An Overview of Nutrition
An Overview of Nutrition

- Nutrition
  - The science of foods and the nutrients and other substances they contain, and their actions in the body.
An Overview of Nutrition

• Food
  – Derived from plant or animal sources
• Provide energy and nutrients
  – Used by the body for maintenance, growth, and repair
Nutrition in Your Life

• Diet
  – The foods and beverages a person consumes
  • The quality of which will either benefit or impair our health
Food Choices

- Choices are personal
  - Behavioral or social
- Personal preference
  - Sweet, salty, spicy
- Habit
- Ethnic heritage or tradition
Food Choices

• Social interactions
• Availability, convenience, economy
  – Accessible, easy to prepare, affordable
• Positive and negative associations
• Emotional comfort
  – Boredom, depression, anxiety
Food Choices

• Values
  – Religious beliefs, environmental concerns
• Body weight and image
• Nutrition and health benefits
Food Choices

- Functional foods
  - Provide health benefits beyond their nutrient contributions
  - Ex. Whole foods, fortified foods
- Phytochemicals- nonnutrient compounds found in plant derived foods that have biological activity in the body
Nutrients in Food and in the Body

• Nutrient – chemical substances obtained from food and used in the body to provide energy, structure, growth, maintenance and repair of body tissues
Nutrients in Food and in the Body

• Composition of foods
  • Water
  • Carbohydrate, protein, lipid
  • Vitamins, minerals
    – Used for growth, maintenance and repair of tissues

• Nonnutrients
  – Fiber, phytochemicals, pigments, additives
The Nutrients

• Chemical composition of nutrients
  – Inorganic – not containing carbon (minerals and water)
  – Organic nutrients – contain carbon (carbohydrate, protein, lipids, and vitamins)
The Nutrients

**TABLE 1-1  Elements in the Six Classes of Nutrients**

Notice that organic nutrients contain carbon.

<table>
<thead>
<tr>
<th></th>
<th>Carbon</th>
<th>Hydrogen</th>
<th>Oxygen</th>
<th>Nitrogen</th>
<th>Minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inorganic nutrients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Water</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Organic nutrients</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbohydrate</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Lipid (fat)</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Protein(^a)</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Vitamins(^b)</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Some proteins also contain the mineral sulfur.

\(^b\)Some vitamins contain nitrogen; some contain minerals.
Nutrients in Foods and the Body

• Composition of the body
  – Made of materials similar to those found in food

• 150 pound body contains about 90 pounds of water and 20-45 pounds of fat
  – 60% is water
Body Composition

Key:
- % Carbohydrates, proteins, vitamins, minerals in the body
- % Fat in the body
- % Water in the body
The Nutrients

**Essential Nutrients**

A nutrient that the body does not make, or makes in insufficient amounts to meet the body’s needs; These must be supplied by food
# Energy-Yielding Nutrients

## Table 1-2 kCalorie Values of Energy Nutrients

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Energy (kcal/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>4</td>
</tr>
<tr>
<td>Fat</td>
<td>9</td>
</tr>
<tr>
<td>Protein</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: Alcohol contributes 7 kcalories per gram that can be used for energy, but it is not considered a nutrient because it interferes with the body’s growth, maintenance, and repair.

*aFor those using kilojoules: 1 g carbohydrate = 17 kJ; 1 g protein = 17 kJ; 1 g fat = 37 kJ; and 1 g alcohol = 29 kJ.*
Energy-Yielding Nutrients

- **Energy** - the capacity to do work; food energy is chemical energy
- **Calorie** – unit by which energy is measured. Food energy is measured in kilocalories.
- **1000 calories equal 1 kilocalorie**
Energy is measured in kcalories
(commonly called calorie”)

Calorie- unit of energy so small that an apple provides tens of thousands of them. To make it easy to calculate, energy is expressed in 1000 calorie metric units known as kilocalories, which we shorten to kcalories or calories.
Energy from Food

- The amount of energy or kcalories a food provides depends on the amount of:
  - Carbohydrate (4 kcalories/gram)
  - Protein (4 kcalories/gram)
  - Fat (9 kcalories/gram)
  - Alcohol (7 kcalories/gram)
LOWENERGY DENSITY

This 450-gram breakfast delivers 500 kcalories, for an energy density of 1.1 (500 kcal ÷ 450 g = 1.1 kcal/g).

HIGHER ENERGY DENSITY

This 144-gram breakfast also delivers 500 kcalories, for an energy density of 3.5 (500 kcal ÷ 144 g = 3.5 kcal/g).
Calculating Energy from Food

• 1 slice of bread with 1 TBSP of peanut butter contains 16 grams of carbohydrate, 7 grams of protein, and 9 grams of fat.
  - 16 grams carb \times 4 \text{ kcalories per gram} = 64 \text{ kcalories}
  - 7 grams protein \times 4 \text{ kcalories per gram} = 28 \text{ kcalories}
  - 9 grams of fat \times 9 \text{ kcalories per gram} = 81 \text{ kcalories}
  
  Total = 173 \text{ kcalories}

What % is from fat?

\[
\frac{81 \text{ fat kcalories} \div 173 \text{ total kcalories}}{0.47}
\]

\[
0.47 \times 100 = 47\%
\]
Energy-Yielding Nutrients

- Energy in the body
  - Energy for activity
  - Stored energy

- Other roles of energy-yielding nutrients
  - Building tissues, providing structure, regulating activities
Vitamins

- Organic
- Not energy-yielding
- Essential
- Water-soluble and fat-soluble
- Vulnerable to destruction
- Each of the 13 different vitamins has its own specific role in the body
Minerals

• Inorganic
• Not energy-yielding
• Essential
• Indestructible
Water

- Provides the environment in which nearly all the body’s activities are conducted.
- Inorganic
- Not energy-yielding
- Essential
The Science of Nutrition

• The study of nutrients and other substances in foods and the body’s handling of them.
• The science of nutrition depends on biology, biochemistry, and physiology
Conducting Nutrition Research

The Scientific Method

1. **Observation & Question**
   - Identify a problem to be solved or ask as a specific question to be answered.

2. **Hypothesis & Prediction**
   - Formulate a hypothesis—a tentative solution to the problem or answer to the question—and make a prediction that can be tested.

3. **Experiment**
   - Design a study and conduct the research to collect relevant data.

4. **Results & Interpretations**
   - Summarize, analyze, and interpret the data; draw conclusions.

5. **Hypothesis Supported**
   - Develop a theory that integrates conclusions with those from numerous other studies.

6. **Hypothesis Not Supported**
   - New Observations & Questions
Conducting Research

- **Control Group**
  - Subjects are divided into two groups. The experimental group receives the treatment being studied and the control group does not receive the treatment.
- **Randomization** is used to randomly assign subjects to the experimental or control group.
- **Sample sizes** must be large to accurately detect differences.
Conducting Research

- **Placebos**
  - (similar appearance and taste) are used to control the placebo effect with subjects in experiments.

- In **blind experiments**, the subjects do not know if they are in the experimental or control group.

- In **double-blind experiments**, the researchers and the subjects do not know their groups to prevent researcher bias.
Analyzing Research Findings

• Correlations and causes
  • No correlation
  • Correlation evidence proves that two variables are associated, not that one causes the other

  **positive correlation** – direct association between 2 variables; as one increases the other increases as in the association between increased smoking and lung cancer

  **negative correlation** - the more vitamin C you take, the fewer colds you have
Publishing Research

• Research Vs. Rumors
  – Peer Review
  – Scientific validity
  – Replication
Researchers observe how much and what kinds of foods a group of people eat and how healthy those people are. Their findings identify factors that might influence the incidence of a disease in various populations.

**Example.** The people of the Mediterranean region drink lots of wine, eat plenty of fat from olive oil, and have a lower incidence of heart disease than northern Europeans and North Americans.

Researchers compare people who do and do not have a given condition such as a disease, closely matching them in age, gender, and other key variables so that differences in other factors will stand out. These differences may account for the condition in the group that has it.

**Example.** People with goiter lack iodine in their diets.

Researchers analyze data collected from a selected group of people (a cohort) at intervals over a certain period of time.

**Example.** Data collected periodically over the past several decades from over 5000 people randomly selected from the town of Framingham, Massachusetts, in 1948 have revealed that the risk of heart attack increases as blood cholesterol increases.
Researchers feed animals special diets that provide or omit specific nutrients and then observe any changes in health. Such studies test possible disease causes and treatments in a laboratory where all conditions can be controlled.

**Example.** Mice fed a high-fat diet eat less food than mice given a lower-fat diet, so they receive the same number of calories—but the mice eating the fat-rich diet become severely obese.

Researchers examine the effects of a specific variable on a tissue, cell, or molecule isolated from a living organism.

**Example.** Laboratory studies find that fish oils inhibit the growth and activity of the bacteria implicated in ulcer formation.

Researchers ask people to adopt a new behavior (for example, eat a citrus fruit, take a vitamin C supplement, or exercise daily). These trials help determine the effectiveness of such interventions on the development or prevention of disease.

**Example.** Heart disease risk factors improve when men receive fresh-squeezed orange juice daily for two months compared with those on a diet low in vitamin C—even when both groups follow a diet high in saturated fat.
Dietary Reference Intakes

- A set of standards that define the amounts of energy, nutrients that best support health.

- Estimated Average Requirements
- Recommended Dietary Allowances
- Adequate Intakes
- Tolerable Upper Limits
Establishing Nutrient Recommendations

- **Estimated Average Requirements** – (EAR) the average amount of a nutrient that is sufficient for half the population
- **Recommended Dietary Allowance** (RDA) - the amount of a nutrient to meet the needs of most healthy people - 98% of the population
Establishing Nutrient Recommendations

- **Adequate Intake (AI)** - When insufficient evidence is present to determine an RDA

- **Tolerable Upper Intake Levels** - Point where nutrient is likely to be toxic
  - Helps protect against overconsumption
DRI

Tolerable Upper Intake Level

RDA or AI

Estimated Average Requirement

Naive view

Accurate view

Danger

Marginal

Safety

Danger of deficiency

Danger of toxicity

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Energy Recommendations

- **Estimated Energy Requirement-(EER)**
  - Average energy intake that will maintain energy balance
- **Acceptable Macronutrient Distribution Ranges (AMDR)**
  - Carbohydrate: 45% - 65%
  - Fat: 20% - 35%
  - Protein: 10% - 35%
Energy Recommendations
Dietary Reference Intakes

- Estimates apply to healthy people
  - Needed adjustments
- Recommendations – not minimum levels nor optimal levels
- Goals intended to be met through diet
- Apply to average daily intakes
- Each DRI category serves a unique purpose
Nutrition Assessment

• Malnutrition
  - Undernutrition vs. overnutrition
Nutrition Assessment of Individuals

- Historical information
- Anthropometric data
- Physical examination
- Laboratory tests
Nutrition Assessment of Populations

- National nutrition surveys
  - Reviews kinds and amounts of food people eat
  - Evaluates the people themselves
  - Used to establish public policy, food assistance programs, regulation of the food supply
National Health Goals

• Healthy People- National public health initiative that identifies the most significant preventable threats to health and focuses on eliminating them. Overseen by the Department of Health and Human Services (DHHS)
TABLE 1-5 Healthy People Nutrition and Overweight Objectives

- Increase the proportion of adults who are at a healthy weight.
- Reduce the proportion of adults who are obese.
- Reduce the proportion of children and adolescents who are overweight or obese.
- Reduce growth retardation among low-income children under age 5 years.
- Increase the proportion of persons aged 2 years and older who consume at least two daily servings of fruit.
- Increase the proportion of persons aged 2 years and older who consume at least three daily servings of vegetables, with at least one-third being dark green or orange vegetables.
- Increase the proportion of persons aged 2 years and older who consume at least six daily servings of grain products, with at least three being whole grains.
- Increase the proportion of persons aged 2 years and older who consume less than 10 percent of calories from saturated fat.
- Increase the proportion of persons aged 2 years and older who consume no more than 30 percent of calories from total fat.
- Increase the proportion of persons aged 2 years and older who consume 2400 mg or less of sodium.
- Increase the proportion of persons aged 2 years and older who meet dietary recommendations for calcium.
- Reduce iron deficiency among young children, females of childbearing age, and pregnant females.
- Reduce anemia among low-income pregnant females in their third trimester.
- Increase the proportion of children and adolescents aged 6 to 19 years whose intake of meals and snacks at school contributes to good overall dietary quality.
- Increase the proportion of worksites that offer nutrition or weight management classes or counseling.
- Increase the proportion of physician office visits made by patients with a diagnosis of cardiovascular disease, diabetes, or hyperlipidemia that include counseling or education related to diet and nutrition.
- Increase food security among U.S. households and in so doing reduce hunger.

NOTE: “Nutrition and Overweight” is one of 28 focus areas, each with numerous objectives. Several of the other focus areas have nutrition-related objectives, and these are presented in Appendix J. Emphasis added.
Diet and Health

Chronic Disease: Slow progression and long duration

**TABLE 1-6 Leading Causes of Death in the United States**

<table>
<thead>
<tr>
<th></th>
<th>Percentage of Total Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>Heart disease</strong></td>
</tr>
<tr>
<td>2.</td>
<td>Cancers</td>
</tr>
<tr>
<td>3.</td>
<td><strong>Strokes</strong></td>
</tr>
<tr>
<td>4.</td>
<td>Chronic lung diseases</td>
</tr>
<tr>
<td>5.</td>
<td>Accidents</td>
</tr>
<tr>
<td>6.</td>
<td><strong>Diabetes mellitus</strong></td>
</tr>
<tr>
<td>7.</td>
<td>Alzheimer’s disease</td>
</tr>
<tr>
<td>8.</td>
<td>Pneumonia and influenza</td>
</tr>
<tr>
<td>9.</td>
<td>Kidney diseases</td>
</tr>
<tr>
<td>10.</td>
<td>Blood infections</td>
</tr>
</tbody>
</table>

NOTE: The diseases highlighted in bold have relationships with diet.
Risk Factors for Chronic Diseases

- Risk factor: condition or behavior associated with an increased frequency of a disease, but not proved to be the cause
  - Risk factors persist over time
  - Risk factors cluster
# TABLE 1-7 Factors Contributing to Deaths in the United States

<table>
<thead>
<tr>
<th>Factors</th>
<th>Percentage of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco</td>
<td>18</td>
</tr>
<tr>
<td>Poor diet/inactivity</td>
<td>15</td>
</tr>
<tr>
<td>Alcohol</td>
<td>4</td>
</tr>
<tr>
<td>Microbial agents</td>
<td>3</td>
</tr>
<tr>
<td>Toxic agents</td>
<td>2</td>
</tr>
<tr>
<td>Motor vehicles</td>
<td>2</td>
</tr>
<tr>
<td>Firearms</td>
<td>1</td>
</tr>
<tr>
<td>Sexual behavior</td>
<td>1</td>
</tr>
<tr>
<td>Illicit drugs</td>
<td>1</td>
</tr>
</tbody>
</table>

Highlight 1

Nutrition Information and Misinformation
Highlight - Nutrition Misinformation

• Not everything on the Internet is true!!
  – Determination of the reliability of a website
  – Anyone can publish anything
    • No guarantees of accuracy
  – Evaluate websites
    • Who, When, Where, Why, and What?
  – May be high-quality information: National Library of Medicine’s PubMed
  – May be misleading, incomplete, and inaccurate
# Highlight-Nutrition Misinformation

## TABLE H1-1 Credible Sources of Nutrition Information

Government agencies, volunteer associations, consumer groups, and professional organizations provide consumers with reliable health and nutrition information. Credible sources of nutrition information include:

- Nutrition and food science departments at a university or community college
- Local agencies such as the health department or County Cooperative Extension Service
- Government health agencies such as:
  - Department of Agriculture (USDA)
  - Department of Health and Human Services (DHHS)
  - Food and Drug Administration (FDA)
  - Health Canada
- Volunteer health agencies such as:
  - American Cancer Society
  - American Diabetes Association
  - American Heart Association
- Reputable consumer groups such as:
  - American Council on Science and Health
  - Federal Citizen Information Center
  - International Food Information Council
- Professional health organizations such as:
  - American Dietetic Association
  - American Medical Association
  - Dietitians of Canada
- Journals such as:
  - American Journal of Clinical Nutrition
  - Journal of the American Dietetic Association
  - New England Journal of Medicine
  - Nutrition Reviews

<table>
<thead>
<tr>
<th>Source</th>
<th>Website</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDA</td>
<td><a href="http://www.usda.gov">www.usda.gov</a></td>
</tr>
<tr>
<td>DHHS</td>
<td><a href="http://www.os.dhhs.gov">www.os.dhhs.gov</a></td>
</tr>
<tr>
<td>FDA</td>
<td><a href="http://www.fda.gov">www.fda.gov</a></td>
</tr>
<tr>
<td>Health Canada</td>
<td><a href="http://www.hc-sc.gc.ca/nutrition">www.hc-sc.gc.ca/nutrition</a></td>
</tr>
<tr>
<td>American Cancer Society</td>
<td><a href="http://www.cancer.org">www.cancer.org</a></td>
</tr>
<tr>
<td>American Diabetes Association</td>
<td><a href="http://www.diabetes.org">www.diabetes.org</a></td>
</tr>
<tr>
<td>American Heart Association</td>
<td><a href="http://www.americanheart.org">www.americanheart.org</a></td>
</tr>
<tr>
<td>American Council on Science and Health</td>
<td><a href="http://www.acsh.org">www.acsh.org</a></td>
</tr>
<tr>
<td>Federal Citizen Information Center</td>
<td><a href="http://www.pueblo.gsa.gov">www.pueblo.gsa.gov</a></td>
</tr>
<tr>
<td>International Food Information Council</td>
<td><a href="http://www.ffic.org">www.ffic.org</a></td>
</tr>
<tr>
<td>American Dietetic Association</td>
<td><a href="http://www.eatright.org">www.eatright.org</a></td>
</tr>
<tr>
<td>American Medical Association</td>
<td><a href="http://www.ama-assn.org">www.ama-assn.org</a></td>
</tr>
<tr>
<td>Dietitians of Canada</td>
<td><a href="http://www.dietitians.ca">www.dietitians.ca</a></td>
</tr>
<tr>
<td>American Journal of Clinical Nutrition</td>
<td><a href="http://www.ajcn.org">www.ajcn.org</a></td>
</tr>
<tr>
<td>Journal of the American Dietetic Association</td>
<td><a href="http://www.adajournal.org">www.adajournal.org</a></td>
</tr>
<tr>
<td>Nutrition Reviews</td>
<td><a href="http://www.lsi.org">www.lsi.org</a></td>
</tr>
</tbody>
</table>
Nutrition Information and Misinformation

• Nutrition in the News
  – Can be misleading and contradictory
  – May report scientific findings prematurely
  – Limited understanding
  – Current and controversial
Nutrition Information & Misinformation

• Identifying nutrition experts
  – Physicians & other health-care professionals
    • Training in nutrition is limited
  – Registered Dietitian (RD)
    • Degree and clinical internship
    • National exam
    • Maintain up-to-date knowledge
  – Dietetic Technician Registered (DTR)
Satisfaction guaranteed
Marketers may make generous promises, but consumers won’t be able to collect on them.

One product does it all
No one product can possibly treat such a diverse array of conditions.

Time tested
Such findings would be widely publicized and accepted by health professionals.

Paranoid accusations
And this product’s company doesn’t want money? At least the drug company has scientific research proving the safety and effectiveness of its products.

Quick and easy fixes
Even proven treatments take time to be effective.

Natural
Natural is not necessarily better or safer; any product that is strong enough to be effective is strong enough to cause side effects.

Personal testimonials
Hearsay is the weakest form of evidence.

Meaningless medical jargon
Phony terms hide the lack of scientific proof.