Digestive System and Nutrition

Chapter 6
Five Functions:
• Break up food
• Transport food (peristalsis, sphincters)
• Secrete digestive enzymes
• Promote absorption of nutrients
• Excrete solid wastes

Mouth, pharynx (throat), esophagus, stomach, small intestine, large intestine, secretory glands (salivary glands, liver, pancreas)
• Aka Alimentary Canal (one continuous tract open at both ends!)

Accessory Organs: liver, gall bladder, pancreas
Digestive System

- Esophagus
- Liver
- Gallbladder
- Pancreas
- Stomach
- Large Intestine
- Small Intestine
- Appendix
- Rectum
- Anus
Main Digestive Processes

- **Mouth** – break food into smaller pieces; saliva makes swallowing easier
- **Esophagus** – peristalsis (rhythmic muscular contractions)
  - Lower esophageal sphincter (LES)
- **Stomach** – gastric juices dissolve food, destroy bacteria, break down proteins
  - Pyloric sphincter
- **Small Intestine** – 20-foot long muscular tube; breakdown food (accessory organ secretions); absorb nutrients
- **Large Intestine** – 5-foot long muscular tube; water absorption; stool formation
- **Rectum** – holds the stool; sensory nerve endings here tell your brain when you have a stool to eliminate
What is Nutrition?

- **Nutrition** = the science of food and how the body uses it
- **Digestion** = the complex process of turning food you eat into energy your body can use
- **Calorie** = energy content of food
We need to get these from our diet.
Our bodies can’t make them at all or can’t make enough.
- Carbohydrates
- Fats
- Proteins
- Vitamins
- Minerals
- Water

Energy Sources
Carbohydrates (CHO)

- **In foods:**
  - **Simple:** fruits, milk, sugary foods, candy, soda
  - **Complex:** whole grains, potatoes, legumes (dried beans & peas), some vegetables

- **In the body:**
  - “Glucose” (in the blood)
  - “Glycogen” (stored in the liver and muscle)

- **Energy for:**
  - The brain, nerve cells, blood cells
  - The muscles (physical activity)
Whole Wheat Kernel

- Bran
- Endosperm
- Germ
Dietary Fiber

- Type of complex carbohydrate from plants
  - Impossible or difficult for humans to digest

- Soluble fiber:
  - Lowers blood cholesterol
  - Plant foods, esp. fruit, legumes, oats/oat bran

- Insoluble fiber:
  - Prevents constipation and maybe even colon cancer
  - Whole wheat, wheat bran, cereals, grains, vegetables

Lack of fiber + refined carbs = \( \uparrow \text{risk of diabetes} \)

25-38 grams fiber per day
Recommended CHO Intake

- **Total CHO**
  - 6-11 servings of breads, cereals, etc. \textit{PLUS} 5-9 servings of vegetables and fruits, \textit{OR}
  - 45-65\% of total daily calories

- **Simple CHO** (refined carbs, sugars)
  - <25\% of total daily calories
  - Only in moderation
2000-calorie Diet

60% of calories total from CHO:
\[0.60 \times 2000 \text{ cal} = 1200 \text{ cal Total CHO}\]

20% of calories from simple CHO:
\[0.20 \times 2000 \text{ cal} = 400 \text{ cal Simple CHO}\]

4 cal / gram of CHO:
\[1200 \text{ cal} \div 4 \text{ cal/g} = 300 \text{ g Total CHO}\]
\[400 \text{ cal Simple CHO} \div 4 \text{ cal/g} = 100 \text{ g Simple CHO}\]
Note the serving size and number of servings in the container. If you eat more than one serving, you have to increase all the values accordingly.

The nutrients required on the nutrient panel are those considered most important to the health of today's consumers.

The Daily Values are based on a daily diet of 2,000 calories. Individuals should adjust these values to fit their own calorie intake. (Moderately active people consume about 15 calories per day for each pound of body weight.)

Calories from fat are shown to help consumers meet dietary guidelines, which recommend that people get no more than 30% of calories from fat.

% Daily Value shows how a food fits into the overall daily diet. You may want to limit your intake of fat, cholesterol, sodium, and sugar and make sure you get enough fiber, protein, vitamins, and minerals.

**Nutrition Facts**

<table>
<thead>
<tr>
<th>Serving Size: 1/2 Cup (65g)</th>
<th>Servings Per Container: 14</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount Per Serving</strong></td>
<td></td>
</tr>
<tr>
<td>Calories 180</td>
<td>Calories from Fat 80</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Fat</strong></td>
<td></td>
</tr>
<tr>
<td>9g</td>
<td>13%</td>
</tr>
<tr>
<td>Saturated Fat</td>
<td></td>
</tr>
<tr>
<td>6g</td>
<td>28%</td>
</tr>
<tr>
<td>Trans Fat</td>
<td></td>
</tr>
<tr>
<td>0g</td>
<td></td>
</tr>
<tr>
<td><strong>Cholesterol</strong></td>
<td></td>
</tr>
<tr>
<td>25mg</td>
<td>9%</td>
</tr>
<tr>
<td><strong>Sodium</strong></td>
<td></td>
</tr>
<tr>
<td>55mg</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total Carbohydrate</strong></td>
<td></td>
</tr>
<tr>
<td>21g</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Dietary Fiber</strong></td>
<td></td>
</tr>
<tr>
<td>0g</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Sugars</strong></td>
<td></td>
</tr>
<tr>
<td>15g</td>
<td></td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td></td>
</tr>
<tr>
<td>3g</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vitamin A 8%</th>
<th>Vitamin C 0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium 6%</td>
<td>Iron 2%</td>
</tr>
</tbody>
</table>

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

<table>
<thead>
<tr>
<th>Calorie</th>
<th>2,000</th>
<th>2,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>Less than 65g</td>
<td>80g</td>
</tr>
<tr>
<td>Sat Fat</td>
<td>Less than 20g</td>
<td>25g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 300mg</td>
<td>300mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>Less than 2400mg</td>
<td>2400mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>300g</td>
<td>375g</td>
</tr>
<tr>
<td>Dietary Fiber</td>
<td>25g</td>
<td>30g</td>
</tr>
</tbody>
</table>
Fats

- Most concentrated source of energy
- Aid absorption of fat-soluble vitamins
  - Vitamins A, D, E, K
- Provide energy for activity
- Insulate and protect body organs
- Regulate:
  - estrogen production, blood pressure, nerve growth in children
Solid at room temperature
- Raise your body’s “bad” cholesterol
- Meats, whole milk, cheese, and butter
- Palm and coconut oils
- Aim for foods with <2 grams of saturated fat/serving

Hydrogenated fats (found in the list of ingredients, often as “partially hydrogenated oil”)
- Most margarines, shortenings, and peanut butters (the non “natural” peanut butters)
- Fried fast foods, fried snacks and chips
- Some salad dressings
- Pastries

Trans fats (found on Nutrition Facts panel)
- Any food with “hydrogenated oil” will contain some trans fatty acids
Unsaturated Fats

- Liquid at room temperature
  - **Monounsaturated:**
  - Raise your body’s “good” cholesterol
  - Olive, canola, and peanut oils
  - Most nuts, nut oils, avocado
  - **Polyunsaturated:**
  - Sunflower, corn, soybean, and safflower oils
“Essential” Polyunsaturated Fats

- Found in oils of plants and cold-water fish
- **Omega-3 fatty acids:**
  - Canola and soybean oils, walnuts, wheat germ, soybean
  - Nuts and seeds
  - Mackerel, salmon, anchovy, sardines, herring, tuna, and lake trout
  - Human milk (breastfeeding)
- **Omega-6 fatty acids:**
  - Leafy vegetables, seeds, nuts, grains, vegetable oils

*Fish Oil Supplements are generally NOT recommended*
The Bottom Line on Fats & Cholesterol

- Saturated, hydrogenated, and trans fats... Unhealthy
- Monounsaturated, Omega-3, Omega-6... Healthy
- Cholesterol in your diet... Not Essential
  - Found only in foods that come from animals

- Cholesterol in your blood... A waxy substance (lipid) carried in the blood that your body needs for certain functions, including production of new cells
  - Our bodies make cholesterol (in the liver)
  - Certain foods we eat signal our livers to make more or less cholesterol
    - Saturated and trans fats
Recommended Fat Intake

- **Total Fat:**
  - 20-35% of total daily calories, OR
  - <65 grams of fat/day

- **Saturated Fat:**
  - 0-10% of total daily calories, OR
  - <20 grams of saturated fat/day

- **Cholesterol:**
  - 0-300 mg/day
2000-calorie Diet

25% of calories from Fat:
\[ 0.25 \times 2000 \text{ cal} = 500 \text{ cal Total Fat} \]
10% of calories from Saturated Fat:
\[ 0.10 \times 2000 = 200 \text{ cal Saturated Fat} \]

9 cal / gram of Fat:
\[ 500 \text{ cal} \div 9 \text{ cal/g} = 56 \text{ g Total Fat} \]
\[ 200 \text{ cal Sat Fat} \div 9 \text{ cal/g} = 22 \text{ g Saturated Fat} \]
### Recommended Daily Intakes for a 2,000-Calorie-a-Day Diet (3 meals)

<table>
<thead>
<tr>
<th>Calories</th>
<th>Total fat</th>
<th>Saturated fat</th>
<th>Sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,000</td>
<td>&lt;65 (g)</td>
<td>&lt;20 (g)</td>
<td>&lt;1,500 (mg)</td>
</tr>
</tbody>
</table>

#### Fast-Food Meal

<table>
<thead>
<tr>
<th>Fast-Food Meal</th>
<th>Calories</th>
<th>Total Fat (g)</th>
<th>Saturated Fat (g)</th>
<th>Sodium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hamburger</td>
<td>670</td>
<td>39</td>
<td>11</td>
<td>1,020</td>
</tr>
<tr>
<td>Medium Fries</td>
<td>360</td>
<td>18</td>
<td>5</td>
<td>640</td>
</tr>
<tr>
<td>Medium Chocolate Shake</td>
<td>690</td>
<td>20</td>
<td>12</td>
<td>560</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>1,720</td>
<td>77</td>
<td>28</td>
<td>2,220</td>
</tr>
</tbody>
</table>
Proteins

- Composed of amino acids (building blocks)
  - There are 9 essential amino acids
  - We cannot store protein, except in the form of body tissue
- Purposes:
  - Form muscles, bones, blood, enzymes, hormones, antibodies, and cell membranes
  - Cell repair
  - Fluid and electrolyte balance
  - For energy only in last resort (from body’s own tissue)
Proteins in Our Diet

- **Incomplete:** Do not supply all 9 essential amino acids (a.a.)
  - Legumes, nuts, whole grains

- **Complete:** Supply all 9 essential a.a.
  - Egg whites, meat, fish, poultry, milk, cheese, soy
  - Complementary proteins – 2 incompletes make a complete protein
    - e.g. combining peanut butter with whole wheat bread
Recommended Protein Intake

- 0.36 – 0.45 gram per pound body wt
- 2-3 servings of beans, peas, eggs, or lean meats, *AND* 2-3 servings of low-fat dairy
- More for growing children and pregnant and lactating women
150-lb College Student

0.36 – 0.45 g protein / lb body weight:

0.36 g/lb x 150 lb = 54 g protein
0.45g/lb x 150 lb = 68 g protein
Vitamins

- Promote chemical reactions in living cells
- No calories (no energy)
- 11 essential vitamins (p. 113)
  - Fat-soluble: Vitamins A, D, E, and K
  - Water-soluble: Vitamins C and B Complex
- Antioxidants:
  - Vitamins E & C
  - Beta-carotene (a precursor to Vitamin A)
  - Yellow, orange, dark green veggies; green tea
Vitamins

- **Sources:**
  - Fruits, vegetables, grains, and fortified foods

- **Health Effects:**
  - Deficiencies
  - Excesses

- In general, it is best to get your vitamins from foods as opposed to supplements
Minerals

- Regulate body functions
- Growth and maintenance of body tissues
- No calories (no energy)
- 20 essential minerals (p. 113)

Major sources:
- Lean meats, fish, dark green vegetables, whole grains, lowfat dairy products
Water

- Digestion and absorption of nutrients
- Blood, fluids, lubricants, regulate body temperature
- Need ~2-3 liters/day (= 8-12 cups)
- If you’re thirsty, you’re already dehydrated
Planning a Healthy Diet

MyPyramid.gov

BMR Calculator: http://www.webmd.com/diet/healthtool-metabolism-calculator
Today’s Ten Tips

1. Whole grains
2. Limit sugars
3. Colorful fruits/veggies
4. Low-fat dairy
5. Animal AND Plant protein
6. Healthy fats
7. Limit saturated fat
8. Whole, fresh foods
9. Balance & Variety
10. Portion sizes
Note the serving size and number of servings in the container. If you eat more than one serving, you have to increase all the values accordingly.

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- 12-oz soda = 39 g of sugar = 8-10t of sugar = 156 calories
- One soda/day = 1.2-1.5 cups sugar/week = 1100 calories/week = 1 lb of body fat/3 weeks
Food Shopping Tips
Energy Drinks...