Chapter 5

The Lipids: Fats, Oils, Phospholipids, and Sterols

PowerPoint Lectures for
Nutrition: Concepts and Controversies, eleventh edition
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Lectures by Judy Kaufman, Ph.D.
Introducing the Lipids

Lipids in foods and the human body fall into three classes:

1. Triglycerides
2. Phospholipids
3. Sterols

When we say “fat,” we generally mean triglycerides
# Usefulness of Fats in the Body and in Food

## Table 5-1: The Usefulness of Fats

<table>
<thead>
<tr>
<th>Fats in the Body</th>
<th>Fats in Food</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy stores</strong> Fats are the body's chief form of stored energy.</td>
<td><strong>Nutrient</strong> Fats provide essential fatty acids.</td>
</tr>
<tr>
<td><strong>Muscle fuel</strong> Fats provide most of the energy to fuel muscular work.</td>
<td><strong>Energy</strong> Fats provide a concentrated energy source in foods.</td>
</tr>
<tr>
<td><strong>Emergency reserve</strong> Fats serve as an emergency fuel supply in times of illness and diminished food intake.</td>
<td><strong>Transport</strong> Fats carry fat-soluble vitamins A, D, E, and K along with some phytochemicals, and assist in their absorption.</td>
</tr>
<tr>
<td><strong>Padding</strong> Fats protect the internal organs from shock through fat pads inside the body cavity.</td>
<td><strong>Raw materials</strong> Fats provide raw material for making needed products.</td>
</tr>
<tr>
<td><strong>Insulation</strong> Fats insulate against temperature extremes through a fat layer under the skin.</td>
<td><strong>Sensory appeal</strong> Fats contribute to the taste and smell of foods.</td>
</tr>
<tr>
<td><strong>Cell membranes</strong> Fats form the major material of cell membranes.</td>
<td><strong>Appetite</strong> Fats stimulate the appetite.</td>
</tr>
<tr>
<td><strong>Raw materials</strong> Fats are converted to other compounds, such as hormones, bile, and vitamin D, as needed.</td>
<td><strong>Satiety</strong> Fats contribute to feelings of fullness.</td>
</tr>
<tr>
<td><strong>Texture</strong> Fats help make foods tender.</td>
<td><strong>Texture</strong> Fats help make foods tender.</td>
</tr>
</tbody>
</table>
Usefulness of Fats in the Body

• Fat cells can expand

• The more fat they store, the larger they grow

• An obese person's fat cells are larger than a thin person's.

• Fats packs in tightly together w/out water (like glycogen) and store more energy in a small space
Usefulness of Fats in the Body

Thanks to internal fat pads, vital organs are cushioned from shock.
People naturally like high-fat foods

- Aromas
- Flavors
- Tenderness
- Satiety
Triglycerides: Fatty Acids and Glycerol

- Glycerol (3 carbons long) + 3 fatty acids
- Each species of animal make its own kind of triglyceride (controlled by genetics)
Saturated versus Unsaturated Fatty Acids

- **Saturated fatty acid** – filled to capacity with hydrogen atoms
- **Unsaturated fatty acid** – missing hydrogen
- **Monounsaturated** – one point of unsaturation
- **Polyunsaturated** – two or more points of unsaturation (PUFA)
Saturated versus Unsaturated Fatty Acids

Fats melt at different temperatures

- Saturated fats – solid at room temperature
- Unsaturated fats – liquids at room temperature
Saturated versus Unsaturated Fatty Acids

Key:
- **Saturated fatty acids**
- **Polyunsaturated, omega-6 fatty acids**
- **Monounsaturated fatty acids**
- **Polyunsaturated, omega-3 fatty acids**

**Animal fats and the tropical oils of coconut and palm contain mostly saturated fatty acids.**

- Coconut oil
- Butter
- Beef tallow (beef fat)
- Palm oil
- Lard (pork fat)

**Some vegetable oils, such as olive and canola, are rich in monounsaturated fatty acids.**

- Olive oil
- Canola oil
- Peanut oil

**Many vegetable oils are rich in omega-6 polyunsaturated fatty acids.**

- Safflower oil
- Sunflower oil
- Corn oil
- Soybean oil
- Walnut oil
- Cottonseed oil

**Only a few oils provide significant omega-3 polyunsaturated fatty acids.**

- Flaxseed oil
- Fish oil

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*These families of polyunsaturated fatty acids are explained in a later section.

Fish oil average values derived from USDA data for salmon, sardine, and herring oils.
Phospholipids

- **Phospholipid**
  - Glycerol + two fatty acids + phosphorus
  - Phosphorus part makes it soluble(able to be dissolved) in water
  - Fatty acids make it soluble in fat
  - Therefore can serve as an **emulsifier:** a substance that mixes w/both fat and water & permanently spreads the fat in water
Lecithin “phospholipid”

- ex: Lecithin (phospholipid) in egg yolks blends vinegar with the oil to make mayonnaise spreadable.
- Key role is in cell membranes - control what goes in and out of the cell.
- May lower blood cholesterol
- Companies may sell it in supplement form but you don't need it
- Your body makes all the lecithin it needs.
Sterols

• Sterols
  – Large molecules consisting of interconnected rings of carbon atoms with side chains of carbon, hydrogen, and oxygen attached
  – Cholesterol
    • is found in all animal cell membranes
    • is not an essential nutrient (body is able to produce)
    • forms plaques that cause atherosclerosis
  – Cholesterol serves as the raw material for making
    • bile
    • vitamin D
    • steroid hormones including the sex hormones
Lipids in the Body

• Lipids affect the body’s functioning and condition

• Lipids demand special handling because they are insoluble in water and body fluids consist largely of water
Digestion and Absorption of Fats

1. In the mouth and stomach:
   Little fat digestion takes place.

2. In the small intestine:
   Digestive enzymes accomplish most fat digestion in the small intestine. There, bile emulsifies fat, making it available for enzyme action. The enzymes cleave triglycerides into free fatty acids, glycerol, and monoglycerides.

3. At the intestinal lining:
   The parts are absorbed by intestinal villi. Small lipid particles such as glycerol and short-chain fatty acids are small enough to enter directly into the bloodstream.

4. The cells of the intestinal lining convert large lipid fragments, such as monoglycerides and long-chain fatty acids back into triglycerides and combine them with protein, forming chylomicrons (a type of lipoprotein) that travel in the lymph vessels to the bloodstream.

5. In the large intestine:
   A small amount of cholesterol trapped in fiber exits with the feces.

Note: In this diagram, molecules of fatty acids are shown as large objects, but, in reality, molecules of fatty acids are too small to see even with a powerful microscope, while villi are visible to the naked eye.
In the stomach, the fat and watery digestive juices tend to separate. Enzymes are in the water and can’t get at the fat.

When fat enters the small intestine, the gallbladder secretes bile. Bile has an affinity for both fat and water, so it can bring the fat into the water.

After emulsification, more fat is exposed to the enzymes, and fat digestion proceeds efficiently.
Storing & Using The Body's Fat

• Triglycerides eaten from food are transported by chylomicrons to: muscles, breasts, outer fat layer under the skin, stored in the body's fat cells for later use.

• When low on fuel from food, the body draws on its stored fat and glycogen for energy.

• Fat cells take apart the stored fat molecules and release fat components into the bloodstream.

• Upon receiving these components, cells break them down further into parts.

• Each fragment is combined with a fragment derived from glucose, and the energy-releasing process continues, liberating energy, carbon dioxide, and water.

• You need carbs in order to break down body fat
What is the best way to use the energy stored as body fat?
• A diet too high in saturated or trans fats invites heart and artery disease.

• Some studies suggest a high saturated fat diet that is also low in fish oils may increase the risk of certain cancers.

• Obesity is more likely since fat has 9 calories per gram.
## Recommendations For Lipid Intakes

<table>
<thead>
<tr>
<th>1. Total fat&lt;sup&gt;a&lt;/sup&gt;</th>
<th><strong>Dietary Guidelines for Americans 2005</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>■ Keep total fat intake between 20 to 35% of calories from mostly polyunsaturated and monounsaturated fat sources such as fish, nuts, and vegetable oils.</td>
</tr>
<tr>
<td></td>
<td>■ Select and prepare foods that are lean, low-fat, or fat-free.</td>
</tr>
</tbody>
</table>

**Dietary Reference Intakes**

■ An acceptable range of fat intake is estimated at 20 to 35% of total calories.

<table>
<thead>
<tr>
<th>2. Saturated fat</th>
<th><strong>American Heart Association</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>■ Limit saturated fat to less than 7% of total energy.</td>
</tr>
</tbody>
</table>

**Dietary Guidelines for Americans 2005;<sup>b</sup> Dietary Reference Intakes<sup>c</sup>**

■ Keep saturated fat intake low, less than 10% of calories, within the context of an adequate diet.

<table>
<thead>
<tr>
<th>3. Trans fat</th>
<th><strong>Dietary Guidelines for Americans 2005</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>■ Keep trans fat intake as low as possible.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Polyunsaturated fatty acids</th>
<th><strong>American Heart Association</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>■ Limit trans fat to less than 1% of total energy.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Cholesterol</th>
<th><strong>American Heart Association, Dietary Guidelines for Americans 2005, and World Health Organization</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>■ Limit cholesterol to less than 300 milligrams per day.&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**Dietary Reference Intakes<sup>c</sup>**

■ Minimize cholesterol intake within the context of a healthy diet.

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<sup>a</sup>Includes monounsaturated fatty acids.

<sup>b</sup>The Dietary Guidelines for Americans, 2005 use the term solid fats to describe sources of saturated fatty acids. Solid fats include milk fat, fats of high-fat meats and cheeses, hard margarines, butter, lard, and shortening.

<sup>c</sup>For DRI values set for various life stages, see the inside front cover. Linoleic and linolenic acids are defined on p. 161.

<sup>d</sup>People with heart disease should aim for less than 200 mg/day.
Lipoproteins & Heart Disease Risk

- We need lipoproteins (chylomicrons) in order to transport monoglycerides and long chain fatty acids around the body.

- Lipoproteins are clusters of proteins & phospholipids that are emulsifiers.

- The tissues of the body can take whatever fat they need from lipoproteins passing by in the bloodstream.
# Lipoproteins: transport lipids in the blood and lymph

<table>
<thead>
<tr>
<th>LDL</th>
<th>HDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Lighter, larger, richer in cholesterol</td>
<td>- Smaller</td>
</tr>
<tr>
<td>- Transport cholesterol and other lipids from the liver to the tissue</td>
<td>- Dense</td>
</tr>
<tr>
<td>- Carry lipids that trigger inflammation (contributed to heart disease)</td>
<td>- Packed w/more protein</td>
</tr>
<tr>
<td>- Carry extra cholesterol away from the body cells to liver for disposal</td>
<td></td>
</tr>
</tbody>
</table>
What does food cholesterol have to do with blood cholesterol?

• Healthy people need 300 mg a day
• Genetics modifies everyone's ability to handle dietary cholesterol
• Body slows down cholesterol mixture when you have too much from food intake
• Moderation is key for people who have high blood cholesterol (200 mg a day)
Essential Polyunsaturated Fatty Acids

- Linoleic acid and linolenic acid
- Body can't make these fatty acids
- Need them from our diet.
- Need a healthy balance of both
- People are consuming more Omega 6s than Omega 3s

Table 5-3: Functions of the Essential Fatty Acids

These roles for the essential fatty acids are known, but others are under investigation.

- Provide raw material for eicosanoids.
- Serve as structural and functional parts of cell membranes.
- Contribute lipids to the brain and nerves.
- Promote normal growth and vision.
- Assist in gene regulation.
- Maintain outer structures of the skin, thus protecting against water loss.
- Help regulate genetic activities affecting metabolism.
- Support immune cell functions.
Deficiencies of Essential Fatty Acids

• When the diet is deficient in all of the polyunsaturated fatty acids, symptoms include:
  • Reproductive failure
  • Skin abnormalities
  • Kidney and liver disorders
  • Growth and vision impairment in infants

• The body stores EFA, so extreme deficiencies are rare.
Omega-6 Fatty Acid

- Linoleic acid is the “parent” member of the omega-6 fatty acid family
  - Abundant in vegetable oils
  - Nuts and seeds
  - Linoleic acid can be converted to other members of this family, for example, arachidonic acid
  - Too much is linked to certain cancers: breast, prostate, and colon cancers, heart disease, stroke, arthritis, asthma, menstrual cramps, diabetes, headaches...
  - Solidify and cause inflammation of tissues
  - Thicken the blood of humans, animals and plant juices
Linolenic acid is the “parent” member of the **omega-3 fatty acid** family

Linolenic acid can be converted to other members of this family, for example, **EPA** and **DHA**

Omega 3 thins the blood of humans and animals and sap of plants

Studies looking at how omega 3s can help with: depression, ADD, bipolar disorder
Omega-6 And Omega-3 Fatty Acid Families

- **EPA** (eicosapentaenoic acid) and **DHA** (decosahexaenoic acid):
  - are made in limited amounts in the body
  - abundant in fish oils
  - lower blood pressure
  - prevent blood clot formation
  - protect against irregular heartbeats
  - may reduce inflammation
  - essential for normal infant growth and development
  - may support immune system
  - may inhibit cancers
To obtain the health benefits from essential fatty acids requires obtaining the right balance between omega-3 and omega-6 fatty acids.

- Most Americans get mostly omega-6 from vegetable oils, salad dressings, and margarine and they need to balance this with *more* fish.
  - Average U.S. intake of EPA and DHA is 150 mg/day.
  - Recommended is 500 mg/day (about 2 fatty fish meals per week) to reduce CVD.
Other Food Sources of Omega-3 Fatty Acids

- Egg producers fortify certain brands of eggs by adding only fish meal to chicken food
  - The chickens lay DHA-enriched eggs
  - Fish are fed grains at fish farms which is low in omega 3.
  - Best source of Omega 3 for fish is phytoplankton (algae rich in chlorophyll)
  - Chlorophyll is the original source of Omega 3 fatty acids in fish
Sources of Omega 3

- Spinach
- Romaine lettuce
- Arugula
- Purslane
- Sprouted flax seed
- Sprouted chia seeds
- Flaxseed oil
What About Fish Oil Supplements?

Fish oil supplements are not recommended because:

- high intakes may increase bleeding times
- high intakes may interfere with wound healing
- high intakes may suppress immune function
- high intakes may upset the proper balance between omega-3 and omega-6 fatty acids
- they may contain toxins
- long-term effects are unknown
Seafood Safety – Balancing Risks and Benefits

• Some fish is contaminated with mercury, yet fish is still a safe food source.

• Safe for most people to consume two 3-ounce servings per week of most ocean fish.

• Not safe to consume raw fish and shellfish.

• Pregnant or lactating women and children are sensitive to mercury.

• Benefits outweigh risks.
The Effects of Processing on Unsaturated Fats

• Vegetable oils make up most of the added fat in the U.S. diet. Why??

Answer: Because fast food restaurants use them for frying, food manufacturers add them to processed foods, and consumers tend to choose margarine over butter.
What Is “Hydrogenated Vegetable Oil,” And What’s It Doing in My Chocolate Chip Cookies?

- Vegetable oils become more saturated when they are hydrogenated.
- Points of unsaturation are vulnerable to attack by oxygen (oxidation).
- **Oxidation** = nutrients combine with oxygen
- When the unsaturated points in the oils of food are oxidized, the oils become rancid.
- Hydrogenation forces hydrogen into the liquid oil, making the oil more saturated as it accepts the hydrogens.
What Is “Hydrogenated Vegetable Oil,” And What’s It Doing in My Chocolate Chip Cookies?

• Hydrogenated fats:
  • Resist rancidity; more resistant to oxidation
  • Are firmer textured; more spreadable
  • Have a higher smoking point than unsaturated oils
  • Are unhealthy
What Is "Hydrogenated Vegetable Oil," And What’s It Doing in My Chocolate Chip Cookies?

Unsaturated fatty acid
Points of unsaturation are places on fatty acid chains where hydrogen is missing. The bonds that would normally be occupied by hydrogen in a saturated fatty acid are shared, reluctantly, as a double bond between two carbons that both carry a slightly negative charge.

Hydrogenated fatty acid (now fully saturated)
When a positively charged hydrogen is made available to an unsaturated bond, it readily accepts the hydrogen and, in the process, becomes saturated. The fatty acid no longer has a point of unsaturation.

Trans-fatty acid
The hydrogenation process also produces some *trans*-fatty acids. The *trans*-fatty acid retains its double bond but takes a twist instead of becoming fully saturated. It resembles a saturated fatty acid both in shape and in its effects on health.
Baked goods often contain hydrogenated fats
What Are Trans Fatty Acids, And Are They Harmful?

- *Trans* fatty acids are a health risk
Formation of Trans Fatty Acids

- *Trans* fatty acids occur in small amounts in nature, mostly in dairy products.
- A lot of *trans* fatty acids formed during hydrogenation.
- Some unsaturated fatty acids change their shape instead of becoming saturated.
- Becomes trans unsaturated fatty acid.
- Change in shape changes their effect on the health of the body.
Health Effects of Trans Fatty Acids

• Consuming *trans* fat poses a risk to heart and arteries by:
  – Raising blood LDL cholesterol
  – Lowering blood HDL cholesterol
  – Increasing tissue inflammation, a key player in heart disease
  – Replacing heart-healthy oils
Trans Fat In Foods

• Largest contributor of *trans* fat to the U.S. diet has been commercially fried foods.

• Newly formulated commercial oils and fats can now perform the same job as the old hydrogenated fats, but with fewer *trans* fatty acids.
Are the New Fats Better For Health?

• Still not sure if the new fats are better for heart health.

• Many new fats merely substitute saturated fat for \textit{trans} fat.

• May be just as bad or worse than \textit{trans} fat.

• Take home message: Just because a food lacks \textit{trans} fat, does not mean it is good for you.
Fat In The Diet

• *Dietary Guidelines for Americans 2005* urge that, beyond a healthy minimum, people should:
  
  – Limit fat
  
  – Limit saturated fat
  
  – Limit *trans* fat
  
  – Limit calories
Added Fats

- Fats added to foods during preparation or at the table are a major source of fat in the diet.
- Majority of fats are hidden in fried foods, baked goods, sauces, and mixed dishes.
- These fats provide about 5 grams of pure fat, providing 45 calories
  - 1 tsp oil or shortening
  - 1 ½ tsp mayonnaise, butter, or margarine
  - 1 tbl regular salad dressing, cream cheese, or heavy cream
  - 1 ½ tbl sour cream
Meat, Poultry, Fish, Dried Peas and Beans, Eggs, and Nuts

Most people consume meats in larger amounts than recommended.
### Milk, Yogurt, and Cheese

#### Fat-free, skim, zero-fat, no-fat, or nonfat milk, 8 oz (<0.5% fat by weight)

<table>
<thead>
<tr>
<th>Calories</th>
<th>80</th>
<th>Calories from Fat 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>5mg</td>
<td>2%</td>
</tr>
</tbody>
</table>

#### Whole milk, 8 oz (3.3% fat by weight)

<table>
<thead>
<tr>
<th>Calories</th>
<th>150</th>
<th>Calories from Fat 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>8g</td>
<td>12%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>5g</td>
<td>25%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>24mg</td>
<td>8%</td>
</tr>
</tbody>
</table>

#### Reduced fat, less-fat milk, 8 oz (2% fat by weight)

<table>
<thead>
<tr>
<th>Calories</th>
<th>120</th>
<th>Calories from Fat 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>5g</td>
<td>8%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>2g</td>
<td>10%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>20mg</td>
<td>7%</td>
</tr>
</tbody>
</table>

#### Low-fat milk, 8 oz (1% fat by weight)

<table>
<thead>
<tr>
<th>Calories</th>
<th>105</th>
<th>Calories from Fat 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>2g</td>
<td>3%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>1.5g</td>
<td>8%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>10mg</td>
<td>3%</td>
</tr>
</tbody>
</table>

#### Cheddar cheese, 1.5 oz

<table>
<thead>
<tr>
<th>Calories</th>
<th>165</th>
<th>Calories from Fat 130</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>14g</td>
<td>22%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>9g</td>
<td>45%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>40mg</td>
<td>13%</td>
</tr>
</tbody>
</table>

#### Low-fat cheddar cheese, 1.5 oz

<table>
<thead>
<tr>
<th>Calories</th>
<th>70</th>
<th>Calories from Fat 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>3g</td>
<td>5%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>2g</td>
<td>10%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>10mg</td>
<td>3%</td>
</tr>
</tbody>
</table>

#### Strawberry yogurt, 8 oz

<table>
<thead>
<tr>
<th>Calories</th>
<th>250</th>
<th>Calories from Fat 45</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>5g</td>
<td>8%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>3g</td>
<td>15%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>15mg</td>
<td>5%</td>
</tr>
</tbody>
</table>

#### Low-fat strawberry yogurt, 8 oz

<table>
<thead>
<tr>
<th>Calories</th>
<th>240</th>
<th>Calories from Fat 20</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Daily Value*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Fat</td>
<td>2.5g</td>
<td>4%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td>2g</td>
<td>10%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>15mg</td>
<td>5%</td>
</tr>
</tbody>
</table>
Grains

Low-fat granola, 1/2 c
- Calories: 195
- Calories from Fat: 35
  - % Daily Value: 5%
- Total Fat: 3g
- Saturated Fat: 1g
- Cholesterol: 0mg

Crispy oat bran, 1/2 c
- Calories: 150
- Calories from Fat: 45
  - % Daily Value: 8%
- Total Fat: 5g
- Saturated Fat: 1.5g
- Cholesterol: 0mg

Buttery crackers, 5 crackers
- Calories: 80
- Calories from Fat: 35
  - % Daily Value: 6%
- Total Fat: 4g
- Saturated Fat: 1g
- Cholesterol: 0mg

Fried rice, 1/2 c
- Calories: 140
- Calories from Fat: 65
  - % Daily Value: 11%
- Total Fat: 7g
- Saturated Fat: 1g
- Cholesterol: 20mg

A home-made waffle
- Calories: 220
  - Calories from Fat: 100
  - % Daily Value:
- Total Fat: 11g
- Saturated Fat: 2g
- Cholesterol: 50mg

A dinner roll
- Calories: 80
  - Calories from Fat: 20
  - % Daily Value:
- Total Fat: 2g
- Saturated Fat: 0g
- Cholesterol: 0mg

Fettuccine alfredo, 1/2 c
- Calories: 250
  - Calories from Fat: 130
  - % Daily Value:
- Total Fat: 14g
- Saturated Fat: 8g
- Cholesterol: 60mg

A breakfast bar
- Calories: 150
  - Calories from Fat: 55
  - % Daily Value:
- Total Fat: 6g
- Saturated Fat: 2.5g
- Cholesterol: 0mg

A muffin
- Calories: 160
  - Calories from Fat: 54
  - % Daily Value:
- Total Fat: 6g
- Saturated Fat: 1g
- Cholesterol: 20mg

A large biscuit
- Calories: 260
  - Calories from Fat: 80
  - % Daily Value:
- Total Fat: 11g
- Saturated Fat: 2.5g
- Cholesterol: 0mg

A small croissant
- Calories: 230
  - Calories from Fat: 108
  - % Daily Value:
- Total Fat: 12g
- Saturated Fat: 7g
- Cholesterol: 38mg
# Food Feature: Defensive Dining

## Table 5.8 Substitutes for High-Fat Ingredients

<table>
<thead>
<tr>
<th>USE</th>
<th>INSTEAD OF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fat-free milk products</td>
<td>Whole-milk products</td>
</tr>
<tr>
<td>Evaporated fat-free (&quot;skim&quot;) milk (canned)</td>
<td>Cream</td>
</tr>
<tr>
<td>Yogurt* or fat-free sour cream replacer</td>
<td>Sour cream</td>
</tr>
<tr>
<td>Reduced-calorie margarine; butter replacers</td>
<td>Butter</td>
</tr>
<tr>
<td>Wine, lemon juice, or broth</td>
<td>Butter</td>
</tr>
<tr>
<td>Fruit butters</td>
<td>Butter</td>
</tr>
<tr>
<td>Part-skim or fat-free ricotta; low-fat or fat-free cottage cheese*</td>
<td>Whole-milk ricotta</td>
</tr>
<tr>
<td>Part-skim or reduced-fat cheeses; &quot;filled&quot; cheeses</td>
<td>Regular cheeses</td>
</tr>
<tr>
<td>in which vegetable oil has replaced saturated fat</td>
<td></td>
</tr>
<tr>
<td>1 tbs cornstarch (for thickening sauces)</td>
<td>1 egg yolk</td>
</tr>
<tr>
<td>Low-fat or fat-free mayonnaise</td>
<td>Regular mayonnaise</td>
</tr>
<tr>
<td>Low-fat or fat-free salad dressing (for salads and marinades)</td>
<td>Regular salad dressing</td>
</tr>
<tr>
<td>Water-packed canned fish and meats</td>
<td>Oil-packed fish and meats</td>
</tr>
<tr>
<td>Lean ground meat and grain mixture</td>
<td>Ground beef</td>
</tr>
<tr>
<td>Low-fat frozen yogurt or sherbet</td>
<td>Ice cream</td>
</tr>
<tr>
<td>Herbs, lemons, spices, fruits, liquid smoke flavoring, or</td>
<td>Butter, bacon, bacon fat</td>
</tr>
<tr>
<td>ham-flavored bouillon cubes</td>
<td></td>
</tr>
<tr>
<td>Baked tortilla or potato chips; pretzels</td>
<td>Regular chips</td>
</tr>
</tbody>
</table>

*If the recipe calls for the food to be boiled, the yogurt or cottage cheese must be stabilized with a small amount of cornstarch or flour.
When ordering Mexican-style fast food, you can reduce both calories and saturated fat by limiting cheese, meat, and sour cream.

2 “grande” burritos with beef, beans, cheese, and sour cream; salsa

A broiled chicken breast sandwich with spicy mustard is just as tasty as a burger but delivers far less saturated fat and fewer calories. Beware of fried chicken sandwiches or “patties”—these can be as fatty as the hamburger choice.

Big double bacon cheeseburger, large fries, regular milkshake

Don’t let add-ons, such as greasy croutons, chips, bacon bits, full-fat cheese, and sour cream pile the calories and saturated fat onto your otherwise healthy fast-food salad. To cut fats and calories, leave off most of the toppings and use just half the dressing.

Taco salad with chili, cheese, sour cream, salsa, and taco chips

Reduce calories and saturated fat even further by ordering your veggie pizza with half the regular melted cheese and sprinkle it with parmesan cheese, herbs, or hot peppers for flavor.

Two slices extra cheese pizza with sausage and pepperoni

Two slices cheese pizza with mushrooms, olives, onions, and peppers
### Table 5-9: Choosing Unsaturated Fats Instead of Saturated Fats

Unsaturated fats can easily substitute for saturated fats in everyday foods, for example, cooking with olive oil instead of butter or slicing avocado on a salad instead of cheese. The fat grams listed in this table are for 100-calorie portions.

<table>
<thead>
<tr>
<th>FOODS (100-CAL PORTIONS)</th>
<th>SATURATED FAT (g/100 cal)</th>
<th>UNSATURATED FAT (g/100 cal)</th>
<th>TOTAL FAT (g/100 cal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olive oil (1 tbs) vs. butter (1 tbs)</td>
<td>2 vs. 7</td>
<td>9 vs. 4</td>
<td>11 vs. 11</td>
</tr>
<tr>
<td>Sunflower seeds (2 tbs) vs. bacon (2 slices)</td>
<td>1 vs. 3</td>
<td>7 vs. 6</td>
<td>8 vs. 9</td>
</tr>
<tr>
<td>Mixed nuts (2 tbs) vs. potato chips (10 chips)</td>
<td>1 vs. 2</td>
<td>8 vs. 5</td>
<td>9 vs. 7</td>
</tr>
<tr>
<td>Avocado (6 small slices) vs. cheese (1 slice)</td>
<td>2 vs. 4</td>
<td>8 vs. 4</td>
<td>10 vs. 8</td>
</tr>
<tr>
<td>Salmon (2 oz) vs. steak (1 1/2 oz)</td>
<td>1 vs. 2</td>
<td>3 vs. 3</td>
<td>4 vs. 5</td>
</tr>
</tbody>
</table>
Other tips to revise high-fat recipes:

- Grill, roast, bake, microwave, stir-fry, or poach foods.
- Choose larger portions of salad greens or vegetables and use dressings lightly.
- Reduce or eliminate “add-ons” such as butter, creamy sauces, cheese, bacon.
- Cut recipe amounts of meat in half; use only lean meats.
- Use defatted soups and gravies.
- Make prepared mixes, such as rice, without the fats called for on the label.
Low-Fat Diet Questions

• For healthy people, researchers now recommend a “wise-fat” approach.
High-Fat Foods and Heart Health

• Which of these high-fat foods rightly belong in a heart-healthy diet?

  a. Avocados
  b. Bacon
  c. Walnuts
  d. Potato chips
  e. Mackerel

Answer: a, c, e
Olive Oil: The Mediterranean Connection

- For those eating a Mediterranean diet rich in olives and olive oil:
  - Lowers total and LDL cholesterol and not HDL
  - Reduces LDL cholesterol’s vulnerability to oxidation
  - Reduces blood-clotting factors
  - Provides phytochemicals that act as antioxidants
  - Lowers blood pressure
• Olive oil cannot take all the credit for lower rates of heart disease seen with the Mediterranean diet.

• Other important factors are:
  • Lower intakes of red meats
  • Higher intakes of nuts, vegetables, and fruits
  • Higher intake of fish and seafood
Olives and their oil may benefit heart health
Nuts: More Than A High-Calorie Snack Food

- Nuts provide up to 80 percent of their calories from fat and one ounce has over 200 calories
- But, nuts are linked to heart health!!
- Nuts may lower heart disease because they are:
  - Low in saturated fats
  - High in fiber, vegetable protein, and vitamin E
  - High in phytochemicals that act as antioxidants