

CHAPTER

1

The Role of Nutrition in Our Health and In Depth

Third Canadian Edition

nutrition

a functional approach

Janice Thompson
Melinda Manore
Judy Sheeshka

What Is Nutrition?

Nutrition: the study of food, including

- How food nourishes our bodies
- How food influences our health

Nutrition is a relatively new discipline of science

Nutrition research focuses on supporting wellness and preventing and treating chronic diseases

Why Is Nutrition Important?

Nutrition contributes to wellness

Wellness: the absence of disease

- Physical, emotional, social, occupational, and spiritual health

Critical components of wellness

- Nutrition
- Physical activity

Why Is Nutrition Important?

Nutrition encompasses the following aspects of food

- Consumption
- Digestion
- Absorption
- Metabolism
- Storage
- Excretion

Why Is Nutrition Important?

Nutrition also studies these aspects of food

- Psychological
- Food safety
- Global food supply
- Cultural

Why Is Nutrition Important?



© 2012 Pearson Education, Inc.

Why Is Nutrition Important?

Nutrition can prevent disease

- Nutrient-deficiency diseases: e.g., scurvy, goiter, rickets
- Diseases influenced by nutrition:
chronic diseases: e.g., heart disease, type 2 diabetes
- Diseases in which nutrition plays a role:
e.g., osteoarthritis, osteoporosis, obesity

Why Is Nutrition Important?

Diseases in which nutrition plays some role

**Osteoporosis
Osteoarthritis
Some forms of cancer**

Diseases with a strong nutritional component

**Type 2 diabetes
Heart disease
High blood pressure
Obesity**

Diseases caused by nutritional deficiencies or toxicities

**Pellagra
Scurvy
Iron-deficiency anemia
Other vitamin and mineral deficiencies
Nutrient toxicities**

What Are Nutrients?

Nutrients: chemicals in foods that are critical to human growth and function

There are 6 groups of essential nutrients found in foods

carbohydrates

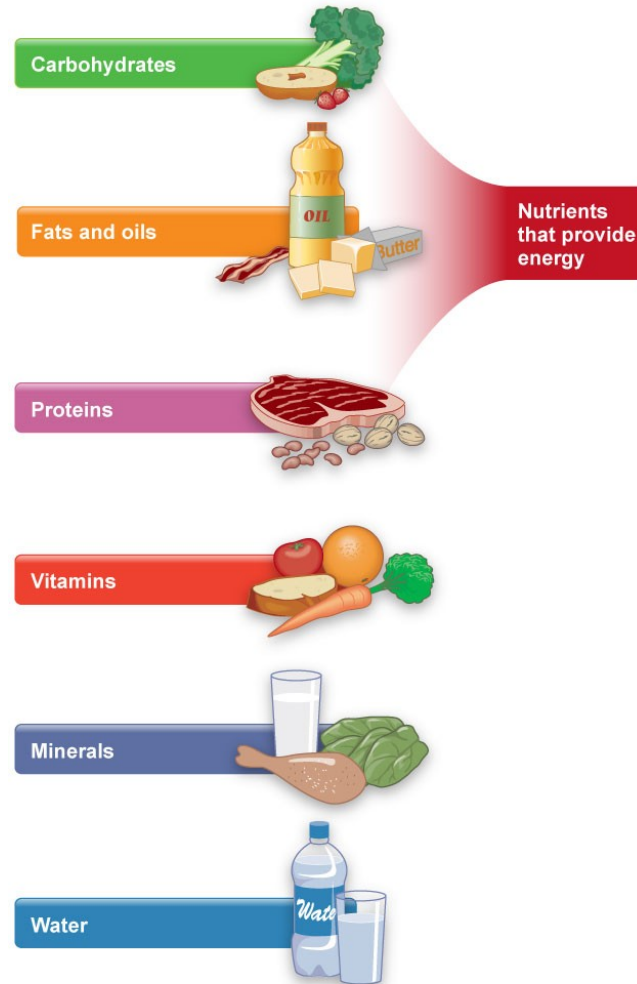
vitamins

fats and oils minerals

proteins water

What Are Nutrients?

SIX GROUPS OF ESSENTIAL NUTRIENTS



© 2012 Pearson Education, Inc.

Figure 1.3

What Are Nutrients?

Macronutrients: nutrients required in relatively large amounts (g or Kg)

- Provide energy
- Carbohydrates, fats and oils, proteins

Micronutrients: nutrients required in smaller amounts (μg or mg)

- Vitamins and minerals

Energy from Nutrients

We measure energy in **kilojoules (kJ)** or **kilocalories (kcal)**

Kilocalorie: amount of energy required to raise the temperature of 1 kg of water by 1°C

In Canada: $1 \text{ kcal} = 4.184 \text{ kJ}$

Canadian food labels use the term,
Calorie

Carbohydrates

- Primary source of fuel for the body, especially for the brain and during exercise
- Provide 17 kJ/4 kcal per gram
- Found in grains (wheat, rice), vegetables, fruits, and legumes

Fats and Oils

- Composed of **lipids**, molecules that are insoluble in water
- Provide **37 kJ/9 kcal** per gram
- Important energy source during rest or low-intensity exercise
- Found in butter, margarine, vegetable oils
- Source of fat-soluble vitamins and essential fatty acids

Proteins

- Chains of amino acids
- Can supply 17 kJ/4 kcal of energy per gram, but are not a primary energy source
- Important source of nitrogen

Proteins

Proteins are important for

- Building cells and tissues
- Maintaining bones
- Repairing damage
- Regulating metabolism
- Fluid balance

Protein sources include meats, dairy products, seeds, nuts, and legumes

Micronutrients

Vitamins and minerals are known as micronutrients

Vitamins: organic molecules that assist in regulating body processes

Vitamins are micronutrients that do NOT supply energy to our bodies

1. Fat-soluble vitamins
2. Water-soluble vitamins

Vitamins

Fat-soluble vitamins

- Vitamins A, D, E, and K
- Dissolve easily in fats and oils

Fat-soluble vitamins can be stored in the body

Toxicity can occur

Vitamins

Water-soluble vitamins

- Vitamin C and the B vitamins
- Remain dissolved in water

Excess water-soluble vitamins are eliminated by the kidneys and cannot be stored in our bodies

Vitamins

TABLE 1.1 Overview of Vitamins

Type	Names	Distinguishing Features
Fat-soluble	A, D, E, and K	Soluble in fat Stored in the human body Toxicity can occur from consuming excess amounts, which accumulate in the body
Water-soluble	C, B-vitamins (thiamin, riboflavin, niacin, vitamin B ₆ , vitamin B ₁₂ , pantothenic acid, biotin, and folate)	Soluble in water Not stored to any extent in the human body Excess excreted in urine Toxicity generally only occurs as a result of vitamin supplementation

Copyright © 2014 Pearson Canada Inc.

Table 1.1

Minerals

Minerals: inorganic substances required for body processes

Important minerals include sodium, calcium, iron, potassium, and magnesium

Minerals have many different functions, such as fluid regulation, bone structure, muscle movement, and nerve functioning

Minerals

Our bodies require at least 100 mg/day of the **major minerals**: calcium, phosphorus, magnesium, sodium, potassium, and chloride

We require less than 100 mg/day of the **trace minerals**: iron, zinc, copper, iodine, and fluoride

Minerals

TABLE 1.2 Overview of Minerals

Type	Names	Distinguishing Features
Major minerals	Calcium, phosphorus, sodium, potassium, chloride, magnesium, sulphur	Needed in amounts greater than 100 mg/day in our diets Amount present in the human body is greater than 5 g (or 5000 mg)
Trace minerals	Iron, zinc, copper, manganese, fluoride, chromium, molybdenum, selenium, iodine	Needed in amounts less than 100 mg/day in our diets Amount present in the human body is less than 5 g (or 5000 mg)

Copyright © 2014 Pearson Canada Inc.

Table 1.2

Water

Water is a critical nutrient for health and survival

Water is involved in many body processes:

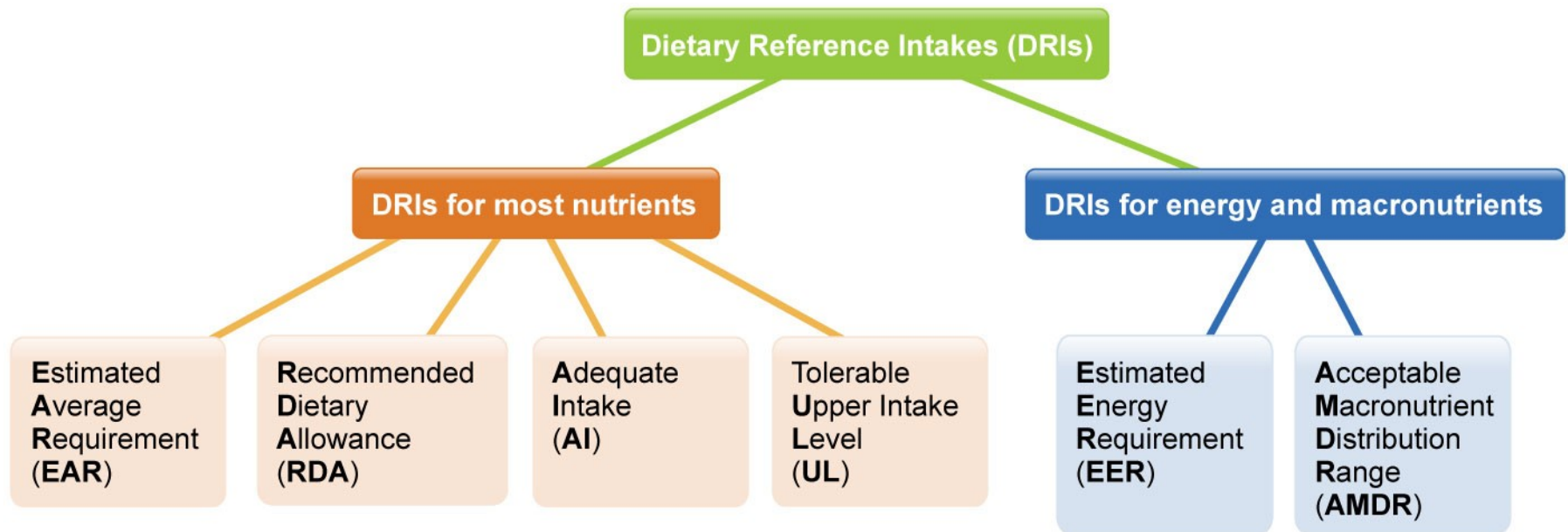
fluid balance	nutrient transport
nerve impulses	removal of wastes
muscle contractions	chemical reactions
and many, many more	

Determining Nutrient Needs

DRIs identify the

- Amount of a nutrient needed to prevent deficiency disease in **healthy** people
- Amount of a nutrient that may reduce the risk of chronic disease
- Upper level of safety for nutrients

Determining Nutrient Needs



© 2012 Pearson Education, Inc.

Figure 1.7

Determining Nutrient Needs

DRIs consist of 4 values

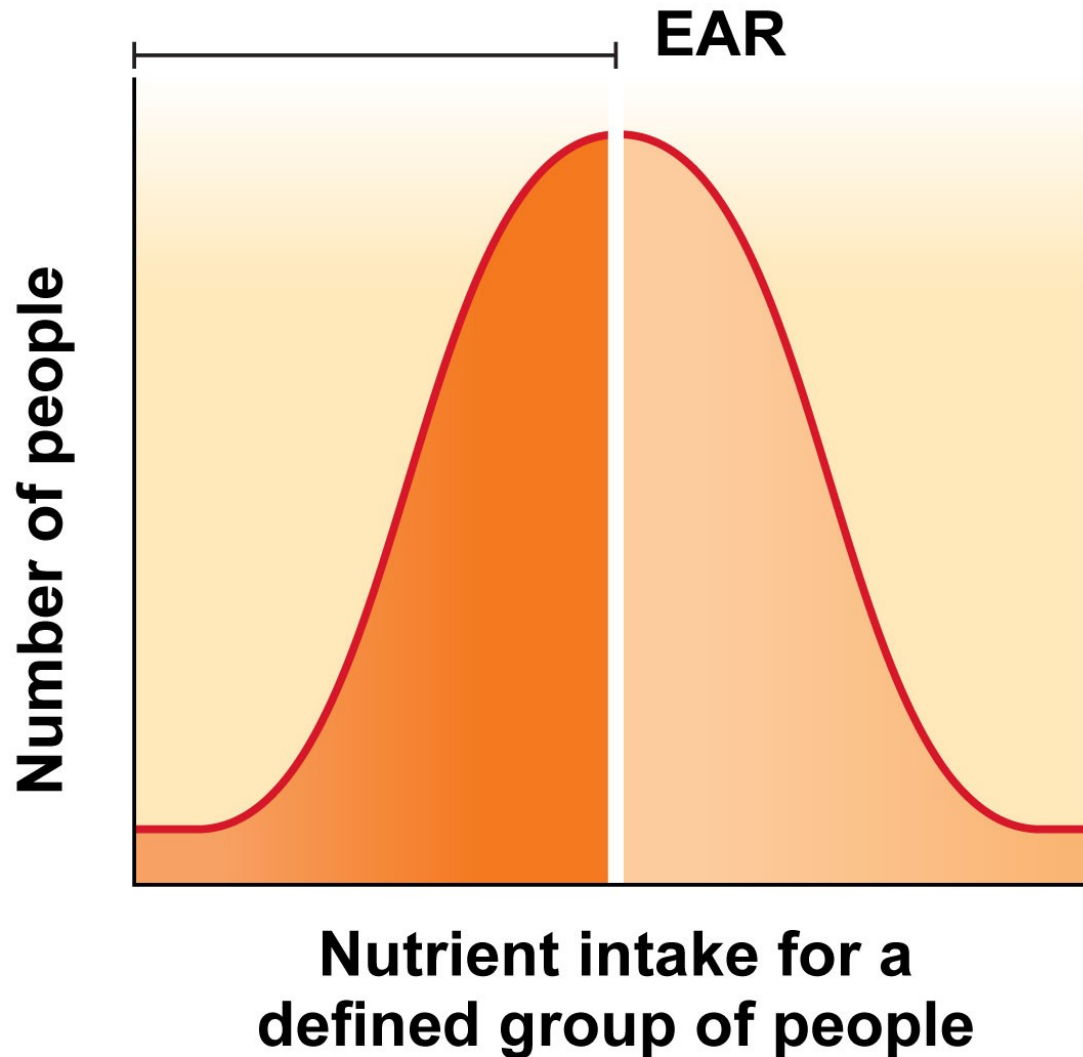
1. Estimated Average Requirement (EAR)
2. Recommended Dietary Allowance (RDA)
3. Adequate Intake (AI)
4. Tolerable Upper Intake Level (UL)

Determining Nutrient Needs

Estimated Average Requirement (EAR)

- The average daily intake level of a nutrient that will meet the needs of half of the **healthy individuals** in a particular life stage and gender group
- Are used to determine the RDA of a nutrient

Determining Nutrient Needs: EAR



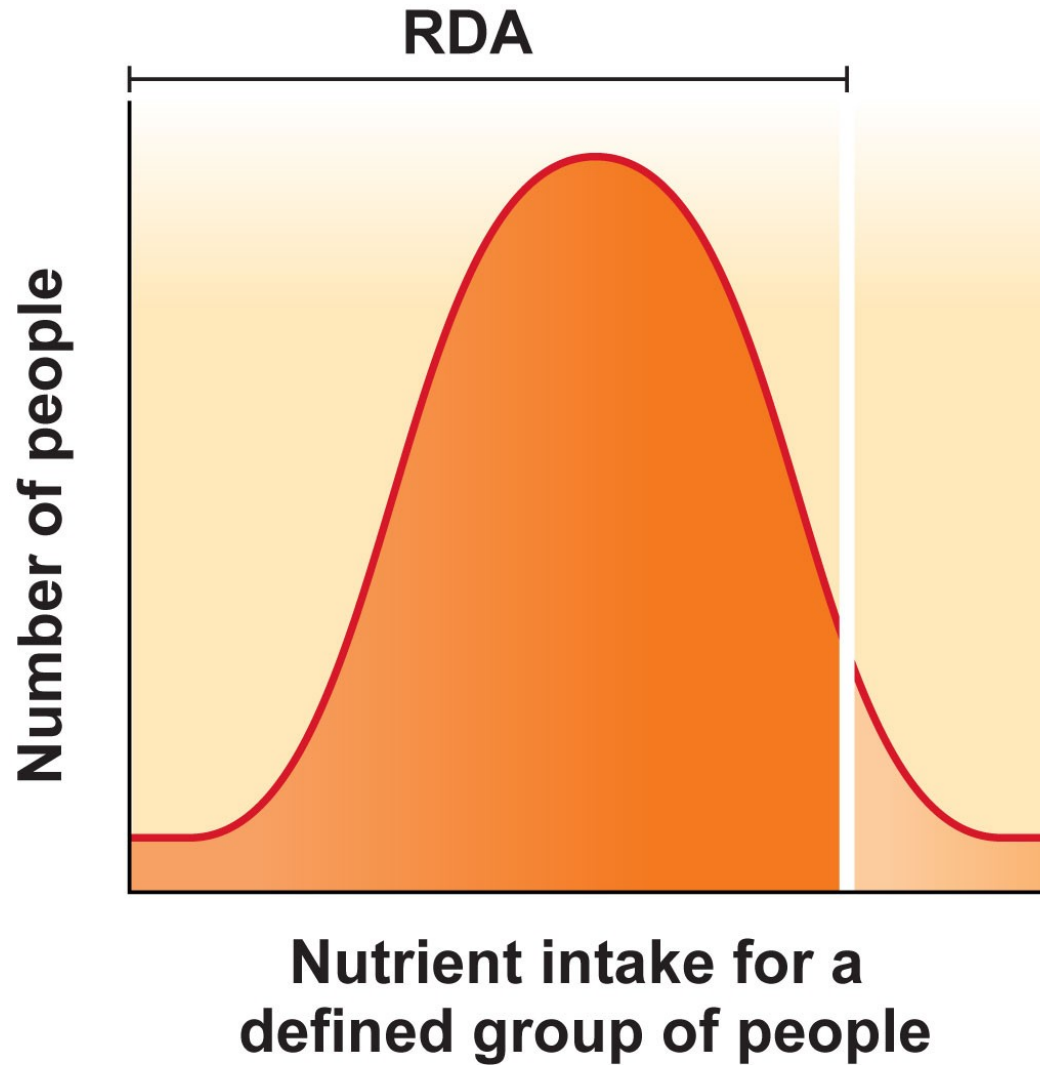
© 2012 Pearson Education, Inc.

Determining Nutrient Needs

Recommended Dietary Allowance (RDA)

- The average daily intake level required to meet the needs of 97% to 98% of healthy individuals in a particular life stage and gender group

Determining Nutrient Needs: RDA



© 2012 Pearson Education, Inc.

Determining Nutrient Needs

Adequate Intake (AI)

- Recommended average daily intake level for a nutrient
- Based on observations and estimates from experiments involving healthy people
- Used when the RDA cannot be determined: vitamin D, vitamin K, fluoride, and others

Determining Nutrient Needs

Tolerable Upper Intake Level (UL)

- Highest average daily intake level that is likely to pose no risk of adverse health effects to almost all individuals in a particular life stage and gender group
- Consumption of a nutrient at levels above the UL is not considered safe

Determining Nutrient Needs

Estimated Energy Requirement (EER)

- Average dietary energy intake (kcal) to maintain energy balance in healthy adults
- Based on age, gender, weight, height, and level of physical activity

Determining Nutrient Needs

Acceptable Macronutrient Distribution Range (AMDR)

- The portion of the energy intake that should come from each macronutrient
- The range of energy intake from carbohydrate, fat, and protein associated with reduced risk of chronic disease
- The range of macronutrient intake that provides adequate levels of essential nutrients

Determining Nutrient Needs: AMDR

TABLE 1.3 Acceptable Macronutrient Distribution Ranges (AMDRs) for Healthful Diets

Nutrient	AMDR*
Carbohydrate	45–65%
Fat	20–35%
Protein	10–35%

Source: Institute of Medicine, Food and Nutrition Board. 2005. *Dietary Reference Intakes for Energy Carbohydrates, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients)*. Washington, DC: National Academies Press. Reprinted by permission.

*AMDR values are expressed as percentages of total energy or as percentage of total calories.

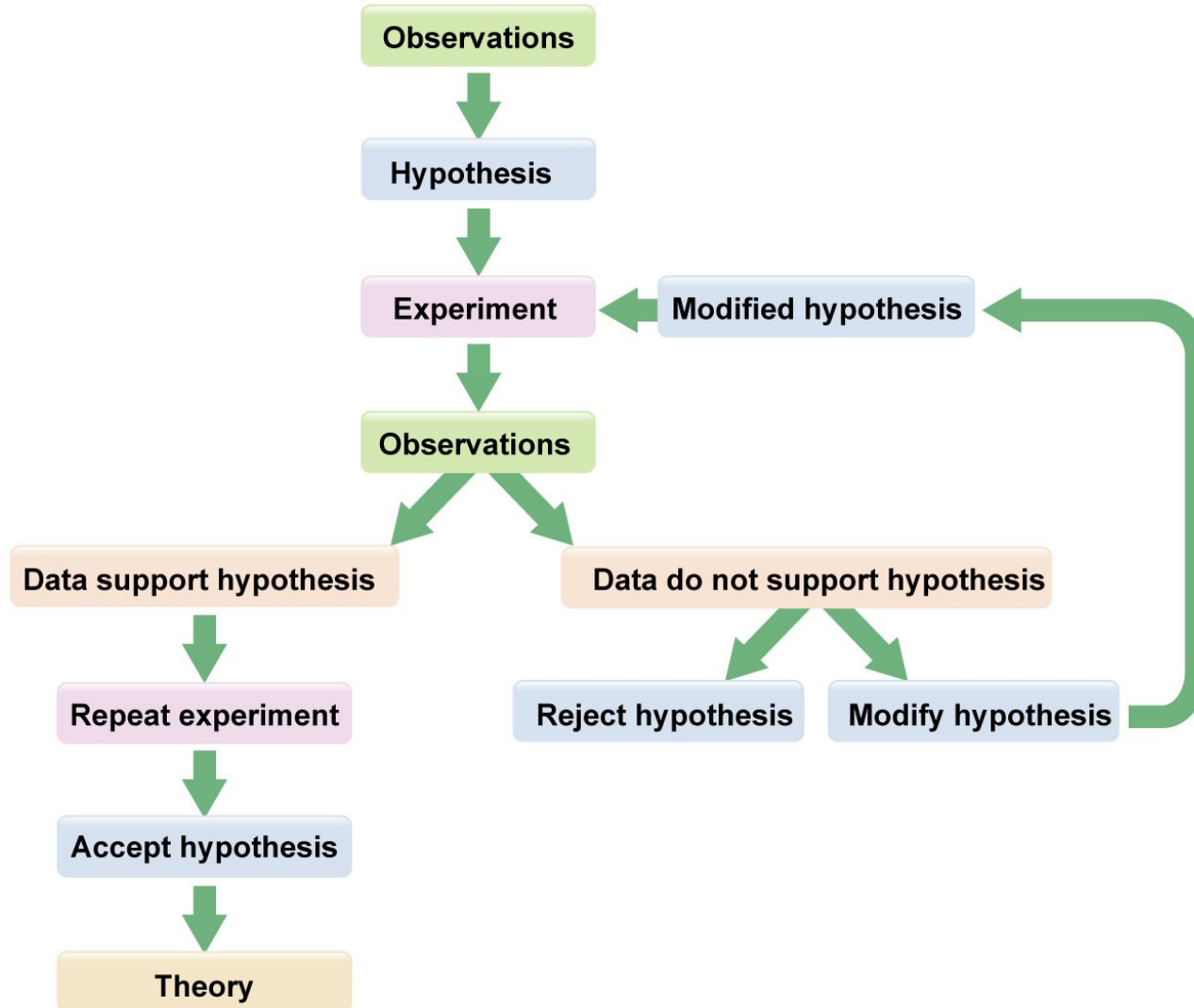
© 2012 Pearson Education, Inc.

Nutrition Research

The scientific method

- Observation: describe the phenomenon
- Create a hypothesis
- Design, collect, and analyze the data
- Interpret the data
- Generalize the findings, develop a theory

Nutrition Research



© 2012 Pearson Education, Inc.

Figure 1.10

Research Terminology

- Hypothesis

Educated guess as to why a phenomenon occurs

- Experiment

Scientific study used to test a hypothesis

- Sample Size

Appropriate number to measure a difference between treatment groups

Research Terminology

- Control Group

Individuals who do not receive treatment

- Theory

Conclusion drawn from repeated experiments

- Placebo

Inert substance with similar appearance and taste

Research Terminology

- Double-blind study

Neither subjects or researchers know who is in the placebo or treatment groups

- Psychosomatic effect (aka placebo effect)

Sometimes just knowing a subject is in a study causes a person to experience physiologic changes, which he/she may interpret as therapeutic

Research Models

- Epidemiological studies
- Model systems
- Animal studies
- Human studies
 - Case control studies
 - Clinical trials

Note: Each type of study has advantages and disadvantages

Evaluating Media Reports

Ask these questions to determine scientific validity

- Who is reporting the information?
- Who conducted the research and who paid for it?
- Is the report based on reputable research studies?
 - Was there a control and an experimental group?
 - Was the sample size large enough to rule out chance variation?
 - Was a placebo effectively administered?
 - Was it a double-blind study?

Evaluating Media Reports

Ask these questions to determine scientific validity (continued)

- Is the report based on testimonials?
- Are the claims too good to be true?

Prior to publication in reputable scientific journals, articles undergo peer review

Experiments must be repeated to confirm or disprove the findings

Reliable Sources of Information

Trustworthy experts

- Registered dietitian (RD)
- Nutritionist
- Professionals with advanced degree(s) in nutrition
- Medical doctor

Reliable Sources of Information

Government sources are usually trustworthy

- Office of Nutrition Policy and Promotion, Health Products and Food Branch, Health Canada
- Natural Health Products Directorate, Health Products and Food Branch, Health Canada
- Canadian Food Inspection Agency, Bureau of Food Safety and Consumer Protection
- Public Health Agency of Canada

Reliable Sources of Information

American Sources of information

- National Institutes of Health (NIH)
- Centers for Disease Control and Prevention (CDC)
- The Academy of Nutrition and Dietetics (formerly called the American Dietetic Association/ADA)

Reliable Sources of Information

Professional organizations publish cutting-edge nutrition research and information, including

- Dietitians of Canada (DC)
- Canadian Society for Nutrition
- Canadian Society of Nutrition Management (CSNM)
- International Society for Behavioural Nutrition and Physical Activity (ISBNPA)

In Depth: Alcohol

Alcohols are chemical compounds characterized by a hydroxyl group

Commonly known as beverages containing ethanol made from fermented fruits, vegetables, or grains

In Depth: Alcohol

What is moderate alcohol intake?

- A **drink** is defined as the amount of a beverage that provides 14 mL (0.5 fl. oz.) of pure alcohol
- **Proof** is a measurement of alcohol content

In Depth: Alcohol



🏠 **Figure 1** What does one drink look like? A drink is equivalent to 43 mL (1.5 fl. oz.) of distilled spirits, 142 mL (5 fl. oz.) of wine, 280 mL (10 fl. oz.) of wine cooler, or 341 mL (12 fl. oz.) of beer.

Copyright © 2014 Pearson Canada Inc.

Figure 1 In Depth

In Depth: Alcohol

TABLE 1 Canada's Low-Risk Alcohol Drinking Guidelines
Guideline 1 (Your limits) Reduce your long-term health risks by drinking no more than: <ul style="list-style-type: none"> • 10 drinks a week for women, with no more than 2 drinks a day most days • 15 drinks a week for men, with no more than 3 drinks a day most days Plan non-drinking days every week to avoid developing a habit.
Guideline 2 (Special occasions) Reduce your risk of injury and harm by drinking no more than three drinks (for women) and four drinks (for men) on any single occasion. Plan to drink in a safe environment. Stay within the weekly limits outlined in Guideline 1.
Guideline 3 (When zero's the limit) Do not drink when you are: <ul style="list-style-type: none"> • driving a vehicle or using machinery and tools; • taking medicine or other drugs that interact with alcohol; • doing any kind of dangerous physical activity; • living with mental or physical health problems; • living with alcohol dependence; • pregnant or planning to be pregnant; • responsible for the safety of others; or • making important decisions.
Guideline 4 (Pregnant? Zero is safest) If you are pregnant, planning to become pregnant, or before breastfeeding, the safest choice is to drink no alcohol at all.
Guideline 5 (Delay your drinking) Alcohol can harm the way the body and brain develop. Teens should speak with their parents about drinking. If they choose to drink, they should do so under parental guidance; never more than 1–2 drinks at a time, and never more than 1–2 times per week. They should plan ahead, follow local alcohol laws and consider the Safer drinking tips listed in this brochure. Youth in their late teens to age 24 years should never exceed the daily and weekly limits outlined in Guideline 1 (Your limits).
<small>Source: Canadian Centre on Substance Abuse (2012). Retrieved on Aug. 1, 2012 from www.ccsa.ca/eng/priorities/alcohol/Canada-low-risk-alcohol-drinking-guidelines/pages/default.aspx. Notice that this definition of low-risk drinking is based on a maximum daily and a maximum weekly intake; a person who does not drink any alcohol on weekdays but downs a six-pack of beer most Saturday nights would NOT be classified as a "low-risk drinker". These guidelines also identify groups of individuals who should not consume alcohol at all, including women who are or may become pregnant and children. In addition, people with a history of alcoholism and those taking medications that interact with alcohol should not drink at all, nor should individuals driving, operating machinery, or engaged in other tasks that require attention and coordination.</small>

Table 1 In Depth

In Depth: Alcohol

Benefits of moderate consumption include

- Stress and anxiety reduction
- Improved self-confidence
- Appetite improvement
- Lower rates of heart disease
- Possible lower risks for diseases such as diabetes, heart disease, and liver disease

In Depth: Alcohol

Concerns about moderate alcohol intake include

- Women appear to be at higher risk for breast cancer
- Increased risk for hypertension
- Higher rates of bleeding in the brain
- Relatively high calorie content
- Potential risk for adverse drug interactions

In Depth: Alcohol

Types of alcohol abuse

- **Alcohol abuse** is excessive intake of alcohol
- **Binge drinking** is consumption of 5 or more drinks per occasion (men) and 4 or more drinks per occasion (women)
- **Alcoholism** is a disease characterized by chronic dependence on alcohol

In Depth: Alcohol

Types of alcohol abuse (continued)

- A **hangover** is a consequence of drinking too much alcohol; symptoms include headache, fatigue, dizziness, muscle aches, nausea, sensitivity to light, and extreme thirst
- **Alcohol poisoning** is a potentially fatal metabolic state involving cardiac or respiratory failure in response to binge drinking
- **Liver damage**

In Depth: Alcohol

TABLE 3 Effects of Blood Alcohol Concentration (BAC) on Brain Activity

Blood Alcohol	
Concentration	Typical Response
0.02%–0.05%	Feeling of relaxation, euphoria, relief
0.06%–0.10%	Impaired judgment, fine motor control, and coordination; loss of normal emotional control; legally drunk in many parts of Canada
0.11%–0.15%	Impaired reflexes and gross motor control; staggered gait; legally drunk in all provinces and territories; slurred speech
0.16%–0.20%	Impaired vision; unpredictable behaviour; further loss of muscle control
0.21%–0.35%	Total loss of coordination; nearly unconscious
0.40% and above	Loss of consciousness; coma; suppression of respiratory response; death

Copyright © 2014 Pearson Canada Inc.

In Depth: Alcohol

Fetal and infant health problems include

- **Fetal Alcohol Syndrome (FAS):** a set of serious, irreversible birth defects, including physical, emotional, behavioural, and developmental problems
- **Fetal Alcohol Spectrum Disorder (FASD):** a term used to describe complications resulting from a woman's alcohol consumption during pregnancy