- You should minimize cholesterol in your diet
  - Your body makes all the cholesterol it needs so you do not need to consume it in your diet
  - Healthy individuals over the age of 2 are advised to limit their dietary cholesterol to less than 300 mg daily
Capping Your Fat Intake

<table>
<thead>
<tr>
<th>If You Need This Many Calories to Maintain Your Weight</th>
<th>You Should Eat No More Than This Much</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fat (grams) (20% to 35% of total calories)</td>
</tr>
<tr>
<td>1,600</td>
<td>36-62</td>
</tr>
<tr>
<td>1,700</td>
<td>38-66</td>
</tr>
<tr>
<td>1,800</td>
<td>40-70</td>
</tr>
<tr>
<td>1,900</td>
<td>42-74</td>
</tr>
<tr>
<td>2,000</td>
<td>44-78</td>
</tr>
<tr>
<td>2,100</td>
<td>47-82</td>
</tr>
<tr>
<td>2,200</td>
<td>49-86</td>
</tr>
<tr>
<td>2,300</td>
<td>51-89</td>
</tr>
<tr>
<td>2,400</td>
<td>53-93</td>
</tr>
<tr>
<td>2,500</td>
<td>56-97</td>
</tr>
<tr>
<td>2,600</td>
<td>58-101</td>
</tr>
<tr>
<td>2,700</td>
<td>60-105</td>
</tr>
<tr>
<td>2,800</td>
<td>62-109</td>
</tr>
</tbody>
</table>

Sedentary women should consume approximately 1,600 calories daily. Teenage girls, active women, and many sedentary men need approximately 2,200 calories daily. Teenage boys, many active men, and some very active women need about 2,800 calories daily.

The percentage of calories from fat and the corresponding grams of fat can be calculated by multiplying your number of daily calories by 20 percent and 35 percent and then dividing those numbers by 9. (Fat provides 9 calories per gram.) To determine the amount of calories you should be eating daily, turn to Table 2.3 in Chapter 2.

For example, if you consume 2,000 calories daily:

\[
\begin{align*}
2,000 \times 0.20 \text{ (20 percent)} &= 400 \text{ calories} + 9 = 44 \text{ grams} \\
2,000 \times 0.35 \text{ (35 percent)} &= 700 \text{ calories} + 9 = 78 \text{ grams}
\end{align*}
\]

Your range of fat intake should be 44 to 78 grams daily.

To find the maximum grams of saturated fat that you should be consuming daily, repeat the process:

\[
\begin{align*}
2,000 \times 0.07 \text{ (7 percent)} &= 140 \text{ calories} + 9 = 16 \text{ grams} \\
2,000 \times 0.10 \text{ (10 percent)} &= 200 \text{ calories} + 9 = 22 \text{ grams}
\end{align*}
\]

The total amount of saturated fat intake should be no more than 22 grams daily.
Creating *Trans* Fatty Acids

**cis**
Hydrogens are on the same side of the double bond

**trans**
Hydrogens are on opposite sides of the double bond
Trans fats

The majority of *trans* fat can be found in *shortenings, stick (or hard) margarine, cookies, crackers, snack foods, fried foods (including fried fast food), doughnuts, pastries, baked goods, and other processed foods* made with or fried in partially hydrogenated oils.

Some *trans* fat is found naturally in small amounts in various meat and dairy products.
Major Food Sources of *Trans* Fat for American Adults

- **Animal products**: 21%
- **Cakes, cookies, crackers, pies, bread, etc.**: 40%
- **Margarine**: 17%
- **Fried potatoes**: 8%
- **Potato chips, corn chips, popcorn**: 5%
- **Household shortening**: 4%
- **Salad dressing**: 3%
- **Breakfast cereal**: 1%
- **Candy**: 1%

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# Cholesterol Content in Common Foods

<table>
<thead>
<tr>
<th></th>
<th>Cholesterol (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver, 3 oz</td>
<td>324</td>
</tr>
<tr>
<td>Breakfast biscuit with egg and sausage, 1</td>
<td>302</td>
</tr>
<tr>
<td>Egg, 1 large</td>
<td>212</td>
</tr>
<tr>
<td>Shrimp, 3 oz, canned</td>
<td>147</td>
</tr>
<tr>
<td>Fast-food hamburger, large, double patty</td>
<td>122</td>
</tr>
<tr>
<td>Ice cream, soft serve, vanilla, ½ cup</td>
<td>78</td>
</tr>
<tr>
<td>Beef, ground, cooked, 3 oz</td>
<td>77</td>
</tr>
<tr>
<td>Salmon, cooked, 3 oz</td>
<td>74</td>
</tr>
<tr>
<td>Chicken or turkey, breast, cooked, 3 oz</td>
<td>72</td>
</tr>
<tr>
<td>Lobster, cooked, 3 oz</td>
<td>61</td>
</tr>
<tr>
<td>Turkey, light meat, cooked, 3 oz</td>
<td>59</td>
</tr>
<tr>
<td>Egg noodles, 1 cup</td>
<td>53</td>
</tr>
<tr>
<td>Butter, 1 tbs</td>
<td>31</td>
</tr>
<tr>
<td>Cheddar cheese, 1 oz</td>
<td>30</td>
</tr>
<tr>
<td>Frankfurter, beef, 1</td>
<td>24</td>
</tr>
<tr>
<td>Milk, whole, 1 cup</td>
<td>24</td>
</tr>
<tr>
<td>Cheddar cheese, low fat, 1 oz</td>
<td>6</td>
</tr>
<tr>
<td>Milk, skim, 1 cup</td>
<td>4</td>
</tr>
</tbody>
</table>


Table 5.2

- Highest per unit volume
What Are the Best Food Sources of Fats?

- Foods that contain unsaturated fats (both monounsaturated and polyunsaturated fats) are better for your health than foods high in saturated fat, cholesterol, and/or trans fat
  - Unsaturated fats are abundant in vegetable oils as well as soybeans, walnuts, peanut butter, flaxseeds, and wheat germ
  - Vegetable oils, nuts, and flaxseeds are also good sources of essential fatty acids
Food Sources of the Essential Fatty Acids

Figure 5.17
Where’s the Saturated Fat in Your Foods?

<table>
<thead>
<tr>
<th>Meal</th>
<th>Grams of saturated fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
</tr>
<tr>
<td>Cream (2 oz) in coffee</td>
<td>7.0</td>
</tr>
<tr>
<td>Low-fat milk (2 oz) in coffee</td>
<td>0.5</td>
</tr>
<tr>
<td>Whole milk, 1 cup</td>
<td>5.0</td>
</tr>
<tr>
<td>Skim milk, 1 cup</td>
<td>&lt;0.5</td>
</tr>
<tr>
<td>Bagel with 2 oz cream cheese</td>
<td>13.0</td>
</tr>
<tr>
<td>English muffin with 1 tbs light margarine</td>
<td>2.0</td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
</tr>
<tr>
<td>Cheeseburger on hamburger roll</td>
<td>13.5</td>
</tr>
<tr>
<td>Veggie burger on hamburger roll</td>
<td>1.5</td>
</tr>
<tr>
<td>Pepperoni pizza, 2 slices</td>
<td>4.5</td>
</tr>
<tr>
<td>Mushroom and pepper pizza, 2 slices</td>
<td>1.5</td>
</tr>
<tr>
<td>Steak and cheese sub</td>
<td>10.0</td>
</tr>
<tr>
<td>Roast beef sandwich on roll</td>
<td>2.0</td>
</tr>
<tr>
<td>Dinner</td>
<td></td>
</tr>
<tr>
<td>Beef hot dog on roll</td>
<td>6.5</td>
</tr>
<tr>
<td>Turkey hot dog on roll</td>
<td>3.0</td>
</tr>
<tr>
<td>Mashed potatoes with butter and milk, 1 cup</td>
<td>6.0</td>
</tr>
<tr>
<td>Baked potato (small) with 1 tbs light margarine</td>
<td>2.0</td>
</tr>
<tr>
<td>Prime rib, 3 oz</td>
<td>13.0</td>
</tr>
<tr>
<td>Grilled salmon, 3 oz</td>
<td></td>
</tr>
<tr>
<td>Snacks</td>
<td></td>
</tr>
<tr>
<td>Nachos with cheese, 2 oz chips and 3 oz cheese</td>
<td>21.0</td>
</tr>
<tr>
<td>Vegetables with salsa, 1 cup vegetables and 1/2 cup salsa</td>
<td>0</td>
</tr>
<tr>
<td>Gourmet vanilla ice cream, 1 cup</td>
<td>21.0</td>
</tr>
<tr>
<td>Gourmet lemon sorbet, 1 cup</td>
<td>0</td>
</tr>
</tbody>
</table>
Composition of Various Fats

Figure 5.19

- **Coconut oil**: High in saturated fats, moderate in monounsaturated fats, and low in polyunsaturated fats.
- **Butter**: High in saturated fats, moderate in monounsaturated fats, and low in polyunsaturated fats.
- **Beef tallow**: High in saturated fats, moderate in monounsaturated fats, and low in polyunsaturated fats.
- **Palm oil**: High in saturated fats, moderate in monounsaturated fats, and moderate in polyunsaturated fats.
- **Lard**: High in saturated fats, moderate in monounsaturated fats, and low in polyunsaturated fats.
- **Olive oil**: High in monounsaturated fats, moderate in saturated fats, and moderate in polyunsaturated fats.
- **Canola oil**: High in monounsaturated fats, moderate in saturated fats, and high in polyunsaturated fats.
- **Peanut oil**: High in monounsaturated fats, moderate in saturated fats, and moderate in polyunsaturated fats.
- **Safflower oil**: High in monounsaturated fats, moderate in saturated fats, and high in polyunsaturated fats.
- **Flaxseed oil**: High in monounsaturated fats, moderate in saturated fats, and high in polyunsaturated fats.
- **Walnut oil**: High in monounsaturated fats, moderate in saturated fats, and moderate in polyunsaturated fats.
- **Sunflower oil**: High in monounsaturated fats, moderate in saturated fats, and moderate in polyunsaturated fats.
- **Corn oil**: High in monounsaturated fats, moderate in saturated fats, and moderate in polyunsaturated fats.
What Are Fat Substitutes and How Can They Be Part of a Healthy Diet?

- Fat substitutes are designed to provide all the creamy properties of fat for fewer calories and total fat grams
  - Because fat has more than double the calories per gram of carbohydrates or protein, fat substitutes have the potential to reduce calories from fat by more than 50 percent

- Fat substitutes can be carbohydrate-, protein-, or fat-based
  - The majority are carbohydrate-based and use plant polysaccharides

Sucrose + FFAs
# Common Fat Substitutes

<table>
<thead>
<tr>
<th>Name (trade names)</th>
<th>Calories per Gram</th>
<th>Properties</th>
<th>How It’s Used</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Carbohydrate-Based</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fibers from Grains (Betatrim)</td>
<td>1–4</td>
<td>Gelling, thickener</td>
<td>Baked goods, meats, spreads</td>
</tr>
<tr>
<td>Fibers, Cellulose (Cellulose Gel)</td>
<td>0</td>
<td>Water retention, texture, mouthfeel</td>
<td>Sauces, dairy products, frozen desserts, salad dressings</td>
</tr>
<tr>
<td>Gums</td>
<td>0</td>
<td>Thickener, texture, mouthfeel, water retention</td>
<td>Salad dressings, processed meats</td>
</tr>
<tr>
<td>Polydextrose (Litesse)</td>
<td>1</td>
<td>Water retention, adds bulk</td>
<td>Baked goods, dairy products, salad dressings, cookies, gum</td>
</tr>
<tr>
<td>Modified Food Starch (Sta Slim)</td>
<td>1–4</td>
<td>Thickener, gelling, texture</td>
<td>Processed meats, salad dressings, frostings, fillings, frozen desserts</td>
</tr>
<tr>
<td><strong>Protein-Based</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microparticulated Protein (Simplesse)</td>
<td>1–4</td>
<td>Mouthfeel</td>
<td>Dairy products, salad dressings, spreads</td>
</tr>
<tr>
<td><strong>Fat-Based</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mono- or Diglycerides (Dur-Lo)</td>
<td>9*</td>
<td>Mouthfeel, moisture retention</td>
<td>Baked goods</td>
</tr>
<tr>
<td>Short-chain Fatty Acids (Salatrim)</td>
<td>5</td>
<td>Mouthfeel</td>
<td>Confections, baked goods</td>
</tr>
<tr>
<td>Olestra (Olean)</td>
<td>0</td>
<td>Mouthfeel</td>
<td>Savory snacks</td>
</tr>
</tbody>
</table>

Less of this fat substitute is needed to create the same effect as fat, so the calories are reduced in foods using this product.

What Is Heart Disease and What Increases Your Risk?

Heart disease begins with a buildup in the arteries.

- **Atherosclerosis:** narrowing of arteries due to buildup of plaque (hardened debris of cholesterol-laden foam cells, platelets, calcium, cellular waste products)
  
  - Thought to begin with injury to lining of arteries, contributed by high blood pressure, high cholesterol levels, and smoking

  - Increases chance of blood clots blocking the vessel, causing heart attack or stroke
Atherosclerosis

Video

Figure 5.20
# Risk Factors for Heart Disease

<table>
<thead>
<tr>
<th>Factors You Cannot Control</th>
<th>Factors You Can Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Your age and gender</td>
<td>Type 2 diabetes mellitus</td>
</tr>
<tr>
<td>Your family history of heart disease</td>
<td>High blood pressure</td>
</tr>
<tr>
<td>Type 1 diabetes mellitus</td>
<td>Smoking</td>
</tr>
<tr>
<td></td>
<td>Physical inactivity</td>
</tr>
<tr>
<td></td>
<td>Excess weight</td>
</tr>
<tr>
<td></td>
<td>A low HDL “good” cholesterol level</td>
</tr>
<tr>
<td></td>
<td>A high LDL “bad” cholesterol level</td>
</tr>
</tbody>
</table>

Table 5.5
What Is Heart Disease and What Increases Your Risk?

Risk factors you can control:

- Regular exercise can help lower LDL and raise HDL cholesterol.
- Losing excess weight and quitting smoking can help increase HDL levels.

Other Potential Risk Factors: high levels of homocysteine, Lp(a) protein, C-reactive protein (sign of inflammation), presence of *clamydia pneumoniae*

- **Syndrome X**: group of risk factors, including insulin resistance, that increase the risk of heart disease
Nutrition in the Real World: The Traditional Mediterranean Diet

Traditional diet of Mediterranean region associated with lower risk of heart disease and cancer

- Very active lifestyle as well as long, relaxing family meals, afternoon siestas, supportive community
- Plant-based diet of whole grains, fruits, vegetables, legumes, and nuts
- With olive oil, low-fat dairy, water
- Occasional fish, poultry, eggs, meat, sweets, wine
The Traditional Healthy Mediterranean Diet Pyramid
Dr. Andrew Weil: Natural ways to lower cholesterol
What Can You Do to Maintain Healthy Blood Cholesterol Levels?

1. Minimize saturated fats, *trans* fats, cholesterol in diet
2. Eat more fish
3. Eat more plant foods
4. Load up on foods rich in antioxidants and phytochemicals
5. Get plenty of exercise and manage your weight
6. Moderate use of alcohol may reduce risk of heart disease but some should avoid alcohol
7. The whole is greater than the sum of its parts
## The Cholesterol Raising Effects of Popular Foods

<table>
<thead>
<tr>
<th>Food</th>
<th>Total Fat</th>
<th>Saturated Fat</th>
<th>Trans Fat</th>
<th>Total Cholesterol-Raising Fats (Saturated fats + trans fats)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spreads</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Butter, 1 tbs</td>
<td>11</td>
<td>7.0</td>
<td>0.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Margarine (stick), 1 tbs</td>
<td>11</td>
<td>2.0</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Margarine (tub), 1 tbs</td>
<td>6.5</td>
<td>1.0</td>
<td>0.5</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Commercially Prepared Foods and Snacks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>French fries, medium</td>
<td>27</td>
<td>6.5</td>
<td>8.0</td>
<td>14.5</td>
</tr>
<tr>
<td>(fast food)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Doughnut, 1</td>
<td>18</td>
<td>4.5</td>
<td>5.0</td>
<td>9.5</td>
</tr>
<tr>
<td>Potato chips, small bag</td>
<td>11</td>
<td>2.0</td>
<td>3.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Cookies, 3</td>
<td>6</td>
<td>1.0</td>
<td>2.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Food Sources of Omega-3 Fatty Acids

Figure 5.21
## Ways to Decrease Excess LDL (Bad) Cholesterol

<table>
<thead>
<tr>
<th>Dietary Changes</th>
<th>Lifestyle Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consume less saturated fat</td>
<td>Lose excess weight</td>
</tr>
<tr>
<td>Consume less trans fats</td>
<td>Exercise more</td>
</tr>
<tr>
<td>Consume less dietary cholesterol</td>
<td></td>
</tr>
<tr>
<td>Consume more soluble fiber-rich foods</td>
<td></td>
</tr>
<tr>
<td>Consume a more plant-based diet</td>
<td></td>
</tr>
</tbody>
</table>
Nutrition in the Real World: Mercury and Fish

- **Methyl-mercury** is a toxic chemical especially harmful to the nervous systems of unborn children
  - Accumulates in larger fish with a longer life span
  - Examples: swordfish, shark, king mackerel, tilefish

- FDA recommends women of childbearing age and young children avoid these four types of fish
  - Pregnant women/women of childbearing age: up to 12 oz of other fish (variety) weekly
  - Canned albacore tuna has more mercury than light tuna: 6 oz/week limit
The End

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