Nutrition for Health Professions

Prepared by: Mr. Adham I. Ahmed. BSN, RN, MCN, PhD Candidate

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Nutrition is defined as the "science of food, the nutrients and other substances therein, their action, interaction and balance in relation to health and disease, and the processes by which the organism ingests, absorbs, transports, utilizes and excretes food substances.

NUTRIENTS AND THEIR FUNCTIONS

To maintain health and function properly, the body must be provided with nutrients. Nutrients are chemical substances that are necessary for life.

Nutrients are divided into six classes:

- Carbohydrates (CHO)
- Fats (lipids)
- Proteins
- Vitamins
- Minerals
- Water

Nutrients chemically grouped into:

Organic
- Contains carbon, hydrogen, oxygen
- Carbon is found in all living things
- Example: carbohydrates, fats, proteins, vitamins

Inorganic
- In simplest form when ingested
- Function: regulate body processes
- Example: water, minerals

Carbohydrates
- Provides major source of energy
- Examples: cereal grains, vegetables, fruits, nuts, and sugars

Fats (lipids)
- Provides energy
- Highest kilocalorie value
- Sources of fat: meats, milk, cream, butter, cheese, egg yolks, oils, nuts

Protein
- Builds and repairs body tissues
- Provides energy
- Only one of the six nutrients that contains nitrogen
- Sources of protein: meats, fish, poultry, eggs, milk, cheese, corn, grains, nuts, and seeds
Vitamins
- Organic compounds
- Regulate body processes
- Examples: vitamins A, B, C, D, E and K

Minerals
- Inorganic compounds that Regulate body processes
- Examples: calcium, phosphorus, potassium, sodium, chloride, iron, magnesium, zinc

Water
- Major constituent of all living cells
- Composed of hydrogen and oxygen

Malnutrition
- Overnutrition: Excess energy or nutrient intake
- Undernutrition: Deficient energy or nutrient intake
- Overnutrition is a larger problem in the United States than undernutrition.

Table 1-2 Characteristics of Nutritional Status

<table>
<thead>
<tr>
<th>GOOD</th>
<th>POOR</th>
</tr>
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<tbody>
<tr>
<td>Alert expression</td>
<td>Apathy</td>
</tr>
<tr>
<td>Shiny hair</td>
<td>Dull, lifeless hair</td>
</tr>
<tr>
<td>Clear complexion with good color</td>
<td>Greasy, blemished complexion with poor color</td>
</tr>
<tr>
<td>Bright, clear eyes</td>
<td>Dull, red-rimmed eyes</td>
</tr>
<tr>
<td>Pink, firm gums and well-developed teeth</td>
<td>Red, puffy, receding gums and missing or cavity-prone teeth</td>
</tr>
<tr>
<td>Firm abdomen</td>
<td>Swollen abdomen</td>
</tr>
<tr>
<td>Firm, well-developed muscles</td>
<td>Underdeveloped, flabby muscles</td>
</tr>
<tr>
<td>Well-developed bone structure</td>
<td>Bowed legs, “pigeon” breast</td>
</tr>
<tr>
<td>Normal weight for height</td>
<td>Overweight or underweight</td>
</tr>
<tr>
<td>Erect posture</td>
<td>Slumped posture</td>
</tr>
<tr>
<td>Emotional stability</td>
<td>Easily irritated; depressed; poor attention span</td>
</tr>
<tr>
<td>Good stamina; seldom ill</td>
<td>Easily fatigued; frequently ill</td>
</tr>
<tr>
<td>Healthy appetite</td>
<td>Excessive or poor appetite</td>
</tr>
<tr>
<td>Healthy, normal sleep habits</td>
<td>Insomnia at night; fatigued during day</td>
</tr>
<tr>
<td>Normal elimination</td>
<td>Constipation or diarrhea</td>
</tr>
</tbody>
</table>

Relation of Food to Health

<table>
<thead>
<tr>
<th>Cumulative</th>
<th>Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excess nutrients over time.</td>
<td>Nutrients lacking for extended period.</td>
</tr>
<tr>
<td>Examples: atherosclerosis, obesity, hypertension, diabetes, gallbladder disease, some cancers.</td>
<td>Examples: iron deficiency, beriberi, scurvy, osteomalacia, osteoporosis, rickets, goiter.</td>
</tr>
<tr>
<td>Deficiency Disease</td>
<td>Nutrients Lacking</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Iron-deficiency anemia</td>
<td>Iron</td>
</tr>
<tr>
<td>Beriberi</td>
<td>Thiamin (V.B.1)</td>
</tr>
<tr>
<td>Night blindness</td>
<td>Vitamin A</td>
</tr>
<tr>
<td>Goiter</td>
<td>Iodine</td>
</tr>
<tr>
<td>Kwashiorkor</td>
<td>Protein</td>
</tr>
<tr>
<td>Marasmus</td>
<td>All nutrients</td>
</tr>
<tr>
<td>Osteomalacia</td>
<td>Calcium, vitamin D, phosphorus, magnesium, and fluoride</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>Calcium and vitamin D</td>
</tr>
<tr>
<td>Pellagra</td>
<td>Niacin</td>
</tr>
<tr>
<td>Rickets</td>
<td>Calcium and vitamin D</td>
</tr>
<tr>
<td>Scurvy</td>
<td>Vitamin C</td>
</tr>
<tr>
<td>Xerophthalmia (blindness)</td>
<td>Vitamin A</td>
</tr>
</tbody>
</table>

**Nutritional Assessment Tools**

*Remember ABCD*

Anthropometric measurements
Biochemical tests
Clinical examination
Dietary/social history

**Anthropometric measurements** includes: Height, Weight, Head circumference (children), Upper arm measurement and Skinfold (Figure 1-3). These measurements will give the examiner an accurate assessment of a person’s body mass index (BMI).

**Body Mass Index (BMI)**

- BMI offers a basic index for determining health concerns related to obesity.
- BMI does not take into account the role of muscles in this ratio.
- Since muscles weigh more than fats, some athletes will be considered obese in spite that they have little body fat.
WHO classification of overweight in adults

Waist circumference
Waist circumference can be used to assess central (abdominal) obesity and risk of CVD. Waist circumference should be less than:
(88cm in women) & (102cm in men) those with high waist circumference values are more likely to have hypertension, diabetes and dyslipidemia than those with normal values.
Biochemical Tests
Serum albumin level
• Measures main protein in blood
• Determines protein status

Serum transferrin level
• Indicates iron-carrying protein in blood
• Indicates iron stores low or indicates body lacks protein

Blood urea nitrogen (BUN) and Serum creatinine
• May indicate renal failure, insufficient renal blood supply, or blockage of the urinary tract
• Used to evaluate renal function

Creatinine excretion
• Indicates amount of creatinine excreted in urine over a 24-hour period
• Used in estimating body muscle mass
• Muscle mass depleted, as in malnutrition; level will be low

Other tests
• CBC: Hemoglobin (Hgb), Hematocrit (Hct), Red blood cells, White blood cells.
• Lipid profile (high & low-density lipoprotein, serum triglycerides)
• Urinalysis

Clinical Examination

<table>
<thead>
<tr>
<th>Clinical Signs</th>
<th>Possible Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pallor, blue half circles beneath eyes</td>
<td>Iron, copper, zinc, B12, B6, biotin</td>
</tr>
<tr>
<td>Edema</td>
<td>Protein (Albumin)</td>
</tr>
<tr>
<td>Bumpy “gooseflesh”</td>
<td>Vitamin A</td>
</tr>
<tr>
<td>Lesions at corner of mouth</td>
<td>Riboflavin</td>
</tr>
<tr>
<td>Glossitis</td>
<td>Folic acid</td>
</tr>
<tr>
<td>Numerous “black and blue” spots and tiny, red “pin prick” hemorrhages under the skin</td>
<td>Vitamin C</td>
</tr>
<tr>
<td>Emaciation</td>
<td>Carbohydrates, proteins; kcal</td>
</tr>
<tr>
<td>Poorly shaped bones or teeth or delayed appearance of teeth in children</td>
<td>Vitamin C</td>
</tr>
<tr>
<td>Slow clotting time of blood</td>
<td>Vitamin K</td>
</tr>
<tr>
<td>Unusual nervousness, dermatitis, diarrhea</td>
<td>Niacin</td>
</tr>
<tr>
<td>Tetany</td>
<td>Calcium, potassium, sodium</td>
</tr>
<tr>
<td>Goiter</td>
<td>Iodine</td>
</tr>
<tr>
<td>Eczema</td>
<td>Fat</td>
</tr>
</tbody>
</table>
Dietary/Social History Evaluation of food habits.

• **24-hour recall**: Client interviewed by the dietitian and asked to give types, amounts, and preparation of all foods eaten in past 24 hours.

• **Food diary**: written record of all food and drink ingested in a specified period.

• **Computer diet analysis**: to determine nutrient deficiencies or toxicities

**Multiple choice. Select the letter that precedes the best answer.**

1. The result of those processes whereby the body takes in and uses food for growth, development, and maintenance of health is
   a. respiration
   b. diet therapy
   c. nutrition
   d. digestion

2. Nutritional status is determined by
   a. heredity
   b. employment
   c. personality
   d. diet

3. To nourish the body adequately, one must
   a. avoid all low-nutrient-density foods
   b. eat foods containing the six classes of nutrients
   c. include fats at every meal
   d. restrict proteins at breakfast

4. Nutrients used primarily to provide energy to the body are
   a. vitamins, water, and minerals
   b. carbohydrates, proteins, and fats
   c. proteins, vitamins, and fat
   d. vitamins, minerals, and carbohydrates

5. Nutrients used mainly to build and repair body tissues are
   a. proteins, vitamins, and minerals
   b. carbohydrates, fats, and minerals
   c. fats, water, and minerals
   d. fats, vitamins, and minerals

6. Foods such as potato chips, cakes, sodas, and candy are called
   a. dietetic foods
   b. essential nutrient foods
   c. low-nutrient-density foods
   d. nutritious foods
7. An inadequate intake of the six classes of nutrients in the diet may result in
   a. stamina  b. malnutrition  c. indigestion  d. diabetes

8. The cumulative effect of a high-fat diet could be
   a. iron deficiency  b. blindness  c. heart disease  d. diabetes mellitus

9. Malnutrition could be caused by
   a. poor posture  b. constipation  c. disease  d. hypertension

10. A cumulative condition is one that develops
    a. within a very short period of time  b. over several years
        c. only in women under 52  d. in premature infants

11. Nutritional status
    a. is determined by heredity  b. never changes
        c. is not reflected in one’s appearance  d. can affect the body’s ability to resist disease

12. Infants, young children, adolescents, pregnant adolescents, and the elderly
    a. are commonly overweight  b. are among those prone to malnutrition
        c. all commonly suffer from osteomalacia  d. never suffer from primary nutrient deficiencies

13. Organic nutrients are
    a. only found in products grown without pesticides  b. only sold at health food stores
        c. substances that cannot be broken down  d. substances containing a carbon atom

14. Which of the following would be an organic nutrient?
    a. fat  b. water  c. calcium  d. selenium

15. Anthropometric measures include measures of:
    a. iron status  b. fluid intake  c. client’s income  d. weight
A balanced diet includes all six classes of nutrients and calories in amounts that preserve and promote good health. Daily review of the Dietary Reference Intakes (DRIs) and the Recommended Dietary Allowances (RDAs) would provide enough information to plan balanced diets.

**What Is a Healthy balanced Diet?**
- Fulfills energy needs (macronutrients)
- Provides sufficient amounts of essential nutrients (micronutrients)
- Reduces risk of disease
- Is safe to consume (low contaminants or potentially harmful added substances)
- Includes all the essential nutrients in appropriate amounts.
- Preserves and promotes good health

**Evolution of the Human Diet**

**DIETARY GUIDELINES FOR AMERICANS**
The Dietary Guidelines provide science-based advice to promote health and to reduce the risk for chronic diseases through diet and physical activity.
- Adequate nutrients within calorie needs
- Weight management
- Physical activity
- Food groups to encourage
- Fats
- Carbohydrates
- Sodium and potassium
- Alcoholic beverages
- Food safety
MYPYRAMID

Dietary Guidelines for Americans, 2005, serve as the U.S. federal nutrition policy (USDHHS & USDA, 2005). These guidelines form the basis for the MyPyramid Food guidance system unveiled in April 2005. MyPyramid is applicable to Americans over age 2.

MyPyramid has the following features:

- **MyPyramid Plan.** Provides a quick estimate of what and how much food you should eat from the different food groups by entering your age, gender, and activity level.
- **MyPyramid Tracker** (www.mypyramidtracker.gov). Provides more detailed information on your diet quality and physical activity status by comparing a day’s work of foods eaten with current nutrition guidance.
- **Inside MyPyramid.** Provides in-depth information for every food group, including recommended daily amounts in commonly used measures, like cups and ounces, with examples and everyday tips. Included in this section are recommendations for choosing healthy oils, discretionary calories, and physical activity.
- **Start Today.** Offers tips and resources that include downloadable suggestions on all the food groups and physical activity and provides a downloadable worksheet to track what you are eating.
For a 2,000-calorie diet, you need the amounts below from each food group. To find the amounts that are right for you, go to MyPyramid.gov.

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<table>
<thead>
<tr>
<th>FOOD GROUP</th>
<th>RECOMMENDED AMOUNTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains</td>
<td>1 cup</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1 cup</td>
</tr>
<tr>
<td>Fruits</td>
<td>2 cups</td>
</tr>
<tr>
<td>Milk</td>
<td>3 cups</td>
</tr>
<tr>
<td>Meat &amp; Beans</td>
<td>4 tsp</td>
</tr>
</tbody>
</table>

Find your balance between food and physical activity
- Be sure to stay within your daily calorie needs.
- Be physically active for at least 30 minutes most days of the week.
- About 60 minutes a day of physical activity may be needed to prevent weight gain.
- For sustaining weight loss, at least 60 to 90 minutes a day of physical activity may be required.
- Children and teenagers should be physically active for 60 minutes every day, or most days.

Know the limits on fats, sugars, and salt (sodium)
- Make most of your fat sources from fish, nuts, and vegetable oils.
- Limit solid fats like butter, stick margarine, shortening, and lard, as well as foods that contain these.
- Check the Nutrition Facts label to keep saturated fats, trans fats, and sodium low.
- Choose food and beverages low in added sugars. Added sugars contribute calories with few, if any, nutrients.

**CALORIE LEVEL**

<table>
<thead>
<tr>
<th></th>
<th>1,000</th>
<th>1,200</th>
<th>1,400</th>
<th>1,600</th>
<th>1,800</th>
<th>2,000</th>
<th>2,200</th>
<th>2,400</th>
<th>2,600</th>
<th>2,800</th>
<th>3,000</th>
<th>3,200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>1 cup</td>
<td>1 cup</td>
<td>1 cup</td>
<td>1.5 cups</td>
<td>1.5 cups</td>
<td>2 cups</td>
<td>2 cups</td>
<td>2 cups</td>
<td>2 cups</td>
<td>2.5 cups</td>
<td>2.5 cups</td>
<td>2.5 cups</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1 cup</td>
<td>1.5 cups</td>
<td>1.5 cups</td>
<td>2 cups</td>
<td>2.5 cups</td>
<td>2.5 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3.5 cups</td>
<td>3.5 cups</td>
<td>4 cups</td>
</tr>
<tr>
<td>Grains</td>
<td>3 oz-éq</td>
<td>4 oz-éq</td>
<td>5 oz-éq</td>
<td>6 oz-éq</td>
<td>6 oz-éq</td>
<td>7 oz-éq</td>
<td>8 oz-éq</td>
<td>9 oz-éq</td>
<td>10 oz-éq</td>
<td>10 oz-éq</td>
<td>10 oz-éq</td>
<td>10 oz-éq</td>
</tr>
<tr>
<td>Meat and beans</td>
<td>2 oz-éq</td>
<td>3 oz-éq</td>
<td>4 oz-éq</td>
<td>5 oz-éq</td>
<td>5 oz-éq</td>
<td>5.5 oz-éq</td>
<td>6 oz-éq</td>
<td>6.5 oz-éq</td>
<td>6.5 oz-éq</td>
<td>7 oz-éq</td>
<td>7 oz-éq</td>
<td>7 oz-éq</td>
</tr>
<tr>
<td>Milk</td>
<td>2 cups</td>
<td>2 cups</td>
<td>2 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
<td>3 cups</td>
</tr>
<tr>
<td>Oils</td>
<td>3 tsp</td>
<td>4 tsp</td>
<td>4 tsp</td>
<td>5 tsp</td>
<td>5 tsp</td>
<td>6 tsp</td>
<td>6 tsp</td>
<td>7 tsp</td>
<td>8 tsp</td>
<td>8 tsp</td>
<td>10 tsp</td>
<td>11 tsp</td>
</tr>
<tr>
<td>Discretionary calorie allowance</td>
<td>165</td>
<td>171</td>
<td>171</td>
<td>132</td>
<td>195</td>
<td>267</td>
<td>290</td>
<td>362</td>
<td>410</td>
<td>426</td>
<td>512</td>
<td>648</td>
</tr>
</tbody>
</table>

*Calorie levels are set across a wide range to accommodate the needs of different individuals.*
**Principles of Mediterranean Diet Pyramid**

- An abundance of food from plant sources, including fruits and vegetables, potatoes, breads and grains, beans, nuts, and seeds.
- Emphasis on a variety of minimally processed and, wherever possible.
- Olive oil as the principal fat, replacing other fats and oils (including butter and margarine).
- Total fat ranging from less than 25 percent to over 35 percent of energy, with saturated fat no more than 7 to 8 percent of energy (calories).
- Daily consumption of low to moderate amounts of cheese and yogurt (low-fat and non-fat versions may be preferable).
- Twice-weekly consumption of low to moderate amounts of fish and poultry (recent research suggests that fish be somewhat favored over poultry); up to 7 eggs per week (including those used in cooking and baking).
- Fresh fruit as the typical daily dessert; sweets with a significant amount of sugar (often as honey) and saturated fat consumed not more than a few times per week.
- Red meat a few times per month (recent research suggests that if red meat is eaten, its consumption should be limited to a maximum of 12 to 16 ounces [340 to 450 grams] per month; where the flavor is acceptable, lean versions may be preferable).
- Regular physical activity at a level which promotes a healthy weight, fitness and well-being.
- Moderate consumption of wine, normally with meals; about one to two glasses per day for men and one glass per day for women. From a contemporary public health perspective, wine should be considered optional and avoided when consumption would put the individual or others at risk.
Note: Mediterranean Diet Pyramid Developed by World Health Organization (WHO) and Harvard’s School of Public Health. Mediterranean Diet Pyramid encourages monounsaturated fats which decrease risk for cardiovascular diseases.

Food Labeling
- Mandatory labeling for nearly all processed foods started in May, 1994 as a result of the Nutrition Labeling and Education Act (NLEA).
- Primary objective is to ensure that labels on most foods provide consistent nutrition information.
Nutrition Facts Required
- Total calories
- Calories from fat
- Total fat
- Saturated fat
- Cholesterol
- Sodium
- Total carbohydrates
- Dietary fiber
- Sugars
- Protein
- Vitamin A
- Vitamin C
- Calcium
- Iron

Terminology
The FDA has also standardized descriptors (terms used by manufacturers to describe products) on food labels to help the consumer select the most appropriate and healthful foods. The following are examples:

- Food and Drug Administration (FDA) sets health claims allowed and serving sizes.
- Descriptive terms standardized
- *Low calorie* means 40 calories or less per serving.
- *Calorie free* means less than 5 calories per serving.
  *Low fat* means a food has no more than 3 grams of fat per serving or per 100 grams of the food.
- *Fat free* means a food contains less than 0.5 gram of fat per serving.
- *Low saturated fat* means 1 gram or less of saturated fat per serving.
- *Low cholesterol* means 20 mg or less of cholesterol per serving.
- *Cholesterol free* means less than 2 mg of cholesterol per serving.
- *No added sugar* means that no sugar or sweeteners of any kind have been added at any time during the preparation and packaging.
- When such a term is used, the package must also state that it is not low calorie or calorie reduced (unless it actually is).
- *Low sodium* means less than 140 mg of sodium per serving.
- *Very low sodium* means less than 35 mg of sodium per serving.
Food Customs

Food habits may be based on nationality, culture, and religion. Foods available in a certain area may be favored for economic reasons. Economic status and social status contribute to food habits.

U.S. Southern
Popular foods: corn bread, biscuits, grits, rice, sweet potatoes, squash, watermelon, oranges, peaches, fried fish, lima beans, green beans cooked with pork, barbecued/stewed meats and poultry. Diet may be high in fat and carbohydrates; limited in protein, iron, calcium, and vitamins A and C.

Central European
Popular foods: potatoes, grain (especially rye and buckwheat), pork, cooked cabbage, carrots, onions, and turnips. Eggs and dairy products used abundantly.
To improve diet, limit number of eggs, use fat-free or low-fat dairy products, and add fresh vegetables and fruits.

Middle Eastern
Popular foods: grains, wheat, rice, chickpeas in the form of hummus, lamb, yogurt, cabbage, grape leaves, eggplant, tomatoes, dates, olives, and figs. May contain insufficient amounts of protein and calcium depending on the amounts of meat and calcium-rich foods eaten.
Fresh fruits and vegetables should be added to increase vitamins, minerals, and fiber. Black, very sweet coffee is a popular beverage.

Chinese
Popular foods: rice, soybeans, eggs, pork, and tea
Low-fat diet, use Soy sauce is high in salt—problematic for patients on low-salt diets.

Vegetarians
Lacto-ovo: use dairy products and eggs, but no meat, poultry, or fish
Lacto: use dairy products but no meat, poultry, or eggs
Vegans: avoid all animal foods
Diets should be carefully planned to include essential amino acids.

Multiple choice. Select the letter that precedes the best answer.
1. Food customs mean one’s
   a. food nutrients    c. food requirements
   b. food habits       d. all of the above
2. Food customs
   a. may be based on religion or nationality
   b. are always nutritious
   c. are easily changed
   d. are not affected by one’s social status
3. Moving to a new environment or experiencing a change in salary
   a. rarely changes established food habits
   b. usually influences established food habits
   c. always reduces the amount of food eaten
   d. never reduces the quality of food eaten
4. Down-home breads are common to diets of people
   From a. Mexico   c. China
   b. the U.S. Midwest d. the U.S. South
5. Rice is a popular carbohydrate food in
   a. Puerto Rico    c. northern Europe
   b. central Europe  d. all of the above

6. In general, the diets of U.S. southerners,
Mexicans, Puerto Ricans, and Italians would
be improved by the addition of more
   a. rice    c. milk
   b. corn    d. pasta

7. A diet of dried beans, corn, and chili peppers
would most likely be used by a(n)
   a. Mexican family c. Armenian family
   b. Italian family d. Orthodox Jewish family

8. A balanced diet is one that includes
   a. equal amounts of carbohydrates and fats
   b. no animal products
   c. all six classes of nutrients
   d. more vegetables than fruits

9. Fruits and vegetables are rich sources of
   a. vitamins c. proteins
   b. fats d. all of the above

10. Teenagers should have a serving of milk (or its
    substitute)
    a. not more than twice a day
    b. three times a day
    c. not more than four times a week
    d. not at all if they are overweight

11. Milk products are made from milk and include
    a. butter and margarine
    b. yogurt and cottage cheese
    c. bean curd and coconut milk
    d. all of the above

12. Milk and its products are the best dietary
    source of
    a. proteins and fats c. carbohydrates
    b. calcium d. all of the above

13. Breads, cereals, and pasta are rich sources of
    a. vitamin D c. carbohydrates
    b. fats d. all of the above

14. Daily intake from the meat group should be
    a. 2 oz b. 5 1/2 oz c. 8 oz d. 11 oz

15. Foods from the meat group are rich sources of
    a. proteins c. vitamin C
    b. carbohydrates d. all of the above

16. An example of a breakfast with high nutrient
density is
    a. pancakes and cocoa
    b. melon, bran muffin, and cocoa made with fat-
    free milk
    c. fruit-flavored beverage, cinnamon bun, and
    coffee
    d. fried eggs, bacon, and coffee

17. Excessive amounts of salt in the diet
    a. raise cholesterol levels substantially
    b. are thought to contribute to hypertension
    c. cause cirrhosis of the liver
    d. have no relevance to one’s nutritional status

18. MyPyramid
    a. food groups are nutritionally interchangeable
    b. is an outline for meal planning for adults only
    c. advises that fruits and vegetables be eaten in
    moderation
    d. recommends portion ranges of bread, cereal,
rice, and pasta each day

19. When choosing foods from the meats, poultry,
and fish food group, one should be careful to select
foods that
    a. are rich in calcium and phosphorus
    b. provide at least one-half of one’s daily need for
carbohydrates
    c. have limited amounts of protein and iron
    d. are low in saturated fats and cholesterol

20. The two vitamins that the Nutrition Labeling
    and
    Education Act of 1990 requires be included as
    amounts per serving on food labels are
    a. vitamin A and thiamine
    b. niacin and folic acid
    c. vitamins A and C
    d. vitamins D and K
Food is broken down through the processes of mechanical and chemical digestion into nutrients that can be absorbed.

**Digestion**
The breakdown of food in the body in preparation for absorption.
- **Mechanical digestion**: food is broken up by teeth and moved along GI tract by peristalsis.
- **Chemical digestion**: carbohydrates, proteins, and fats are broken down into nutrients tissues can absorb and use.
  - Chemical changes occur through hydrolysis (the addition of water and breaking down of food molecules).
  - Enzymes act on food substances, causing them to break down into simple compounds.
  - An enzyme can act as a catalyst, which speeds up the chemical reactions without itself being changed in the process.

**Absorption**
The passage of nutrients into the blood or lymphatic system.
**Nutrients must be in their simplest form**
- Carbohydrates: simple sugars
- Proteins: amino acids
- Fats: fatty acids and glycerol

Most absorption occurs in the small intestine; some occurs in the large intestine. Water is absorbed in the stomach, small intestine, and large intestine.

**The Digestive System**
Mouth
- Digestion begins here
- Enzyme (salivary amylase) acts on starch
- Starch is a complex carbohydrate
- Teeth break up food; food mixes with saliva
- “Bolus” formed
- Length of time food is in mouth is brief
- Small amounts of carbohydrates changed

Esophagus
- Food travels through this muscular tube
- Connects mouth to stomach
- Peristalsis and gravity act to move bolus
- Cardiac sphincter opens at lower end of esophagus to allow passage of bolus into stomach.
- Indigestion or heartburn occurs as a result of stomach acid flowing back into the esophagus. This is called gastroesophageal reflux.

Stomach
- Anatomy:
  - Fundus: upper portion of the stomach
  - Body of the stomach: middle area
  - Pylorus: end of stomach near small intestines
- Temporary storage of food
- Mixing of food with gastric juices
- Regulation of a slow, controlled emptying of food into the intestine
- Secretion of the intrinsic factor for vitamin B12
- Destruction of most bacteria inadvertently consumed
- Hydrochloric acid prepares the gastric area for enzyme action
- Pepsin breaks down proteins
- In children, rennin breaks down milk proteins
- Lipase acts on emulsified fats
- Chyme: semiliquid mass of food and gastric juices
- Pernicious anemia: lack of intrinsic factor

Small Intestine
- Anatomy:
  - The small intestine is divided into three sections.
  - The duodenum is the first section of the small intestine.
  - The jejunum is the middle section and the ileum is the last section.
  - Twenty-two feet long
  - Villi, hairlike projections, increase surface area for maximum absorption
- Hormones released from small intestine
  - Secretin causes pancreas to release sodium bicarbonate to neutralize acidity of chyme
  - Cholecystokinin triggers gallbladder to release bile
- **Bile**
  - Emulsifies fat after it is secreted into small intestine
  - Produced in liver; stored in gallbladder

- **Enzymes are found in the pancreatic juice that is secreted into small intestine.**
  - Pancreatic proteases (trypsin, chymotrypsin, carboxypeptidases): split proteins
  - Pancreatic amylase: converts starches (polysaccharides) to simple sugars
  - Pancreatic lipase: reduces fats to fatty acids and glycerol

- **Produced enzymes is used to prepare foods for absorption**
- **Lactase, maltase, sucrase convert lactose, maltose, sucrose to simple sugars**
- **Peptidases reduce proteins to amino acids**

**Large Intestine**
- The cecum (blind pocket), colon and rectum make up the large intestine. Contents travel through:
  - Ascending colon
  - Transverse colon
  - Descending colon
  - Sigmoid colon
  - Rectum
  - Anal canal
- Colon walls secrete mucus to protect against acidic digestive juices in chyme.
- Major tasks of the large intestine:
  - Absorb water
  - Synthesize some B vitamins and vitamin K
  - Collect food residue

**Metabolism**
- The use of food by the body after digestion
- Results in energy Occurs after digestion and absorption; nutrients are carried by the blood to the cells of the body
- **Metabolism is consisting to two processes:**
  - Anabolism is the process of using energy from oxidation to create new compounds.
  - Catabolism is the breakdown of compounds during metabolism.

**Common Diseases affects Metabolism**
- **Hyperthyroidism**: metabolism speeds up and the body metabolizes its food too quickly, weight is lost.
- **Hypothyroidism**: metabolism slows down and the body metabolizes its food too slowly; patient tends to become sluggish and accumulate fat.
- Controlled primarily by hormones secreted by the thyroid gland: Triiodothyronine (T3) and thyroxine (T4).
Oxidation

- Nutrients combine with oxygen
- Carbohydrates reduce to carbon dioxide and water
- Protein reduce to carbon dioxide, water, and nitrogen
- Also known as aerobic metabolism
- Energy is released as nutrients are oxidized.
- Anaerobic metabolism reduces fats without the use of oxygen.
- The complete oxidation of carbohydrates, proteins, and fats is commonly called the Krebs cycle.

Energy

- The unit used to measure the energy value of foods is the kilocalorie.
- kcal: amount of heat needed to raise the temperature of 1 kilogram of water 1 degree Celsius.
- kcal is commonly called calorie.

Needed for involuntary and voluntary activity

- Involuntary activity: maintenance of body tissue, temperature, growth
- Voluntary activity: walking, swimming, eating, reading, typing

Three groups of nutrients provide energy

- Carbohydrates (should be primary source of energy)
- Proteins
- Fats

Amount of Energy yield from Groups of Nutrients

- 1 gram of carbohydrate yields 4 kcal
- 1 gram of protein yields 4 kcal
- 1 gram of fat yields 9 kcal
- 1 gram of alcohol yields 7 kcal

Basal Metabolic Rate (BMR) Also known as resting energy expenditure (REE).

- BMR is the rate at which energy is needed for body maintenance.
- The energy necessary to carry on all involuntary vital processes while the body is at rest.

Factors that affect BMR

- BMR is affected by lean body mass, body size, sex, age, heredity, physical condition, and climate.
- It’s greater in men than women.
- It increases during growth and fever and decreases with age and during starvation.

Calculating BMR

Harris-Benedict equation

- Used by dietitians for persons over age 18
- Uses height, weight, and age
  - Female BMR: \[ \frac{655 + (9.6 \times \text{weight in kg}) + (1.8 \times \text{height in cm}) - (4.7 \times \text{age})}{66} \]
  - Male BMR: \[ 66 + (13.7 \times \text{weight in kg}) + (5 \times \text{height in cm}) - (6.8 \times \text{age}) \]
Another method used to estimate BMR

- Convert body weight from pounds to kilograms
- Multiply kilograms by 24 (hours per day)
- Multiply the answer obtained by 0.9 for a woman and by 1.0 for a man

Example
Calculate the BMR for a woman who weighs 110 pounds.

1. 110 pound woman: BMR 1,080 kcal
2. 110 pounds ÷ 2.2 (pounds per kg) = 50 kg
3. 50 kg × 24 hours in a day = 1,200 kcal

4. 1,200 kcal × 0.9 = 1,080 kcal

Multiple choice. Select the letter that precedes the best answer.

1. Digestion begins in the
   a. mouth
   b. stomach
   c. liver
   d. small intestine

2. Most of the digestive processes occur in the
   a. mouth
   b. stomach
   c. small intestine
   d. colon

3. The small intestine is divided into three segments.
   They are, in descending order,
   a. ileum, jejunum, duodenum
   b. jejunum, ileum, duodenum
   c. duodenum, ileum, jejunum
   d. duodenum, jejunum, ileum

4. The fluid mixture that moves from the stomach through the pyloric sphincter is called
   a. bolus
   b. chyme
   c. food
   d. gastrin

5. A muscular movement that moves food down the GI tract is called
   a. a pump
   b. peristalsis
   c. lymphatic circulation
   d. circular propulsion

6. The pyloric sphincter is between the
   a. ileum and colon
   b. stomach and duodenum
   c. small intestine and colon
   d. colon and rectum

7. An organic substance that causes changes in other substances is a/an
   a. hormone
   b. bacterium
   c. enzyme
   d. acid

8. Maltase, sucrase, and lactase are produced in the
   a. stomach
   b. small intestine
   c. colon
   d. pancreas

9. Bile is needed to digest
   a. carbohydrates
   b. fiber
   c. proteins
   d. fats

10. When energy intake is greater than energy output, the body weight will
    a. remain the same
    b. decrease
    c. increase and then decrease
    d. increase
Carbohydrates provide energy and its Primary source of energy for the body.

- They should be the major source of energy.
- Carbohydrates spare protein, maintain normal fat metabolism, and provide fiber.
- Excessive carbohydrate intake may lead to obesity, dental caries, and digestive disturbances.
- Least expensive and most abundant of the energy nutrients.
- Named for the chemical elements they are composed of—carbon, hydrogen, and oxygen.

**Functions of Carbohydrates**

- Provide energy
- Protein-sparing action
- Normal fat metabolism
- Provide fiber

**Providing Energy**

- Each gram of carbohydrate provides 4 kcal.
- A body needs a constant energy supply.
- A half day’s supply of carbohydrates is stored in the liver and muscles for use as needed.
- Stored form is called glycogen.

**Protein-Sparing Action**

- The primary function of proteins is to build and repair tissues.
- When enough carbohydrates (at least 50-100 g/day) are ingested, protein is spared.

**Normal Fat Metabolism**

- Without an adequate supply of carbohydrates, fat is metabolized to meet energy requirements.
- Ketones are produced as a byproduct of fat metabolism.
- Ketosis may result.
- Lack of adequate carbohydrate intake may result in ketosis (a condition in which acids, called ketones, accumulate in the blood).
- Protein is best used for building and repairing body tissues.

**Providing Fiber**

- Dietary fiber is found in grains, vegetables, and fruits.
- Recommended intake is 20-35 g/day.
- Fiber lowers blood glucose levels; may prevent some colon cancers; and helps prevent constipation, hemorrhoids, and diverticular disease by softening stool.
Food Sources of Carbohydrates
Principal sources of carbohydrates are plant foods:
- Cereal grains
- Vegetables
- Fruits
- Nuts
- Sugars
- The only substantial animal source is milk.

Classification of Carbohydrates
- Monosaccharides (Simple sugars)
- Disaccharides
- Polysaccharides (Complex carbohydrates)

Monosaccharides
- Simplest form of carbohydrates
- Absorbed directly into bloodstream from the small intestine
- Glucose, fructose, galactose

Glucose
- Also called dextrose
- All other forms are converted to glucose for eventual metabolism
- Berries, grapes, sweet corn, corn syrup
- Central nervous system, red blood cells and brain use only glucose as fuel

Fructose
- Also called levulose or fruit sugar
- Ripe fruits, honey, soft drinks
- Sweetest of all the monosaccharides

Galactose
- Product of digestion of milk
- Not found naturally
- Source is lactose

Disaccharides
- Pairs of monosaccharides
- Must be changed to simple sugars by hydrolysis before absorption
- Sucrose, maltose, and lactose

Sucrose (Glucose + Fructose)
- It Composed of glucose and fructose
- Form of carbohydrate present in granulated, powdered, and brown sugar, and in molasses
- One of the sweetest and least expensive sugars
- Sources: sugar cane, sugar beets, maple syrup, candy, jams and jellies
Maltose (2 Glucose)
- Intermediary product in the hydrolysis of starch
- Also created during the fermentation process that produces alcohol
- Found in some infant formulas, malt beverage products, and beer
- Less sweet than glucose or sucrose

Lactose (Galactose + Glucose)
- Sugar found in milk
- Distinct from other sugars in that it is not found in plants
- Helps body absorb calcium
- Less sweet than monosaccharides or other disaccharides
- Lactose intolerance is the likely cause.
- Caused by insufficient lactase, the enzyme required for digestion of lactose.
- Low-lactose milk products can be used instead of regular milk.
- Lactase-containing products are also available.

Polysaccharides
- Complex carbohydrates “Compounds of many monosaccharides”
- Important polysaccharides in nutrition: Starch, Glycogen & Fiber.

Starch
- Found in grains and vegetables
- Storage form of glucose in plants
- Supplies energy over a longer period of time because it takes the body longer to digest polysaccharides than monosaccharides or disaccharides
- Sources: Cereals, grains, potatoes, corn, beans, yams
- Sources of Dextrins: Starch hydrolysis

Glycogen
- Sometimes called animal starch because it is the storage form of glucose in the body
- Hormone glucagon helps liver convert glycogen to glucose as needed
- Sources: Glucose stored in liver and muscles

Fiber
- It is indigestible because it cannot be broken down by digestive enzymes
- Insoluble: does not readily dissolve in water (cellulose, hemicellulose, lignins)
- Soluble: dissolves in water (gums, pectins, some hemicellulose, mucilages)
- Sources of Cellulos: Wheat bran, whole-grain cereals, fruits, green and leafy vegetables

Digestion and Absorption of Carbohydrates

Digestion and Absorption: Monosaccharides
- Simple sugars absorbed directly into bloodstream
- Carried to the liver; fructose and galactose changed to glucose
- Glucose carried to cells
Digestion and Absorption: Disaccharides  
- Enzymes sucrase, maltase, lactase convert sucrose, maltose, lactose to simple sugars.
- Simple sugars absorbed directly into bloodstream
- Carried to the liver; fructose and galactose changed to glucose
- Glucose carried to cells

Digestion and Absorption: Polysaccharides  
- More complex; digestibility varies
- Cellulose wall broken down, starch changed to intermediate product dextrin, then maltose, and finally glucose
- Starch digestion begins in mouth where the enzyme salivary amylase begins to change starch to dextrin

Metabolism of Carbohydrates  
- Islets of Langerhans in pancreas secrete insulin
- Insulin is the hormone that controls glucose metabolism
- Impaired or absent insulin secretion results in high blood glucose level (hyperglycemia)
- Low blood glucose level (hypoglycemia)

Dietary Requirements of Carbohydrates  
- Food and Nutrition Board of the National Research Council recommends:
- Half of one’s energy requirement should come from carbohydrates
- Complex carbohydrates preferred
- Weight loss and fatigue can result from a diet deficient in carbohydrates

Multiple choice. Select the letter that precedes the best answer.

1. The three main groups of carbohydrates are  
   a. fats, proteins, and minerals  
   b. glucose, fructose, and galactose  
   c. monosaccharides, disaccharides, and polysaccharides  
   d. sucrose, cellulose, and glycogen

2. Galactose is a product of the digestion of  
   a. milk  
   b. meat  
   c. breads  
   d. vegetables

3. The simple sugar to which all forms of carbohydrates are ultimately converted is  
   a. sucrose  
   b. glucose  
   c. galactose  
   d. maltose

4. A fibrous form of carbohydrate that cannot be digested is  
   a. glucose  
   b. glycogen  
   c. cellulose  
   d. fat

5. Glycogen is stored in the  
   a. heart and lungs  
   b. liver and muscles  
   c. pancreas and gallbladder  
   d. small and large intestines

6. Substances to which fatty acids are broken down in the liver are  
   a. galactose  
   b. estrogen  
   c. thyroxin  
   d. ketones

7. Starch is  
   a. the form in which glucose is stored in plants  
   b. a monosaccharide  
   c. an insoluble form of dietary fiber  
   d. found only in grains

8. Insoluble dietary fiber  
   a. can increase blood glucose  
   b. can decrease blood cholesterol  
   c. commonly causes diverticular disease  
   d. is preferably provided by commercially prepared fiber products
Fats provide energy, carry essential fatty acids and fat-soluble vitamins, protect organs and bones, insulate from cold, and provide satiety to meals. It composed of carbon, hydrogen, and oxygen and are found in both animal and plant foods.

**Facts about fats**
- Fats belong to a group of organic compounds called lipids.
- Greasy substances that are insoluble in water.
- Each gram of fat contains 9 kcal.
- Composed of carbon, hydrogen, and oxygen; lower proportion of oxygen than carbohydrates.

**Functions of fats**
- Provide energy
- Carry fat-soluble vitamins
- Supply essential fatty acids
- Protect and support organs and bones
- Insulate from cold
- Provide satiety to meals

**Food Sources of fats**
There are two Sources of fats include:

<table>
<thead>
<tr>
<th>Animal</th>
<th>Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatty meats</td>
<td>Vegetable oils</td>
</tr>
<tr>
<td>Lard</td>
<td>Nuts</td>
</tr>
<tr>
<td>Butter</td>
<td>Chocolate</td>
</tr>
<tr>
<td>Cheese</td>
<td>Avocados</td>
</tr>
<tr>
<td>Cream; whole milk</td>
<td>Olives</td>
</tr>
<tr>
<td>Egg yolk</td>
<td>Margarine</td>
</tr>
</tbody>
</table>

**Types of Fats**
Fats can be classified according to visibility into:
- **Visible fats**: Fats in foods that are purchased and used as fats, such as butter or margarine, lard, cooking oils.
- **Invisible fats**: Fats those are not immediately noticeable such as those in egg yolk, cheese, cream, and salad dressings

- Beware of hidden fats!
- Decrease the amount of fatty meats (bacon, sausage, luncheon meats) and use lean meats instead. Use low-fat or skim milk.
- Use egg whites instead of yolks when possible. (Egg white contains no fat; it is almost entirely protein and water.)
Fats also classified into:

**Triglycerides**
- Most lipids in the body (95%) are triglycerides
- Composed of three fatty acids attached to a framework of glycerol

**Phospholipids**

**Sterols**
- Cholesterol

**Fatty Acids**
Fatty acids are organic compounds of carbon atoms to which hydrogen atoms are attached. They may be classified in two ways.

**Classification of Fatty Acid**
May be classified by the body’s need for them
- Essential and Nonessential

May be classified by degree of saturation with hydrogen atoms
- Saturated
- Unsaturated
  -- Monounsaturated
  -- Polyunsaturated

**Essential Fatty Acids**
Cannot be synthesized by the body. It must be obtained from the diet

**Types**
- Linoleic acid
- Linolenic acid

**Non-essential Fatty Acids**
Can be synthesized by the body. Arachidonic fatty acid, previously thought to be essential, can be synthesized in the body from linoleic fatty acid.

**Saturated Fats**
- Each of its carbon atoms carries all the hydrogen atoms possible.
- In general, animal foods contain more saturated fatty acids than unsaturated.
- Usually solid at room temperature.
- Examples: Meat, poultry, egg yolks, whole milk, whole milk cheeses, cream, ice cream, butter, chocolate, coconut, palm oil

**Monounsaturated Fats**
- Fewer hydrogen atoms attached to one place among the carbon atoms of its fatty acids than saturated fats.
- Lowers low-density lipoprotein (LDL or “bad cholesterol”).
- Examples: Olive oil, canola oil, avocados, cashew nuts
- Recommended: 15% of total daily kcal
Polyunsaturated Fats
- Fewer hydrogen atoms attached to two or more places among the carbon atoms of its fatty acids than saturated fats.
- Examples: Cooking oils made from sunflower, safflower, sesame seeds or from corn or soybeans, soft margarines whose major ingredient is liquid vegetable oil, and fish
- Foods containing high proportions of polyunsaturated fats are usually soft or oily.
- Omega-3 fatty acids (found in fish) lower the risk of heart disease.
- Omega-6 (linoleic acid) has a cholesterol-lowering effect.
- Recommended: 10% of total daily kcal

Hydrogenated Fats
- Polyunsaturated vegetable oils to which hydrogen has been added commercially to make them solid at room temperature.
- This process, called hydrogenation, turns polyunsaturated vegetable oils into saturated fats.
- Margarine is made in this way.

Trans-Fatty Acids (TFAs)
- Produced when hydrogen atoms are added to monounsaturated or polyunsaturated fats to produce a semi-solid product like margarine and shortening.
- TFAs raise low-density lipoproteins (LDL) and total cholesterol.
- Major source: baked goods and restaurant foods

Phospholipid
Found in both plant and animal foods, and is synthesized in the liver.
Natural emulsifier that helps transport fat in the bloodstream. Example: Lecithin

Cholesterol
Cholesterol is a sterol
- Fatlike substance
- Exists in animal foods and body cells
- Does not exist in plant foods
- Essential for the synthesis of bile, sex hormones, cortisone, and vitamin D
- Needed by every cell in the body
- High cholesterol leads to atherosclerosis, a cardiovascular disease in which plaque (fatty deposits containing cholesterol and other substances) forms on the inside of artery walls. This can lead to heart attacks and strokes.
- Reduce the amount of total fat, saturated fats, and cholesterol.
- Increase monounsaturated fats in the diet, lose weight and exercise. Increase consumption of soluble dietary fiber. Medication may be prescribed in some cases. Daily cholesterol intake should not exceed 300 mg.
Digestion and Absorption of Fats
- 95% of ingested fats are digested
- Complex process
- Chemical digestion of fats occurs mainly in the small intestine
- No digestion of fats occurs in the mouth
- Slight digestion in stomach where gastric lipase acts on emulsified fats such as those found in cream and egg yolk.

Digestion in the small intestine
- Bile emulsifies the fats
- The enzyme pancreatic lipase reduces the fats to fatty acids and glycerol
- The body subsequently absorbs through the villi of the small intestine

Lipoproteins
In the initial stages of fat absorption, bile joins with the products of fat digestion to carry fat. Later, protein combines with the final products of fat digestion to form special carriers called lipoproteins. Lipoproteins carry the fat in the blood to the body cells.

Lipoproteins are Classified according to mobility and density
Types
- Chylomicrons
- Very-low-density lipoproteins (VLDLs)
- Low-density lipoproteins (LDLs)
- High-density lipoproteins (HDLs)

Chylomicron
- First lipoprotein identified after eating
- Largest lipoprotein
- Lightest in weight
- Composed of 80-90% triglycerides

Very-low-density Lipoproteins (VLDLs)
- Made by the liver to transport lipids throughout the body. Composed of 55-65% triglycerides. Carry triglycerides and other lipids to all cells.
- As the VLDL lose triglycerides, they pick up cholesterol from other lipoproteins in the blood and they then become LDL.

Low-density Lipoproteins (LDLs)
- Composed of 45% cholesterol with few triglycerides.
- Carry most of the blood cholesterol from the liver to the cells.
- Elevated blood levels greater than 130 mg/dl of LDL are thought to be contributing factors in atherosclerosis.
- “Bad cholesterol”
**High-density Lipoproteins (HDLs)**
- Carry cholesterol from the cells to the liver for eventual excretion.
- Levels of HDL greater than 35 mg/dl are thought to reduce the risk of heart disease.
- Exercise, maintaining a desirable weight, and giving up smoking are all ways to increase one’s HDL.
- “Good cholesterol”

**Metabolism and Elimination of fats**
- The liver controls fat metabolism.
- The metabolism of fats occurs in the cells.
- Fatty acids are broken down to carbon dioxide and water, releasing energy.
- Portion of fat not needed for immediate use stored as adipose tissue.
- Carbon dioxide and water are waste products removed from the body by the circulatory, respiratory, and excretory systems.

**Fat Alternatives**
- **Olestra**: Made from carbohydrates and fat
  - FDA approved for use in snack food
  - Government requires that food labels indicate olestra “inhibits absorption of some vitamins and other nutrients”
  - Contains no calories; can cause cramps and diarrhea
- **Simplesse**: Made from egg white or milk protein
- **Oatrim**: Carbohydrate-based; derived from oat fiber

**Dietary Requirements of fats**
- The Food and Nutrition Board’s Committee on Diet and Health recommends that people reduce their fat intake to 30% of total kcal.
- American Heart Association’s newest recommendation is to consume $\leq 7\%$ of saturated fats, 8-10% polyunsaturated fats and 15% monounsaturated fats.
- At present, 36% of kcal in U.S. diets is derived from fats.
Multiple choice. Select the letter that precedes the best answer.

1. Fats provide the most concentrated form of
   a. carbon  c. lipase
   b. oxygen  d. energy

2. Adipose tissue is useful because it
   a. can synthesize triglycerides   b. prevents
     eczema
   c. provides satiety       d. protects and insulates

3. Atherosclerosis is thought to increase the risk of
   a. cancer      c. heart attacks
   b. plaque       d. hypercholesterolemia

4. A diet grossly deficient in fats may be deficient in
   a. lipase c. cholesterol
   b. linoleic acid d. triglycerides

5. Invisible fats can be found in
   a. cake and cookies
   b. orange and tomato juice
   c. egg white and skim milk
   d. lettuce and tomatoes

6. Plant foods that contain saturated fats are
   a. olives and avocados
   b. coconut and chocolate
   c. corn and soybeans
   d. cashew nuts and canola oil

7. When a polyunsaturated vegetable oil is changed to a saturated fat, the process is called
   a. hydrolysis c. hydrogenation
   b. hypercholesterolemia d. hyperlipidemia

8. Linoleic acid is one of the fatty acids that is known to be
   a. a triglyceride   c. monounsaturated
   b. saturated       d. essential to the human diet

9. Cholesterol is
   a. not essential to the human diet
   b. thought to contribute to atherosclerosis
   c. not found in animal foods
   d. classified as a mineral

10. Another name for fats is
    a. lipase c. lipoproteins
    b. lipidemia d. lipids

11. Three groups of lipids found naturally in the human body and in food are triglycerides, phospholipids, and
    a. cortisone c. sterols
    b. steroids d. hydrogenated fats

12. Fatty acids are organic compounds of carbon atoms and
    a. hydrogen atoms     c. triglycerides
    b. arachidonic acids d. glycerol

13. Cholesterol
    a. is found in both plants and animals
    b. is found only in plants
    c. does not contribute in any way to heart disease
    d. is a sterol

14. HDL (high-density lipoprotein)
    a. is sometimes called good cholesterol
    b. carries lipids to the cells
    c. is the same as lipase
    d. levels should be less than 40 mg/dl of human blood

15. For digestion, fats require the help of gastric lipase,
    a. bile, and fatty acids   b. bile, and pancreatic lipase
    c. pancreatic lipase, and glycerol
    d. cholesterol, and bile
Proteins contain nitrogen. They build and repair body tissues, regulate body processes, and supply energy. Each gram of protein provides 4 kcal.

Proteins are composed of amino acids. Nine of the amino acids are essential for growth and development.

**Facts of Proteins**
- Of the six nutrient groups, only proteins can make new cells and rebuild tissue.
- Proteins are the basic material of every body cell.
- Proteins are the only nutrient group that contains nitrogen.
- Proteins are composed of amino acids.

**Amino Acid**
- Nitrogen containing compound of which protein is composed.
- There are twenty amino acids.
- Nine are considered essential.

**Types of Amino Acids**

*Essential amino acids* which an organism needs to ingest because it is necessary for nutrition and cannot be synthesized in the body.
- Examples: Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Treonine, Tryptophan, Valine

*Nonessential amino acids* which can be synthesized in the body.
- Examples: Alanine, Arginine, Asparagine, Aspartic acid, Cysteine, Cystine, Glutamic acid, Glutamine, Glycine, Hydroxyproline, Proline, Serine, and Tyrosine

**Classification of Proteins**

1. **Complete**
   - High quality
   - Contains all nine essential amino acids

2. **Incomplete**
   - Low quality
   - Lacks one or more amino acid
   - Cannot build tissue without help

3. **Complementary Proteins**
   Occurs when a combination of incomplete proteins are eaten in the same day to make a complete protein. Examples: corn and beans, rice and beans, bread and peanut butter, bread and split pea soup, bread and cheese, bread and baked beans, macaroni and cheese, cereal and milk
Food Sources of Proteins

Animal food sources
- Complete proteins
  - Meats, fish, poultry, eggs, milk, cheese

Plant food sources
- Incomplete proteins
  - Corn, grain, nuts, sunflower seeds, sesame seeds, and legumes

Analogues
- Meat alternatives made from soy protein and other ingredients to simulate various kinds of meat
- Tofu is a soft cheeselike food made from soy milk

Although animal foods are the best sources of complete proteins, foods that provide incomplete proteins can be combined to make complete proteins. The best sources of incomplete proteins are legumes, corn, grains, and nuts. Soy protein and tofu are nutritious meat replacements.

Functions of Proteins

- Building and repairing body tissue
- Regulating body functions
  - Metabolism and digestion
  - Fluid and electrolyte balance
  - Development of antibodies
- Providing energy
  - Each gram of protein provides 4 kcal

Digestion and Absorption of Proteins

<table>
<thead>
<tr>
<th>Mechanical digestion</th>
<th>Chemical digestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Begins in mouth</td>
<td>- Begins in stomach</td>
</tr>
<tr>
<td>- Teeth grind food into small pieces</td>
<td>- Hydrochloric acid prepares stomach</td>
</tr>
<tr>
<td></td>
<td>- Enzyme pepsin reduces proteins to polypeptides</td>
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<tr>
<td></td>
<td>- Polypeptides: ten or more amino acids bonded together</td>
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<tr>
<td></td>
<td>- In the small intestine, three pancreatic enzymes (trypsin, chymotrypsin, carboxypeptidase) continue chemical digestion and absorption through the villi</td>
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</tbody>
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Metabolism and Elimination of Proteins

- Amino acids are broken down; the nitrogen-containing amine group is stripped off (deamination).
- Ammonia is produced.
- Liver picks up ammonia and converts it to urea.
- Kidney filters out urea and excretes it.
- Remaining parts are used for energy or converted to carbohydrate or fat and stored as glycogen or adipose tissue.
Dietary Requirements of Proteins
- Determined by size, age, sex, and physical and emotional conditions.
- The National Research Council of the National Academy of Sciences considers the average daily requirement to be 0.8 g of protein for each kilogram of body weight.
- To determine your requirement.
- Divide body weight by 2.2 (the number of pounds per kilogram)
- Multiply the answer obtained in the first step by 0.8 (grams of protein per kilogram of body weight)

Protein Excess
- Saturated fats and cholesterol may contribute to heart disease
- Connection to colon cancer
- Substitute for essential fruits and vegetables
- Increased demand on kidneys
- National Research Council recommends that protein intake represent no more than 15-20% of one’s daily kcal intake and not exceed double the amount given of Recommended Dietary Allowances.

Nitrogen Balance
- Nitrogen intake equals nitrogen excreted.
- Positive nitrogen balance exists when nitrogen intake exceeds amount excreted.
- Negative nitrogen balance exists when more nitrogen is lost than taken in.

<table>
<thead>
<tr>
<th>Positive nitrogen balance</th>
<th>Negative nitrogen balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>o Pregnancy</td>
<td>o Fever</td>
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<tr>
<td>o Growth periods</td>
<td>o Injury</td>
</tr>
<tr>
<td>o Building muscle</td>
<td>o Surgery</td>
</tr>
<tr>
<td>o Rebuilding tissue after trauma/illness</td>
<td>o Burns</td>
</tr>
<tr>
<td></td>
<td>o Starvation</td>
</tr>
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<td></td>
<td>o Immobilization</td>
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</tbody>
</table>

Protein Deficiency
- Muscle wasting occurs
- Albumin (protein in blood plasma) causes edema
- Loss of appetite, strength, weight
- Lethargy, depression, slow wound healing

Protein Energy Malnutrition (PEM)
Lack protein and energy-rich foods. Found in developing countries with shortages of protein and energy-rich foods. Stunted growth and mental retardation may occur.

Marasmus
- Affects very young children.
- Results from severe malnutrition (lack of protein, vitamins, & minerals).
- Emaciated, no edema
- Hair is dull and dry; skin thin and wrinkled.

Kwashiorkor
- Sudden or recent lack of protein-containing food; affects children and adults.
- Fat accumulates in liver, and lack of protein and hormones results in edema, painful skin lesions, and changes in pigmentation of skin and hair.
- High mortality rate
Multiple choices. Select the letter that precedes the best answer.

1. The building blocks of proteins are  
   a. ascorbic acids c. nitrogen and sulfur only  
   b. amino acids d. meat and fish  

2. Proteins are essential because they are the only nutrient that contains  
   a. nitrogen c. hydrochloric acid  
   b. niacin d. carbon  

4. Protein deficiency may result in  
   a. beriberi c. edema  
   b. goiter d. leukemia  

5. Good sources of complete protein foods are  
   a. eggs and ground beef c. butter and margarine  
   b. breads and cereals d. legumes and nuts  

6. One gram of protein provides  
   a. 4 calories c. 7 calories  
   b. 9 calories d. 19 calories  

7. Complete proteins contain all the essential  
   a. nutrients c. amino acids  
   b. ascorbic acids d. calories  

3. Corn, peas, and beans  
   a. are complete protein foods  
   b. are incomplete protein foods  
   c. contain no protein  
   d. lose proteins during cooking  

8. The primary function of protein is to  
   a. build and repair body cells  
   b. provide energy  
   c. digest minerals and vitamins  
   d. none of the above  

9. Once proteins reach the small intestine, chemical digestion continues through the action of  
   a. rennin c. bile  
   b. pancreatic enzymes d. hydrochloric acid  

10. It is unwise to regularly ingest excessive amounts of protein because  
    a. it can cause positive nitrogen balance  
    b. it can contribute to heart disease  
    c. it may reduce the work of the kidneys  
    d. it may cause uremic poisoning
Micronutrients
Micronutrient includes two groups of nutrients: Vitamins, and Minerals.

Vitamins
Organic (carbon-containing) compounds those are essential in small amounts for body processes. Do not provide energy. Enable the body to use the energy provided by fats, carbohydrates, and proteins. Megadoses can be toxic.

Types of Vitamin (13)
Fat soluble (4): A, D, E, K
Water soluble (9):
- Vitamin C and Vitamin B complex which includes: thiamin (B₁), riboflavin (B₂), niacin, vitamin B₆, folate, vitamin B₁₂ (cobalamin), pantothenic acid, biotin

Requirements of Vitamin
Vitamin allowances given by weight in milligrams (mg) or micrograms (mcg or µg)
Dietary reference intake (replacing recommended dietary allowance)
UL–tolerable upper limits–maximum level of daily intake unlikely to cause adverse effects

Vitamin Deficiency
People prone to vitamin deficiency
- Alcoholics
- Poor and incapacitated elderly
- Clients with serious diseases that affect appetite
- Mentally retarded
- Children receiving inadequate care

Deficiency of Fat-soluble Vitamins can cause:
- Chronic malabsorption diseases, Cystic fibrosis, Celiac disease & Crohn’s disease

Avoiding Vitamin Loss
- Buy fresh, unbruised vegetables and fruits and use them raw when possible.
- Prepare fresh vegetables and fruits just before serving.
- Heat canned vegetables quickly and in their own liquid.
- Follow package directions when cooking frozen vegetables or fruit.
- Steam, or use as little water as possible.
- Cover pan and cook for a short period of time.
- Save cooking liquid for soups, stews, and gravy.
- Store in a cool, dark place.
Fat-Soluble Vitamins (Vitamins A, D, E, K)

Vitamin A
Preformed (retinol) "Active form of vitamin A"
Carotenoids "Inactive form of vitamin A found in plants"

Functions of Vitamin A
Antioxidant; protects cells from destruction by oxygen.
Maintains healthy eyes and skin, normal growth and reproduction, and a healthy immune system. It helps in prevent of infection.

Sources of Vitamin A
- Preformed vitamin A (retinol) : Fat-containing animal foods: liver, butter, cream, whole milk, cheeses
- Carotenoids (provitamin A or beta-carotene): Green leafy vegetables & fruits, carrots, sweet potatoes, squash, spinach, broccoli, mango, cantaloupe, pumpkin

Vitamin D
Prohormone–converted to a hormone in the body.
D2 (ergocalciferol) is formed in plants.
D3 (cholecalciferol) is formed in humans from cholesterol in the skin.

Sources of Vitamin D
Sunlight
Milk, fish liver oils, egg yolk, butter, fortified margarine
Most milk in the U.S. has 10 μg of vitamin D concentrate added per quart.

Excess of Vitamin D
Deposits of calcium and phosphorus in soft tissues, kidney and heart damage, and bone fragility

Deficit of Vitamin D
Poor bone and tooth formation, rickets which causes malformed bones and pain in infants
Osteomalacia (softening of bones)
Osteoporosis (brittle, porous bones)

Vitamin E
Tocopherols: Alpha (most biologically active), others Beta, delta, gamma

Functions of Vitamin E
- Antioxidant
- Prevention of hemolytic anemia among premature infants
- Enhance immune system
- Retard spoilage of commercial foods

Sources of Vitamin E
- Vegetable oils: corn, soybean, safflower, and cottonseed, and products made from them such as margarine
- Wheat germ, nuts, green leafy vegetables
Deficit of Vitamin E
Serious neurological defects can occur from malabsorption.

**Vitamin K**
Made up of several compounds essential to blood clotting.

**Functions of Vitamin K**
Formation of prothrombin; clotting of blood
Candidates likely to receive Vitamin K
Newborns immediately after birth
Clients who suffer from faulty fat absorption
After extensive antibiotic therapy
Antidote for an overdose of anticoagulant
Clients being treated for hemorrhage

**Sources of Vitamin K**
Green leafy vegetables such as broccoli, cabbage, spinach, and kale.
Dairy products such as eggs, meats, fruits, and cereals.
Bacteria in small intestine synthesizes some vitamin K but must be supplemented by dietary sources.

Deficit of Vitamin K
Defective blood coagulation, which increases clotting time and makes client prone to hemorrhage

**Water-soluble Vitamins**

**Vitamin B complex and Vitamin C**

**Thiamin B1**
Essential for nerve and muscle action, and metabolism of carbohydrates and some amino acids.
Sources include unrefined and enriched cereals, yeast, wheat germ, lean pork, organ meats, and legumes.
Deficiency symptoms include loss of appetite, fatigue, nervous irritability, and constipation.
Beriberi is a disease caused by extreme deficiency of vitamin B1.

**Riboflavin B2**
Necessary for: the metabolism of carbohydrates, protein, and fats; tissue maintenance (especially the skin around the mouth); and healthy eyes.
Sources include milk, meats, poultry, fish, enriched breads, cereals, broccoli, spinach, and asparagus.
Deficiency can result in cheilosis (a condition characterized by sores on the lips and cracks at the corners of the mouth); glossitis (inflammation of the tongue); dermatitis; and eye strain in the form of itching, burning, and eye fatigue.
Niacin B3
Generic name for nicotinic acid and nicotinamide.
A coenzyme in energy metabolism.
Sources include meats, poultry, fish, peanuts, legumes. Milk and eggs are sources of tryptophan (precursor).
Excessive amounts of niacin may cause flushing due to vascular dilation, GI problems, itching, and liver damage.
May be used as a cholesterol-lowering agent under close supervision of a physician due to adverse side effects, which include liver damage and peptic ulcers.
Deficiency symptoms include weakness, anorexia, indigestion, anxiety, and irritability.
Pellagra is an extreme deficiency causing sores on the skin, diarrhea, anxiety, confusion, irritability, poor memory, dizziness, and untimely death.

Pantothenic Acid B5
Involved in metabolism of carbohydrates, fats, proteins.
Essential for synthesis of neurotransmitter acetylcholine and steroid hormones.
Sources include meats, poultry, fish, eggs, whole grain cereals, and legumes.
Thought to be synthesized by the body.
Food and Nutrition Board has provided an estimated intake of 5 mg a day for normal adults.
Toxicity from excess not confirmed.
Natural deficiencies unknown. Signs include weakness, fatigue, burning sensation in feet (deficiencies produced experimentally).

Pyridoxine B6
Pyridoxine, pyridoxal, pyridoxamine
Essential for protein metabolism and absorption, and aids in release of glucose from glycogen.
Serves as catalyst in conversion of tryptophan to niacin; helps synthesize neurotransmitters such as serotonin and dopamine.
Sources include poultry, fish, liver, kidney, potatoes, bananas, spinach, and unrefined whole grains (oats and wheat).
Deficiency symptoms include irritability, depression, and dermatitis.
Deficiency in infants can cause various neurological symptoms and abdominal problems.
Toxicity is rare; may cause temporary neurological problems.

Biotin B7
Coenzyme in synthesis of fatty acids and amino acids.
Sources include liver, egg yolk, soy flour, cereals, yeast.
Synthesized in intestine by microorganisms, amount available for absorption unknown.
Food and Nutrition Board suggests adequate intake of 30 μg for adults.
Toxicity from excess unknown.
Deficiency symptoms include nausea, anorexia, depression, pallor, dermatitis, increase in serum cholesterol.
**Folate B9**
Folate, folacin, and folic acid are chemically similar compounds, and names are used interchangeably. Needed for DNA synthesis, protein metabolism, formation of hemoglobin.
*Sources* include cereals fortified with folate, green leafy vegetables, legumes, sunflower seeds, fruits such as orange juice and strawberries.
Deficiency linked to neural tube defects in fetus such as spina bifida (spinal cord or spinal fluid bulge through the back) and anencephaly (absence of the brain).
Other signs include inflammation of mouth and tongue, poor growth, depression and mental confusion, problems with nerve functions, megaloblastic anemia.

**Cobalamin B12**
Cobalamin—contains mineral cobalt.
Stored in body three to five years.
Involved in folate metabolism, maintenance of the myelin sheath, and healthy red blood cells.
To be absorbed, must bind with intrinsic factor in stomach. Pernicious anemia may result from loss of intrinsic factor.
*Sources* include animal foods, especially organ meats, lean meat, seafood, eggs, dairy products.
Deficiency is rare and may be due to congenital problems of absorption or years of a vegetarian diet with no animal foods.
Symptoms included megaloblastic anemia, pernicious anemia (if intrinsic factor absent), anorexia, glossitis, sore mouth, tongue, pallor, depression, dizziness, weight loss, neurological system damage.

**Vitamin C** (Ascorbic acid)
Has antioxidant properties and protects food from oxidation.
Role in formation of collagen.
Aids in absorption of nonheme iron.
May be involved with formation or functioning of norepinephrine, some amino acids, folate, leukocytes, the immune system, allergic reactions
*Sources* include citrus fruits, melon, strawberries, tomatoes, potatoes, red and green peppers, cabbage, broccoli.
Stress and cigarette smoking increase need for Vitamin C.
*Scurvy*: disease characterized by gingivitis, easy bruising, pinpoint hemorrhages of the skin, poor wound healing, sore joints and muscles, weight loss. Extreme cases result in death. Found in sailors who lived without fresh fruits and vegetables.
*Deficiency of Vitamin C*: bleeding gums, loose teeth, tendency to bruise easily, poor wound healing, scurvy. *Excess of Vitamin C*: diarrhea, nausea, cramps, excessive absorption of food iron, rebound scurvy (when megadoses are stopped abruptly) and possibly oxalate kidney stones. Generally considered nontoxic.

**Vitamin Supplementation**
- Balanced diet provides nutritional needs of healthy people.
- No amount of vitamins will build muscles.
- Vitamins do not provide energy; they help to release the energy provided by nutrients.
- Heart disease, cancer and the common cold cannot be cured by vitamin supplements.
Multiple choice. Select the letter that precedes the best answer.

1. The daily vitamin requirement is best supplied by
   a. eating a well-balanced diet
   b. eating one serving of citrus fruit for breakfast
   c. taking one of the many forms of vitamin supplements
   d. eating at least one serving of meat each day

2. All of the following measures preserve the vitamin content of food except
   a. using vegetables and fruits raw
   b. preparing fresh vegetables just before serving
   c. adding raw, fresh vegetables to a small amount of cold water and heating to boiling
   d. storing fresh vegetables in a cool place

3. Fat-soluble vitamins
   a. cannot be stored in the body
   b. are lost easily during cooking
   c. are dissolved by water
   d. are slower than water-soluble vitamins to exhibit deficiencies

4. Night blindness is caused by a deficiency of
   a. vitamin A  
   b. thiamine
   c. niacin
   d. vitamin C

5. Good sources of thiamine include
   a. citrus fruits and tomatoes
   b. wheat germ and liver
   c. carotene and fish liver oils
   d. nuts and milk

6. Water-soluble vitamins include
   a. A, D, E, and K
   b. A, B6, and C
   c. thiamine, niacin, and retinol
   d. thiamine, riboflavin, niacin, B6, and B12

7. Injections of B12 are given in the treatment of
   a. scurvy
   b. pernicious anemia
   c. pellagra
   d. beriberi

8. Blindness can result from a severe lack of
   a. vitamin K
   b. vitamin A
   c. thiamine
   d. vitamin E

9. Organ meats are good sources of the vitamins
   a. thiamine, riboflavin, and B12
   b. biotin and vitamin C
   c. vitamins E and K
   d. all of the above

10. Fortified milk is a good source of
    a. vitamin E
    b. vitamin D
    c. vitamin K
    d. vitamin C

11. Good sources of vitamin C are
    a. meats
    b. milk and milk products
    c. breads and cereals
    d. citrus fruits

12. The vitamin that aids in the prevention of rickets is
    a. vitamin A
    b. thiamine
    c. vitamin C
    d. vitamin D

13. The vitamin that is necessary for the proper clotting of the blood is
    a. vitamin A
    b. vitamin K
    c. vitamin D
    d. niacin

14. Vitamins commonly added to breads and cereals are
    a. vitamins A, D, and K
    b. thiamine, riboflavin, niacin, and folate
    c. vitamins E, B6, and B12
    d. ascorbic acid, pantothenic acid, and folate
Human body made up of specific chemical elements.
Oxygen, carbon, hydrogen, and nitrogen make up 96% of body weight.
Remaining elements, minerals, represent 4% of body weight.
Minerals are essential for good health.
Inorganic elements are necessary to build tissues, regulate body fluids, and assist in various body functions.
Found in all body tissues.
Cannot provide energy by themselves.
Contribute to production of energy within the body.
Enriched foods are foods to which nutrients, usually B vitamins and iron, have been added to improve their nutritional value.

Classification of Minerals
Major minerals
- Required in amounts greater than 100 mg a day
Trace minerals
- Needed in amounts smaller than 100 mg a day

Electrolytes (Ions)
- Electrically charged atoms resulting from chemical reactions
- Positively charged called cations & Negatively charged called anions
- Must be balanced within body
- These ions are known as electrolytes
- Maintain the body’s fluid balance, contribute to electrical balance, assist in transmission of nerve impulses and contraction of muscles, help regulate the body’s acid-base balance.

Major minerals  Calcium, Phosphorus, Potassium, Sodium, Chloride

Calcium (Ca)
- Human body contains more calcium than any other mineral.
- 99% found in skeleton and teeth and 1% found in blood
- Functions: In combination with phosphorus, gives strength and hardness to bones and teeth.
- Bones provide storage for calcium.
- Needed for normal nerve and muscle action, blood clotting, heart function, and cell metabolism.
- Sources: Milk and milk products and Dark green, leafy vegetables
- When vegetables contain oxalic acid, as spinach and Swiss chard do, the calcium remains unavailable because the oxalic acid binds it and prevents it from being absorbed
- Vitamin D Enhances absorption of calcium
- Deficiency: Rickets results in poorly formed bone structure and causes bowed legs, “pigeon breast”, enlarged wrists or ankles, and stunted growth.
- “Adult rickets” (osteomalacia) causes bones to become soft.
- Tetany, characterized by involuntary muscle movement, results from insufficient calcium in blood.
**Phosphorus (P)**
- Constituent of all body cells.
- Necessary for the formation of strong, rigid bones and teeth; metabolism of carbohydrates, fats, and proteins; proper acid-base balance; and effective action of several B vitamins.
- Stored in bones, absorption is increased in the presence of vitamin D.
- **Sources:** Protein-rich foods such as milk, cheese, meats, poultry, and fish.
- Cereals, legumes, nuts, soft drinks
- **Deficiency** is rare.
- Excessive use of antacids affect absorption.
- Symptoms of deficiency include bone demineralization (loss of minerals), fatigue, and anorexia.

**Potassium (K)**
- Found primarily in intracellular fluid.
- Essential for fluid balance and osmosis.
- Maintains fluid level within the cell.
- Potassium is necessary for transmitting nerve impulses and muscle contractions.
- **Sources:** Fruits—especially melons, oranges, bananas, peaches
- Vegetables—mushrooms, brussel sprouts, potatoes, tomatoes, winter squash, lima beans, carrots
- **Deficiency** : Hypokalemia
  - Caused by diarrhea, vomiting, diabetic acidosis, severe malnutrition, or excessive use of laxatives or diuretics. Symptoms of deficiency include nausea, anorexia, fatigue, muscle weakness, heart abnormalities
  - **Excess:** Hyperkalemia. Caused by dehydration, renal failure, excessive intake Cardiac failure can result

**Sodium (Na)**
- Primary function is the control of fluid balance in the body.
- Maintains acid-base balance.
- Participates in the transmission of nerve impulses essential for normal muscle function.
- **Sources:**
  - Table salt contains 40% sodium.
  - One teaspoon of table salt contains 2,000 mg of sodium.
  - Sodium is naturally available in animal foods.
- **Deficiency:**
  - Caused by severe vomiting, diarrhea, and heavy perspiration, Can upset the acid-base balance.
  - Tetany due to alkalosis may develop.
- **Excess:**
  - May cause edema and resulting hypertension & Associated with hypertension and congestive heart failure.
  - Treatment includes sodium-restricted diets; 3-4g (no-added salt, or NAS) or 1-2g sodium-restricted diet. Diets below 1g rarely prescribed.
Chloride (Cl)
- Essential for maintenance of fluid, electrolyte, and acid-base balance.
- Found in hydrochloric acid, cerebrospinal fluid, and muscle and nerve tissue.
- Helps blood carry carbon dioxide to the lungs and is necessary during immune responses when white blood cells attack foreign cells.
- Chloride is found almost exclusively in table salt or in foods containing sodium chloride.
- Estimated minimum requirement for normal adults is 750 mg a day.
- Deficiency is rare.
- Can occur with severe vomiting, diarrhea, excessive use of diuretics, and alkalosis.

Magnesium (Mg)
- Vital to both hard and soft body tissues.
- Essential for metabolism.
- Regulates nerve and muscle function.
- Plays a role in the blood-clotting process.
- Sources: Found primarily in plant foods.
- Green leafy vegetables, legumes, nuts, whole grains, some fruits (avocados and bananas)
- Milk in sufficient quantities
- Deficiency among people on normal diets is unknown.

Sulfur (S)
- Necessary to all body tissue and is found in all body cells.
- Contributes to the characteristic odor of burning hair and tissue.
- Necessary for metabolism.
- Component of some amino acids.
- Found in protein-rich foods.
- Neither the amount of sulfur required by the human body nor its deficiency is known.

Trace minerals
Iron, Iodine, Zinc, Selenium, Copper, Manganese, Fluoride, Chromium, Molybdenum

Iron (Fe)
- Delivers oxygen to body tissues.
- Component of hemoglobin.
- Component of myoglobin, a protein compound in muscles that provides oxygen to cells.
- Utilized by enzymes that are involved in making amino acids, hormones, and neurotransmitters.
- Sources:
- Meat, poultry, and fish are the best sources of iron. Animal flesh contains heme iron, which is absorbed more than twice as efficiently as nonheme iron.
- Nonheme iron is found in whole grain cereals, enriched grain products, vegetables, fruit, eggs, meat, fish, and poultry.
Factors that Affect Iron Absorption

Increase:
- Acid in the stomach
- Heme iron
- High body demand for red blood cells (blood loss, pregnancy)
- Low body stores of iron
- Meat protein factor (MPF)
- Vitamin C

Decrease:
- Phytic acid (in fiber)
- Oxalic acid
- Polyphenols in tea and coffee
- Full body stores of iron
- Excess of other minerals (Zn, Mn, Ca)
- Some antacids

Deficiency of Iron:
- Caused by insufficient intake, malabsorption, lack of stomach acid, or excessive blood loss. Most common nutrient deficiency worldwide is iron-deficiency anemia.
- Symptoms include fatigue, weakness, irritability, shortness of breath, pale skin, and spoon-shaped fingernails.

Excess of Iron:
- Hemochromatosis is a condition due to an inborn error of metabolism and causes excessive absorption of iron.
- Untreated, can damage liver, spleen, heart.
- To control buildup of iron, patients with this condition must give blood on a regular basis.

Iodine (I)
- Component of thyroid hormones, thyroxine (T4) and triiodothyronine (T3).
- Necessary for the normal functioning of thyroid gland, which determines rate of metabolism.
- Sources include iodized salt, seafood, and some plant foods grown in soil bordering the sea.
- Lack of iodine results in decrease in thyroxine and triiodothyronine.
- Gland grows, forming a lump on the neck called a goiter.
- Myxedema is a condition of hypothyroidism in adults.
- Cretinism is low thyroid in a child; retards physical and mental development.

Zinc (Zn)
- Cofactor for more than 300 enzymes.
- Essential for growth, wound healing, taste acuity, glucose tolerance, and mobilization of vitamin A within the body.
- Sources include meat, fish, eggs, dairy products, wheat germ, and legumes.
- Symptoms of deficiency include decreased appetite, taste acuity, delayed growth, dwarfism, hypogonadism, poor wound healing, anemia, acnelike rash, impaired immune response.
**Selenium (Se)**
- Constituent of most body tissues. Concentrated in liver, kidneys, and heart.
- Component of an enzyme that acts as an antioxidant, thereby protecting cells against oxidation and sparing vitamin E. **Sources** include seafood, kidney, liver, muscle meats. Selenium supplements appear to be effective in treating Keshan disease.

**Copper (Cu)**
- Found in all tissues; heaviest concentration in the liver, kidneys, muscles, and brain.
- Helps in formation of hemoglobin; aids in transport of iron to bone marrow for the formation of red blood cells; and participates in energy production.
- **Sources** include organ meats, shellfish, legumes, nuts, cocoa, whole grain cereals, and human milk. Deficiency is rare. People with malabsorption conditions and gross protein deficiency such as premature infants; clients on long-term parenteral nutrition programs lacking copper; and people taking excess zinc supplements are candidates for deficiency.
- Anemia, bone demineralization, and impaired growth may result.
- **Excess of Copper** is highly toxic.
- Single dose of 10-15 mg can cause vomiting.
- **Wilson’s disease** is an inherited condition causing damage to liver cells and neurons. Detected early, copper-binding agents may be used to bind copper in bloodstream and increase excretion.

**Manganese (Mn)**
- Constituent of several enzymes involved in metabolism.
- Important in bone formation.
- **Sources** include whole grains, tea, vegetables, and fruits.
- Adequate intake is 2.3 mg for men and 1.8 mg for women.
- No deficiency/toxicity from ingestion known.
- Inhalation linked to neurological problems.

**Fluoride (F)**
- Increases resistance to dental caries, and may strengthen teeth and bones.
- **Sources** include fluoridated water, fish and tea. Commercially prepared foods with fluoridated water. Deficiency can result in increased tooth decay.
- Excess can cause discoloration or mottling of children’s teeth.
- **Chromium (Cr)**
- Associated with glucose and lipid metabolism.
- **Levels decrease with age** except in lungs, where chromium accumulates.
- **Sources** include meat, mushrooms, nuts, yeast, organ meats, and wheat germ.
- **Deficiency related to disturbances in glucose metabolism.**

**Molybdenum (Mo)**
- Constituent of enzymes, and thought to play a role in metabolism.
- **Sources** include milk, liver, legumes, and cereals.
- No deficiencies noted.
- **Excess inhibits copper absorption.**
Multiple choice. Select the letter that precedes the best answer.

1. Minerals are inorganic elements that
   a. help to build and repair tissues
   b. are found only in bones
   c. provide energy when carbohydrates are lacking
   d. can substitute for proteins

2. The trace minerals in the human body are defined as
   a. those minerals that cannot be detected in laboratory tests
   b. those essential minerals found in very small amounts
   c. those minerals that are not essential to health
   d. only those minerals that are found in the blood

3. Calcium is necessary for
   a. healthy bones and teeth
   b. normal red blood cells
   c. preventing goiter
   d. energy

4. Phosphorus is found in
   a. poultry
   b. common table salt
   c. vegetable oils
   d. leafy vegetables

5. The coloring matter of the blood is
   a. hemoglobin
   b. lymph
   c. marrow
   d. plasma

6. Some of the common signs of iron deficiency anemia are
   a. muscle spasms and pain in the liver
   b. bowed legs and an enlarged thyroid gland
   c. edema and loss of vision
   d. fatigue and weakness

7. Sodium is often restricted in cardiovascular conditions because it
   a. causes the heart to beat slowly
   b. encourages the growth of the heart
   c. contributes to edema
   d. raises the blood sugar

8. Iron is known to be a necessary component of
   a. thyroxine
   b. adipose tissue
   c. hemoglobin
   d. amino acids

9. Liquid from cooking vegetables should be used in preparing other dishes because
   a. mineral salts are soluble in water
   b. the hydrogen and oxygen in water aid the digestion of minerals
   c. the amino acids are soluble in water
   d. none of the above

10. Goiter can result from a deficiency of
    a. manganese
    b. magnesium
    c. copper
    d. iodine

11. A deficiency of calcium can cause
    a. lactose intolerance
    b. severe nausea
    c. tetany
    d. hypertension

12. Sulfur
    a. is found only in bones and teeth
    b. is richly supplied in carbohydrates
    c. is found in all body cells
    d. deficiency is very common

13. Hypokalemia is
    a. caused by an abnormal heartbeat
    b. caused by potassium deficiency
    c. often a precursor of hyperkalemia
    d. a common result of chronic overeating
Humans can live about 8 weeks without food.
One can live only a few days without water.
Water is in all body cells.
50-60% of body weight of normal adults.
Percentage is highest in newborns; decreases with age.

Two basic compartments
- Intracellular fluid (ICF): within cells; 65% of total body fluid.
- Extracellular fluid (ECF): outside cells; 35% of total body fluid.
  - Divided into intravascular fluid (in bloodstream) and interstitial fluid (between cells)

Body Fluid Compartments

Functions Major component of blood plasma.
- Solvent for nutrients and waste products.
- Necessary for hydrolysis of nutrients.
- Essential for metabolism.
- Lubricant in joints and digestion.
- Cools the body through perspiration.
- Provides some mineral elements.

Sources
- Drinking water is the best source.
- Beverages are second-best source.
- Other sources include fruits, vegetables, soups, milk, and gelatin desserts.
- Energy metabolism produces water.
Fluid and Electrolyte Balance

- Electrolytes are measured in milliequivalents (mEq/L).
- Sensible (noticeable) water loss is water lost through urine.
- Insensible (unnoticeable) water loss is in feces, perspiration, and respiration.
- Waste products of metabolism excreted in the form of urine (500 ml of water each day).
- Solute: substance dissolved in a solution.
- Osmosis: water flows from the side with the lesser amount of solute to the side with the greater solute concentration.
- Sodium, chloride, and potassium maintain the balance between intracellular and extracellular fluids.
- Potassium is the principal electrolyte in intracellular fluid.
- Sodium is the principal electrolyte in extracellular fluid.
- Osmolality measures particles in a solution.

![Osmosis Diagram](image)

- When electrolytes in extracellular fluid are increased, ICF moves to the ECF to equalize the concentration of electrolytes on both sides of the membrane. Reduces the amount of water in the cells.
- Hypothalamus stimulates pituitary gland to excrete ADH (antidiuretic hormone).
- ADH causes kidneys to reabsorb water.
- Thirst causes healthy person to drink fluids.
- When sodium in ECF is reduced, water flows from ECF into cells, causing cellular edema.
Adrenal glands secrete aldosterone, which triggers kidneys to increase the amount of sodium reabsorbed.
When the missing sodium is replaced in the ECF, excess water moves back to the ECF and edema is relieved.
Amount of water use varies, depending on age, size, activity, environmental temperature, and physical condition.
Average adult requirement is 1 ml for every kcal in food consumed.

**How many glasses of fluid would be required for an adult eating 1,800 kcal/day?**

\[
1 \text{ ml} \times 1,800 \text{ kcal} = 1,800 \text{ cc} \\
1,800 \text{ cc} \div 240 \text{ oz} = 7.5 \text{ glasses of water}
\]

It is recommended that adults drink eight 8-ounce glasses of fluid a day.
Youth, fever, diarrhea, unusual perspiration, and hyperthyroidism increase the requirement.

**Dehydration**
- Amount of water in the body is inadequate.
- Caused by inadequate intake or abnormal loss.
- Loss can occur from severe diarrhea, vomiting, hemorrhage, burns, diabetes mellitus, excessive perspiration, excessive urination, or the use of certain medications such as diuretics.
- Symptoms of dehydration include low blood pressure, thirst, dry skin, fever, and mental disorientation.
- As water is lost, electrolytes are also lost.
- Treatment involves replacement of electrolytes and fluids.
- 10% loss can cause serious problems.
- Blood volume and nutrient absorption are reduced, and kidney function is upset.
- 20% loss can cause circulatory failure and death.
- Infants are at high risk for dehydration when fever, vomiting, and diarrhea occur.
- Treatment involves IV fluids.
- Thirst sensation lags behind the body’s need for water, especially in the elderly, children, athletes, and the ill.
- Feeling thirsty is not a reliable indicator of when the body needs water.
- Fluids should be drunk throughout the day to prevent dehydration.

**Failure to replace water lost through perspiration could lead to one of the four stages of heat illness:**
- Heat fatigue
- Heat cramp
- Heat exhaustion
- Heat stroke

**Signs of Dehydration**
- Health history reveals inadequate intake of fluids
- Decrease in urine output
- Weight loss
- Eyes appear sunken
- Tongue has increased furrows and fissures
- Oral mucous membranes are dry
- Decreased skin turgor
- Changes in neurological status
Excess Water Accumulation
- Positive water balance—more water taken in than excreted; edema results.
- Hypothyroidism, congestive heart failure, hypoproteinemia, some infections, some cancers, and some renal conditions can cause water retention because sodium is not being excreted normally. Fluids and sodium may then be restricted.

Acid-base Balance
- Regulation of hydrogen ions
- Acid gives off hydrogen ions
- Base picks up hydrogen ions
- Acidic substances—pH 1 to 7
- Alkaline substances—pH 7 to 14
- pH 7 is considered neutral
- Blood plasma—pH 7.35 to 7.45
- Intracellular fluid—pH 6.8
- Kidneys maintain acid-base balance
- What a person eats affects the acidity not of the body but of the urine.

Buffer Systems
Regulate hydrogen ion content in body fluids
- Mixture of a weak acid and a strong base
- Normal buffer system—ratio of base to acid 20:1
- Carbonic acid and sodium bicarbonate forms the body’s main buffer system.
- Carbonic acid moves easily to buffer a strong alkali, and sodium bicarbonate moves easily to buffer a strong acid.
- Amounts are easily adjusted by the lungs and kidneys to suit needs.
- End products of metabolism are carbon dioxide and water, and together they can form carbonic acid.
- The medulla oblongata in the brain causes the breathing rate to increase if the amount of carbon dioxide is more concentrated than it should be. This increases the rate at which the body rids itself of carbon dioxide.
- Excess sodium bicarbonate is excreted via the kidneys.
- The kidneys can excrete urine from pH 4.5 to pH 8.
- The pH of average urine is 6.

Acidosis and Alkalosis
Renal failure, uncontrolled diabetes mellitus, starvation, or severe diarrhea can cause acidosis. Alkalosis can occur when the body has suffered a loss of hydrochloric acid from severe vomiting or has ingested too much alkali, such as too many antacid tablets.
Multiple choice. Select the letter that precedes the best answer.

1. Fluid within the cells is called
   a. interstitial fluid  c. intracellular fluid
   b. extracellular fluid  d. none of the above

2. Intravascular fluid contains
   a. interstitial fluid  c. intracellular fluid
   b. extracellular fluid  d. none of the above

3. In a mixture of sugar and water, water is the
   a. solvent  c. solution
   b. solute  d. none of the above

4. Water
   a. is essential for hydrolysis
   b. causes hydrogenation
   c. reduces hypoproteinemia
   d. is produced by hypothyroidism

5. Good sources of water include
   a. oranges and melon
   b. seafood and meats
   c. baked desserts and rice
   d. all of the above

6. The solute in the extracellular fluid principally responsible for maintaining fluid balance is
   a. potassium  c. calcium
   b. phosphorus  d. sodium

7. The solute in the intracellular fluid principally responsible for maintaining fluid balance is
   a. potassium  c. calcium
   b. phosphorus  d. sodium

8. ADH causes the kidneys to
   a. conserve fluid
   b. reabsorb water
   c. release additional sodium
   d. excrete increased amounts of urine

9. The amount of water needed by individuals
   a. varies from day to day
   b. is not affected by one’s activities
   c. decreases with fever
   d. all of the above

10. Thirst is a symptom of
    a. dehydration
    b. hydrolysis
    c. cellular edema
    d. osmosis
Pathogens are disease-causing agents. Pathogens or certain chemicals can contaminate food. Bacteria, viruses, molds, worms, and protozoa are pathogens that can contaminate food. Food poisoning develops as a result of a pathogen’s infecting someone, it is a foodborne infection. When it is caused by toxins produced by the pathogen, it is called food intoxication.

Symptoms of food poisoning
Includes:
- Vomiting, diarrhea, headache, and abdominal cramps.
- Many never know they are suffering from food poisoning and assume they have the flu.
- Young children, elderly or immunocompromised may become very ill and even die.

Bacteria that Cause Foodborne Illness
- Campylobacter jejuni: One of the most prevalent causes of diarrhea.
- Clostridium botulinum: Produced in sealed containers, most deadly of all food poisonings.
- Clostridium perfringens: The “cafeteria” or “buffet” germ, transmitted by eating heavily contaminated food.
- Escherichia coli (E. coli 0157:H7) very infectious cause hemorrhagic colitis, transmitted through contaminated water, unpasteurized milk.
- Staphylococcus aureas: Found on human skin, transmitted by carriers and by eating foods that contain the toxin these bacteria create.
- Listeria monocytogenes: Transmitted by unpasteurized milk foods; leafy, raw processed meats.
- Salmonella: Found in raw meats, poultry, fish, milk, and eggs, transmitted by eating contaminated food.
- Shigella: Transmitted by an infected food handler with poor hand washing. Cold foods are common carriers.

Other Substances that Cause Food Poisoning
- Cyclospora cayentanensis: Parasite Causes gastroenteritis, transmitted by poor hygiene and contaminated water. Symptoms include watery diarrhea.
- Mold: Fungus, cause respiratory problems and liver cancer.
- Trichinella spiralis: Parasitic worm that causes trichinosis found in infected pigs meat.
- Protozoa or Dysentery: Found in contaminated water, causes severe diarrhea that can occur intermittently.
- Ingestion of plants or animals that contain poison (mushrooms, rhubarb leaves, fish from polluted water).
- Cleaning agents.
- Insecticides.
- Drugs.
Food preparation safety guidelines for prevention of food poisonings

- All meats and poultry should be cooked thoroughly.
- Ground beef, veal, and lamb should be cooked to 71 degrees Celsius, and ground poultry to at least 74 degrees Celsius.
- Fruits and vegetables should be carefully washed and unpasteurized milk, other dairy products, vegetable and fruit juices should be avoided.
- People with compromised immune systems should be especially vigilant.
- Thaw poultry and meats in the refrigerator or microwave and cook immediately.
- Avoid cross-contamination of raw and cooked foods by carefully cleaning utensils and counter surfaces that were in contact with raw food.
- Do not eat raw or undercooked eggs or foods that contain them.
- Keep hot foods hot and cold foods cold.
- Cleanliness of kitchen and equipment.
- Proper hand washing.
- Wear gloves if cooking with any hand wound.
- Cover and store foods to prevent microbes or animals from reaching it.
- Cook foods to appropriate temperatures.
- Prevent known carriers from preparing foods.
- Select only packages and jars that were sealed by the manufacturer.
- Avoid bulging cans, foods that look or smell odd, and foods showing signs of mold.

Food Allergies

A food allergy occurs when the immune system reacts to a food substance, usually a protein.

Types of Allergic Reactions

- Hay fever
- Urticaria
- Edema
- Headache
- Dermati
- Nausea
- Dizziness
- Asthma

Treatment of Allergies

- Removal of allergen
- Food diary
- Laboratory tests
- Elimination diet
- Patient education

Elimination Diet

- A limited diet in which only certain foods are allowed in an attempt to pinpoint the food allergen causing the reaction.
- Additional foods are introduced slowly until an allergic reaction occurs.
Patient education
• Avoid microbial contamination of food supplies at home.
• Read food labels.
• Ask about ingredients of foods in a restaurant and at another person’s home.

Common Food Allergens
• Milk  Strawberries  Chocolate  
• Wheat  Tomatoes  Soybeans  
• Corn  Legumes  Pork  
• Eggs  Tree Nuts  Fish  
• Citrus fruit  Peanuts  Shellfish

Multiple choice. Select the letter that precedes the best answer.

1. A microorganism is
a. a unit of measurement  
b. sometimes pathogenic  
c. a component of a microscope  
d. an individual human cell

2. Some foods that frequently cause an allergic reaction are
a. milk, eggs  
b. lamb, rice, and sugar  
c. canned pears  
d. rice and pears

3. Someone who is capable of spreading an infectious organism but is not sick is called a
a. food handler  
b. carrier  
c. transport  
d. fomite

4. When an organism is infectious, it is
a. disease-causing  
b. prone to infections  
c. not contagious  
d. always fatal

5. Most cases of food poisoning in the United States are caused by
a. careless processing in commercial factories  
b. lack of government inspection  
c. careless handling of food in the kitchen  
d. house pets

6. Food poisoning symptoms generally include
a. joint pain  
b. constipation  
c. abdominal upset and headache  
d. swelling of the feet

7. Salmonella infections and staphylococcal poisoning are caused by
a. a virus  
b. bacteria  
c. protozoa  
d. worms

8. The deadliest of the bacterial food poisonings is
a. staphylococcal  
b. salmonellosis  
c. botulism poisoning  
d. perfringens poisoning

9. The disease caused by a parasite sometimes found in pork is
a. tularemia  
b. dysentery  
c. avitaminosis  
d. trichinosis

10. The disease caused by a protozoan and characterized by severe diarrhea is
a. salmonellosis  
b. dysentery  
c. botulism  
d. infectious hepatitis

11. Substances that cause altered physical reactions are called
a. symptoms  
b. allergies  
c. allergens  
d. abstinence

12. One of the typical symptoms of food allergies is
a. diabetes mellitus  
b. colitis  
c. hives  
d. atherosclerosis
Weight Gain during Pregnancy
- Average weight gain is 12 to 15 Kg.
- Average weight gain during the first trimester is 1-2 Kg.
- The second and third trimester average 0.5 Kg per week.
- Weight Gain During Pregnancy
  - Generally, no additional kcal are required during the first trimester.
  - An additional 300 kcal is needed during the second and third trimesters.

Prepregnancy Nutritional Needs
- Research has shown that adequate prepregnancy nutrition is critical for the prevention of neural tube defects such as spina bifida.
- Nutritional Needs During Pregnancy
  - The protein requirement is increased by 20% for the pregnant woman over age 25 (25% for pregnant adolescent).
  - No need to increase vitamin A.
  - No increase in Vitamin D requirement for age 24 and younger; Vitamin D doubles for age 25 and older.

Nutritional Needs During Pregnancy
- Vitamin E requirement increases for all ages (from 8 to 10 µg).
- Vitamin K requirement remains the same for women 25 and older (65 µg), but dramatically increases for girls 11-14 (from 45 µg to 65 µg).
- Requirements for all the water-soluble vitamins are increased.
- Requirements for vitamins B and C are increased.
- Requirements for calcium, iron, zinc, iodine, and selenium are all increased.
- Iron supplements are commonly prescribed.
- Fulfillment of Nutritional Needs During Pregnancy
  - Base diet on the Food Guide Pyramid.
  - Drink additional milk each day.
  - Fat-free milk is best because it provides the needed nutrients without the fat and cholesterol.

Fulfillment of Nutritional Needs during Pregnancy
- Vitamin supplements may be prescribed.
- No unprescribed nutrient supplements should be taken because they may be harmful to the fetus.
Concerns during Pregnancy

- Nausea
- Constipation
- Heartburn
- Excessive weight gain
- Pregnancy-induced hypertension
- Pica
- Anemia
- Alcohol, caffeine, drugs, and tobacco

Nausea

“Morning sickness” occurs most commonly in first trimester.
- Eat dry crackers or dry toast before rising
- Small, frequent meals
- Avoid food with offensive odors
- Avoid liquids at mealtime

Hyperemesis Gravidarum

- Occurs when the nausea becomes so severe that it is life-threatening.
- This may require hospitalization and parenteral nutrition.

Constipation

- Eat high fiber diet.
- Participate in daily exercise.
- Drink eight glasses of water per day.

Heartburn

- Caused by pressure on the mother’s stomach as the fetus develops.
- Eat small, frequent meals.
- Avoid spicy or greasy foods.
- Avoid liquids with meals.
- Wait at least one hour after eating to lay down and two hours before exercising.

Excessive Weight Gain

- Reevaluate diet and eliminate food that does not fit within the Food Guide Pyramid.
- Drink fat-free milk.
- Eat clean, crisp, raw vegetables as a snack.
- Eat fruits and custards made with fat-free milk as desserts.
- Broil, bake, or boil instead of frying.
**Pregnancy-induced Hypertension**
Formerly called “preeclampsia” or “toxemia.”
Characterized by
- High blood pressure,
- Presence of protein in the urine, and edema.
- If condition persists, it may result in convulsions, coma, and death of the mother.
There is a higher incidence of this disorder among mothers with inadequate diets.

**Pica**
Pica is the craving for nonfood substances such as starch, clay (soil), or ice.
Soil binds with minerals making it impossible for the body to absorb them.
If these substances take the place of nutrient rich foods in the diet, there can be multiple nutritional deficiencies.

**Anemia**
- Anemia is a condition caused by an insufficiency of red blood cells, hemoglobin, or blood volume.
- Often the client with anemia feels weak and tired, has a poor appetite, and appears pale.
- Iron deficiency anemia is the most common form of anemia.
- Folate deficiency may lead to megaloblastic anemia, another form of anemia.

**Alcohol, Caffeine, Drugs, and Tobacco**
- Fetal alcohol syndrome (FAS) is characterized by a growth deficiency, central nervous system dysfunction, and microcephaly (small head).
- Caffeine has been shown to cause birth defects in rats, but no data exists for humans.
- Illegal drugs can cause the infant to be born addicted.
- Drugs derived from vitamin A can cause fetal malformations and spontaneous abortions.
- Tobacco smoking is associated with low birth weights, sudden infant death syndrome (SIDS), fetal death, spontaneous abortions, and complications at birth.

**Diet for the Pregnant Woman with Diabetes**
- Nutrient requirements of the pregnant woman with diabetes are the same as for the nondiabetic pregnant woman.
  Dietitian should plan the diet depending on the type and number of insulin injections required.
- Gestational diabetics may require insulin during pregnancy.
- Oral hypoglycemic agents may be harmful to the fetus and should not be used.
- Artificial sweeteners have been found to be safe during pregnancy.
Pregnancy During Adolescence
- Nutritional, physical, psychological, social, and economic demands on pregnant adolescents are tremendous.
- High risk for pregnancy-induced hypertension and premature delivery.
- Inadequate nutrition of the mother is related to both mental and physical birth defects.
- Much counseling and emotional support is needed.

Diet During Lactation
- The production and secretion of breast milk for the purpose of nourishing an infant.
- 2 to 3 weeks to establish a feeding routine.
- Recommended that no supplemental feedings be given during this time.
- Human milk is formulated to meet the nutrient needs of infants for the first 6 months of life.
- Does not supply iron, vitamin D, or flouride.

Kcal requirements during breastfeeding increase.
The Food and Nutrition Board suggests an increase of 500 kcal a day.

Benefits of Breastfeeding for the Infant
- Nutritional benefits: contains just the right amount of lactose, water, fatty acids, and amino acids.
- No babies are allergic to their mother’s milk.
- Human milk contains at least 100 ingredients not found in formula.
- Lower incidence of ear infections, diarrhea, allergies, and hospital admissions.
- Breast-fed babies receive antibodies from breast milk.
- Promotes good jaw development.
- Encourages growth of straight, healthy teeth.
- May have psychological benefits.

Benefits of Breastfeeding for the Mother
- Ability to quickly lose the pounds gained during pregnancy.
- Stimulates uterus to contract back to its original size.
- Breastfeeding is economical.
- Provides opportunity for resting.
- Milk is always at the right temperature and is readily available.

Nutrient Requirements during Lactation
- Most nutrient requirements are increased.
- Depends on age of the mother.
- Protein is the most important because it is secreted in the milk each day.
- Important to include fruits and vegetables rich in vitamin C.
- Extra fat-free milk is beneficial.
- Increase fluid intake to replace loss.
- Check with obstetrician before using any medication or nutrient supplement.
- Caffeine may make infant irritable.

**Considerations for the Health Care Professional**
- Articles in newspapers and magazines may be inaccurate.
- Reeducation may be necessary.
- Teaching of pregnant teenagers presents the biggest challenge.
- A pregnant woman is most likely to remain healthy and bear a healthy infant if she follows a well-balanced diet.

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**Diet During Infancy**

**Nutritional Requirements of the Infant**
- During the **first year**, the normal child needs about **100 kcal** per kilogram of body weight each day.
- Infants up to 6 months of age should have 2.2 g of protein per kg of weight each day; age 6-12 months should have 1.56 g of protein per kg of weight each day.

**Iron-fortified cereal** is usually started at about 6 months.
- A **vitamin K supplement** is routinely given shortly after birth.
- Infants should not be given an excess of vitamin A or D.

**Breastfeeding**
- Provides infant with temporary immunity to many infectious diseases (colostrum).
- It is economical, nutritionally adequate, and sterile.
- Easily digested
- Breastfed infants grow more rapidly during the first few months of life than formula-fed babies and have fewer infections.
- Breast should be offered every 2 hours in the first few weeks.
- The infant should nurse 10-15 min on each breast.
- Growth spurts occur at about 10 days,
- 2 weeks, 6 weeks, and 3 months; infant may nurse more frequently.

**Indications of adequate nutrition include:**
- The infant has six or more wet diapers per day.
- The infant has normal growth.
- The infant has one or two mustard-colored bowel movements per day.
- The breast becomes soft during nursing.
Bottle Feeding
- The infant should be cuddled and held in an upright position.
- He should be burped.
- Formulas are developed so that they are similar to human milk in nutrient and kcal values.
- Synthetic milk made from soybeans may be used for sensitive or allergic infants.
- Burping a Baby
- Sterile water must be used to mix formula.
- Infants under one year should not be given cow’s milk.
- Consistent temperature should be used.
- Infants should not be put to bed with bottle.

Supplementary Foods
- Limit diet to breast milk or formula until the age of 4 to 6 months. Cow’s milk should be avoided until after one year of age.
- Solid foods should not be introduced before 4 to 6 months of age and should be done gradually.
  - The typical order of introduction begins with cereal, usually iron-fortified rice, then oat, wheat, and mixed cereals.
    - Cooked and pureed vegetables
    - Cooked and pureed fruits
    - Egg yolk
    - Ground meats.
- Between 6 and 12 months, toast, teething biscuits, custards, and ice cream can be added.
- Honey should never be given to an infant because it could be contaminated with *Clostridium botulinum* bacteria.
- When the infant learns to drink from a cup, juice can be introduced.
- Juice should never be given from a bottle because babies will fill up on it and not get enough calories from other sources.
- Pasteurized apple juice is usually given first.
- It is recommended that only 4 oz. of 100% juice products be given because they are nutrient-dense.

Indications for Readiness for Solid Foods
- Ability to pull food into the mouth rather than pushing the tongue and food out of the mouth.
- Willingness to participate in the process.
- Ability to sit up without support.
- Having head and neck control.
- The need for additional nutrients.
- Drinking more than 32 ounces of formula or nursing 8 to 10 times in 24 hours.

Special Nutritional Needs
- Premature infants
- Cystic Fibrosis
- Failure to thrive
- Metabolic Disorders
- Galactosemia
- Phenylketonuria
- Maple Syrup Urine Disease
Premature Infants
- An infant born before 37 weeks gestation.
- The sucking reflex is not developed until 34 weeks gestation.
- Infants born earlier will require total parenteral nutrition, tube feedings, or bolus feedings.
- Other concerns include: low birth weight, underdeveloped lungs, immature GI tracts, inadequate bone mineralization, and lack of fat reserves.
  Many special formulas are available.

Cystic Fibrosis
- An inherited disease
- Decreased production of digestive enzymes
- Malabsorption of fat
- **Recommendation:** 35-40% of diet should be from fat
  - Digestive enzyme is taken in pill form.
  - There is a water-soluble form of fat-soluble vitamins that can be administered if normal levels cannot be maintained with the use of fat-soluble vitamins.
- Nighttime tube feedings may be indicated.

Failure to Thrive
- Determined by plotting the height and weight of the infant on the growth chart.
- May be caused by poverty, congenital abnormalities, AIDS, lack of bonding, child abuse, or neglect.
- The first six months are the most crucial for brain development.

Galactosemia
- A condition in which there is a lack of the liver enzyme transferase.
- **Transferase normally converts galactose to glucose.**
- The amount of galactose in the blood becomes toxic.
- Diarrhea, vomiting, edema, and abnormal liver function
- Cataracts may develop, galactosuria occurs, and mental retardation develops.
- Diet therapy: exclusion of anything containing milk from any mammal; nutritional supplements of calcium, vitamin D, and riboflavin.

Phenylketonuria (PKU)
- Lack the liver enzyme “phenylalanine hydroxylase”, which is necessary for the metabolism of the amino acid phenylalanine.
- Infants are normal at birth, but if untreated become hyperactive, suffer seizures, and become mentally retarded between 6 to 18 months.
- Hospitals routinely screen newborns for PKU.

Maple Syrup Urine Disease (MSUD)
- Congenital defect resulting in the inability to metabolize three amino acids: leucine, isoleucine, and valine.
- Named for the odor of the urine of clients with the condition.
- Hypoglycemia, apathy, and convulsions occur and if not treated promptly, will result in death.
- **Diet therapy**: extremely restricted amounts of the three amino acids; a special formula and low protein diet is used; diet therapy necessary throughout life.

### Diet During Childhood and Adolescence

#### Nutrition in Children

Children who have an inadequate supply of nutrients—especially of protein—and kcal during their early years may be shorter and less intellectually able than children who receive an adequate diet.

#### Children Aged 1-12

- Once developed, poor eating habits will be difficult to change.
- Poor eating habits can exacerbate emotional and physical problems such as irritability, depression, anxiety, fatigue, and illness.
- Children’s appetites vary.
- As the child ages, the growth rate slows.
- Children’s likes and dislikes change.
- New foods should be introduced gradually.
- Snacks should be nutrient dense.
- Fats should not be limited before the age of two years.
- Whole milk is recommended until the age of two, but low-fat or fat-free should be served from two on.
- Calorie needs will depend on rate of growth, activity level, body size, metabolism, and health.
- Snacks are needed every 3 to 4 hours.
- Forcing a child to eat can cause eating disorders.
- Choking is prevalent in young children.
- To prevent choking, do not give children under four years of age peanuts, grapes, hot dogs, raw carrots, hard candy, or thick peanut butter.

#### Kcal and Nutrient Needs of Young Children

- Nutrient needs increase because of increase in body size.
- Need 2 to 3 cups of milk or equivalent in terms of calcium per day.
- Minimize sweets.
- Limit sweetened fruit juices.
- Drink 1 ml of water for each kcal of food.
- Introduce fiber slowly.
Childhood Obesity
- 25% of children are considered obese today (In USA).
- 85% of obese children over the age of ten will become obese adults (In USA).
- Leads to many health and social problems
  - increased severity of asthma
  - increased blood pressure, heart rate, and cardiac output
  - hip and knee problems
  - social stigma

Treatment
- Exercise
- Portion and snacking control

What Parents Can Do
- Provide only healthy, nourishing foods.
- Limit TV and computer time.
- Exercise yourself.
- Never tell a child “he is too fat”.
- Learn correct portions.
- It is more important how often and how much is eaten rather than what.
- Never provide food as comfort or reward.
- Eat only at the table and at designated times.
- Give water rather than juice.
- Eat slowly.
- Determine if child is really hungry or just bored.
- Change your own bad habits.

Adolescence
- Period of rapid growth that causes major changes.
- Physical changes like acne occur.
- Acne is not caused by specific foods.
- Adolescents typically have enormous appetites.
- Kcal requirements increase.
- Often substitute low nutrient density foods.
- Except for Vitamin D, nutrient needs increase dramatically at the onset of adolescence.
- Because of menstruation, girls have a greater need for iron than do boys.
- Adolescents may prefer to imitate their peers.
- Foods that are popular often have low nutrient density such as potato chips, sodas, and candy.
- Eating habits can be seriously affected by busy schedules, part-time jobs, athletics, social activities, and the lack of an available adult to prepare nutritious food.

Adolescent Problems Related to Nutrition
- Anorexia Nervosa
- Bulimia
- Overweight
Anorexia Nervosa
- A psychological disorder that causes a client to so drastically reduce kcal that the reduction disrupts metabolism.
- An inordinate fear of being fat.
- Results in hair loss, low blood pressure, weakness, amenorrhea, brain damage, and even death.

**Treatment for Anorexia Nervosa**
- Development of a strong and trusting relationship between client and care provider.
- Client must accept that weight gain and a change in body contours are normal during adolescence.
- Diet therapy
- Individual and family counseling
- Close supervision
- Time and patience

Bulimia
A syndrome in which the client alternately binges and purges by inducing vomiting and using laxatives and diuretics to get rid of ingested food.
- Bulimics are said to fear that they cannot stop eating.
- A bulimic usually binges on high-kcal foods such as cookies, ice cream, pastries, and other “forbidden” foods.
- Binging occurs when client is alone.
- Bulimia is not usually life-threatening, but it can irritate the esophagus and cause electrolyte imbalances, malnutrition, dehydration, and dental caries.

**Treatment for Bulimia**
- Limit eating to mealtime
- Portion control
- Close supervision after eating
- Psychological counseling

Overweight
Contributing factors include heredity, overfeeding as an infant or child, psychological factors.

**Treatment**
- Evaluation by physician
- Discuss plan with dietitian
- Teach teen to understand the nutrient and kcal content of fast foods
- Exercise
- Being overweight during adolescence is apt to diminish the individual’s self-esteem and can exclude her or him from the normal social life of the teen years, further diminishing self-esteem. It also makes the adolescent prone to being overweight as an adult.

Fast Foods
- Nutrient charts are often available at restaurants.
- Fast food is excessively high in fat and sodium, as well as kcal.
- Contain limited amounts of vitamins and minerals and little fiber.
- Nevertheless, fast food is more nutritious than sodas, cakes, and candy.
- Should be used with discretion in a balanced diet.
Tobacco
- Is addictive.
- Can influence appetite, nutritional status, and weight.
- Smokers need more vitamin C because smoking alters the metabolism.
- Low intakes of vitamin C, vitamin A, betacarotene, folate, and fiber are common among smokers.
- Smoking increases the risk of lung cancer and heart disease.

Dental Caries
- Promoted by the use of sugar in the diet.
- Avoid sticky sugar foods unless teeth can be brushed or rinsed immediately.
- Addition of fluoride to drinking water reduces the number of dental caries.
- Fluoride toothpaste is also helpful.
- Excessive fluoride can be toxic.

Nutrition for the Athlete
- The athlete needs additional water, kcal, thiamin, riboflavin, niacin, sodium, potassium, iron, and protein.
- Plain water is the recommended liquid for rehydration.
- “Electrolyte drinks” are useful after an athletic event but not during one.
- The increase in kcal depends on the activity and its length.
- Increased vitamin B for energy metabolism.
- Protein needs are not increased by physical activity.
- Increased need for potassium and sodium, which can be met by salting food to taste, bananas, and orange juice.
- Iron rich foods eaten with vitamin C-rich foods should satisfy extra iron requirement.

Diet During Adulthood and Late Adulthood

Adulthood is broadly divided into three periods: young, middle, and late adulthood.
- Young adulthood age range is from 18-40 years.
- Middle period ranges from about 40-65 years of age.
- Late + 65 Year

Nutrient Requirements
- Growth is usually complete by age 25.
- Nutrient requirements of healthy adults during these years change very little.
- The iron requirement for women is higher than men until after menopause.
- Protein requirement for adults is 0.8 g per kilogram of body weight.
- Current requirement for calcium for adults from 19-50 is 1,000 mg.
- Vitamin D requirement is 5 g per day.
- Both calcium and vitamin D are essential for strong bones, and both are found in milk.
- Three glasses of milk per day fulfill the calcium and vitamin D requirements.
- Bone loss begins slowly, at about the age of 35 to 40.
Diet changes that prevents rheumatoid arthritis
- Researchers have determined that diet changes have no effect on rheumatoid arthritis.
- Maintain a healthy diet that includes adequate calcium and protein.
- A multiple vitamin containing vitamin D and a calcium supplement should be taken daily.
- Omega-3 fatty acids have been helpful in reducing inflammation. Discuss with a physician.

Kcal Requirements
- Begins to diminish after the age of 25.
- Basal metabolic rates are reduced by 2 to 3% a decade.
- Determined primarily by activity and amount of lean muscle mass.

Nutrition Related Concerns

Eating Habits
- Food selection is often made based on concerns about weight, cost of food, or time.
- These habits may lead to nutrient deficiencies.
- People today are concerned about nutrition.
- Selection of food, however, is often based on convenience and flavor rather than nutritional content of food.
- Consequently, many people ingest more fat, sugar, salt, and high-calorie foods and less fiber and other nutrients.

Weight Control
- Weight control is one of the top concerns of adults in the United States today.
- Most people are interested in controlling their weight.
- Being overweight can introduce health problems.
- Being overweight can lead to an increased incidence of diabetes mellitus and hypertension.
- Overweight people are poor risks for surgery, live shorter lives, and are prone to social and emotional problems.
- Most common cause of being overweight is energy imbalance (more calories have been taken in than were needed for energy).
- An intake of 3,500 kcal more than the body needs for maintenance and activities will result in one extra pound (0.45 Kg).
- Genetics and a hypothyroid condition can also contribute to overweight condition.
- The best solution is increased exercise combined with reduced kcal.

Considerations for the Health Care Professional
- The young and middle years of life are busy.
- Most people feel they have too many things to do and too little time to accomplish them.
- Families, jobs, and social obligations lead to more responsibilities.
- The health care professional can help the client have hope and alert others on the team to problems that need addressing.
Diet During Late Adulthood

Physiological Changes
- Body’s functions slow with age, and its ability to replace worn cells is reduced.
- The metabolic rate slows.
- Bones become less dense.
- Lean muscle mass is reduced.
- Eyes don’t focus on nearby objects as they once did; some grow cloudy from cataracts.
- Poor dentition is common.
- Heart and kidneys become less efficient.
- Hearing, taste, and smell are less acute.
- Immune system may be compromised if poor nutrition has been chronic.
- Excessive weight, certain vitamin deficiencies and the type of diet being followed may influence some types of arthritis.
- Eating a healthy, well-balanced diet that includes the “5 a day” fruits and vegetables, along with grain products can beneficial to those with arthritis.
- Digestion is affected because secretion of hydrochloric acid and enzymes is diminished.
- There is a decrease in the intrinsic factor synthesis, which leads to a deficiency of vitamin B₁₂.
- Tone of intestines reduced resulting in constipation or, in some cases, diarrhea.

Psychosocial Changes
- Feelings do not decrease with age.
- Age does not diminish the psychosocial needs of the client.
- Psychosocial problems can increase as one grows older
- Problems feeling useful, appreciated and loved
- Loss of self-esteem
- Grief
- Economic changes include retirement that may result in decreased income.
- Loss of spouse with resulting loneliness and possible financial impact can occur.
- Problems like these can diminish a person’s appetite and ability to shop and cook.

Sidestepping Potential Problems
- Healthy eating habits throughout life, an exercise program suited to one’s age, and social activities that please can prevent or delay physical deterioration and psychological depression during the senior years.
- Food-drug interactions must be monitored closely in the elderly.
- Dairy products should not be consumed within two hours of taking the antibiotic tetracycline or it will not be absorbed.
- A person taking a blood clot-reducing drug such as coumadin or warfarin (often called blood thinners) needs to consume vitamin K-rich food in moderation as they counteract blood thinners.
- The antioxidant vitamins are not to be taken with blood clot-reducing medications because they tend to thin the blood.
Nutritional Requirements for Late Adulthood

- Follow a modified food guide pyramid for individuals 70 and older.
- Despite the physical changes the body undergoes after the age of 51 or so, only a few of the recommendations for people in that age category are less than those for younger people.
- Protein requirement remains at the average 50 g per day for women and 63 g for men.
- This is based on 0.8 g per kg of body weight.
- After age 65, it may be advisable to increase one’s daily protein intake to 1.0g per kg of body weight.
- Vitamin requirements do not change after the age of 51, except for a slight decrease in the RDAs for thiamin, riboflavin, and niacin because of decreased kcal intake.
- The need for iron is decreased after age 51 in women because of menopause.
- The kcal requirement decreases approximately 2 to 3% a decade because metabolism slows and activity is reduced.
- The Nutrition Screening Initiative checklist was developed to identify those at “no nutritional risk,” “moderate nutritional risk,” and “high nutritional risk.”

Food Habits of Senior Citizens

- Established food habits may be especially difficult to change.
- The following may cause difficulties in food selection and preparation:
  - Decreased income during retirement
  - Physical disability
  - Inadequate cooking facilities
  - Anorexia caused by grief, loneliness, boredom, or difficulty in chewing can decrease food consumption.
  - Many senior citizens consume diets deficient in protein; vitamins C, D, B6, B12, and folate; and the minerals calcium, zinc, iron, and sometimes kcal.
  - Variety and nutrient-dense foods should be encouraged.
  - Water is important to help prevent constipation, to maintain urinary volume, and to prevent dehydration.

Food Fads and the Elderly

- Senior citizens may spend money on unnecessary vitamins, minerals, and special honey, molasses, bread, milk, and other foods that food faddists may promote as important.
- The money could be better spent on foods from the Food Guide Pyramid.

What makes elderly people susceptible to food faddists?

- Some older people are consciously or unconsciously searching for eternal life, if not youth.
- Food faddists may pick this segment of the population to profit from their ignorance.
- Some older people with chronic disease may hope that products will bring them relief.
Osteoporosis
- Condition in which the amount of calcium in bones is reduced, making them porous.
- Bone density scan can be done with a special X-ray to determine if one has osteoporosis.
- Sedentary life coupled with a diet deficient in calcium, vitamin D, and fluoride, and estrogen loss contribute to the condition.
- Estrogen replacement therapy (ERT), 1,500 mg of calcium, and exercise are possible preventative measures.
- Another possible cause of osteoporosis may be a diet containing excessive amounts of phosphorus, which can speed bone loss.
- Sodas and processed foods contain phosphorus, and their consumption is increasing as milk consumption is decreasing in the United States.

Arthritis
- Disease that causes the joints to become painful and stiff.
- Regular use of aspirin or anti-inflammatory drugs may help relieve the pain, but have side effects such as bleeding in the stomach lining.
- There is no cure for arthritis.

Cancer
- Diets consistently high in fat, or low in fiber and vitamin A may contribute to cancer.
- Research about the role of nutrition in cancer development continues.

Diabetes Mellitus
- Chronic disease that develops when the body does not produce sufficient amounts of insulin or does not use it effectively for normal carbohydrate metabolism.
- Diet is very important in the treatment of diabetes mellitus.

Hypertension
- High blood pressure can lead to strokes.
- It is associated with diets high in salt or possibly low in calcium.
- Most Americans ingest from 2 to 6 times the amount of salt needed each day.
- The earlier a person reduces salt intake, the better that person’s chances of avoiding hypertension.

Heart Disease
- Heart attack and stroke are the major causes of death in the United States.
- Arteries become blocked (occluded), thereby preventing the normal passage of blood.
- Atherosclerosis: plaque, a fatty substance containing cholesterol, accumulates in the walls of the artery.

Effects of Nutrition
- Cumulative over many years.
- Effects of a lifetime of poor eating habits cannot be cured overnight.
- Prevention should begin in childhood.
- Nutrition can be used to help stabilize the condition of a client who has a chronic disease.
<table>
<thead>
<tr>
<th>Disease</th>
<th>Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIDS</td>
<td>Based on specific symptoms.</td>
</tr>
<tr>
<td>Anemia, folate deficiency</td>
<td>Recommend folic acid (folate) supplements.</td>
</tr>
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<td></td>
<td>Increase dietary intake of dark-green, leafy vegetables.</td>
</tr>
<tr>
<td>Anemia, iron deficiency</td>
<td>Give iron supplements and iron-rich diet that includes liver, red meats, whole grains, dark-green leafy vegetables, and cereals. Ensure adequate intake of vitamin C.</td>
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<tr>
<td>(called milk anemia in child who drinks excessive amounts of milk rather than eating iron-rich foods)</td>
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<tr>
<td>Anemia, pernicious</td>
<td>Administer B12.</td>
</tr>
<tr>
<td>Anemia, sickle cell</td>
<td>Increase fluids to at least 1 ½ times usual requirement for weight and age. Folic acid (folate) may be given.</td>
</tr>
<tr>
<td>Arthritis</td>
<td>Maintain ideal body weight by limiting fat and caloric intake.</td>
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<tr>
<td>Burns</td>
<td>High kilocaloric and protein intake.</td>
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<tr>
<td></td>
<td>Give vitamin and mineral supplements.</td>
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<tr>
<td></td>
<td>Enteral or parenteral feedings if PO feedings inadequate.</td>
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<tr>
<td>Calculi, renal</td>
<td>Generous fluid intake.</td>
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<td></td>
<td>Dietary calcium adequate to maintain serum calcium and prevent excessive bone loss of calcium.</td>
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<tr>
<td>Cancer</td>
<td>Varies according to site and type of cancer.</td>
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<td></td>
<td>Generally, increase calories and protein with low to moderate fat.</td>
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<tr>
<td></td>
<td>When chemotherapy destroys taste buds, slightly salty or sour tastes are usually accepted best.</td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>Prudent diet: Control calories in accordance with ideal body weight. Diet to consist of: carbohydrate (mainly complex) 50% of daily calories, Protein 20% of daily calories, and fat (mostly vegetable) 30% of daily Calories. Salt added lightly during cooking, but not at table. Avoid salty-tasting foods.</td>
</tr>
<tr>
<td>Celiac disease</td>
<td>Exclude wheat, oats, rye, barley, and buckwheat products.</td>
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<tr>
<td></td>
<td>Give potato, corn, and rice products.</td>
</tr>
<tr>
<td>Cholecystitis or cholelithiasis</td>
<td>Low-fat or possibly a fat-free diet for a limited time.</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>Increase calories.</td>
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<tr>
<td></td>
<td>Protein as tolerated (usually limited).</td>
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<tr>
<td></td>
<td>Moderate fat.</td>
</tr>
<tr>
<td></td>
<td>Low sodium.</td>
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<td></td>
<td>Medium-chain triglycerides (MCTs) contain 6–12 carbon fatty acid esters of glycerol. If fat poorly tolerated. BCAAs (branched-chain amino acids) an amino acid having aliphatic side-chains with a branch (a carbon atom bound to more than two other carbon atoms) may be used to provide protein.</td>
</tr>
</tbody>
</table>

Chapter 12
THERAPEUTIC NUTRITION
<table>
<thead>
<tr>
<th>Condition</th>
<th>Dietary Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constipation</td>
<td>Increased fluid and fiber intake. If enteral feedings are in use, try formula with added fiber. If fiber-containing formula is ineffective, try one that is fiber free. Corn syrup may be added to infant formula.</td>
</tr>
<tr>
<td>COPD</td>
<td>Increased fats. Decrease carbohydrates. Adequate fluids.</td>
</tr>
<tr>
<td>Crohn’s disease (regional enteritis)</td>
<td>Inactive periods: Regular diet with lactose and fiber limited. Exacerbations: Increase calories and protein. Parenteral (IV) feedings may be used.</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>Increased calories and protein. Fats as tolerated (decrease if stools are fatty). Encourage salty foods.</td>
</tr>
<tr>
<td>Decubitus (pressure ulcers)</td>
<td>Adequate kilocalories, protein, vitamin C, iron, and zinc.</td>
</tr>
<tr>
<td>Diabetes mellitus Type 1</td>
<td>Balance available glucose from food with available insulin. Exchange system often used. Dietary fiber may reduce rate of GI glucose absorption. For children, limitation of concentrated sweets may be only modification. Diet adjusted for individual life style and eating habits.</td>
</tr>
<tr>
<td>Diabetes mellitus Type 2</td>
<td>Primarily weight reduction and control of diet.</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>First, give diet of clear liquids (including ORS [oral rehydration solutions]). NPO if PO intake causes increased stooling. Advance to full liquids if tolerated, then to BRAT diet (bananas, rice, apple sauce, and tea or toast).</td>
</tr>
<tr>
<td>Diverticulitis</td>
<td>High fiber during remissions. Bland diet during exacerbations. Elemental formulas or parenteral feedings may be used.</td>
</tr>
<tr>
<td>Dumping syndrome</td>
<td>Alternate liquids and dry foods. Avoid simple carbohydrates such as fruit juices or sodas. Dilute concentrated tube-feeding Formulas.</td>
</tr>
<tr>
<td>Edema</td>
<td>Control sodium. Provide adequate protein.</td>
</tr>
<tr>
<td>Esophagitis</td>
<td>Give small, frequent meals. Promote weight loss if overweight. Avoid caffeine, pepper, and any food not well tolerated. Chew food thoroughly. Avoid lying down after meals.</td>
</tr>
<tr>
<td>Fracture</td>
<td>Adequate protein, calcium, phosphorus, and vitamins A, C, and D. Dairy products are excellent sources for the above nutrients except for vitamin C. Citrus fruits provide vitamin C.</td>
</tr>
<tr>
<td>Gallbladder disease</td>
<td>See Cholecystitis.</td>
</tr>
<tr>
<td>Condition</td>
<td>Recommendations</td>
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<tr>
<td>-----------------------------------------</td>
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</tr>
<tr>
<td>Gastroesophageal reflux disorder (GERD)</td>
<td>Avoid chocolate, fatty foods, peppermint and spearmint oils, caffeine, and alcohol. Encourage protein-rich foods.</td>
</tr>
<tr>
<td>Gout</td>
<td>Encourage fluids. Limit fats. Decrease high-purine foods such as meats (especially organ meats), fish, fowl, lentils, whole grains, asparagus, mushrooms, spinach, cauliflower, and alcohol.</td>
</tr>
<tr>
<td>Hepatic encephalopathy</td>
<td>Limit protein intake. Essential amino acids may be used (given IV)</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>High calorie and protein. Moderate fat. Avoid alcohol.</td>
</tr>
<tr>
<td>Hiatal hernia</td>
<td>Same indications as Esophagitis.</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Control calories to avoid excess weight. Limit sodium. Increase foods high in potassium (fruits and vegetables) and calcium (low-fat dairy products). DASH diet (Dietary Approaches to Stop Hypertension)</td>
</tr>
<tr>
<td>Irritable bowel syndrome</td>
<td>Regular diet when asymptomatic. Bland diet during exacerbation.</td>
</tr>
<tr>
<td>Keshan disease</td>
<td>Intake of selenium rich food like Brazil nuts, canned Tuna and beef. Selenium supplementation.</td>
</tr>
<tr>
<td>Lactose intolerance</td>
<td>Reduce lactose (milk sugar) intake.</td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>Clear liquids. Offer ORS every 20–30 min</td>
</tr>
<tr>
<td>Nephrosis or nephrotic syndrome</td>
<td>Increase protein in diet unless accompanied by renal failure or elevated BUN. No salt added at table</td>
</tr>
<tr>
<td>Obesity</td>
<td>Decrease calories. Modify food habits and exercise. An increase or decrease of 500 Kcal a day leads to 1 lb weight gain or loss per week.</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>Ensure adequate dietary calcium by consuming dairy products or by taking supplemental calcium. Encourage exercise as tolerated.</td>
</tr>
<tr>
<td>Ostomy</td>
<td>Progress from clear liquid to low-residue, high-calorie diet. Maintain until desirable weight attained. Gradually add fiber (individual tolerance varies), avoiding gas-forming foods (based on individual tolerance). Ileal resections make B12 injections necessary.</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>Weight management; adequate dietary antioxidants, calcium, folate, vitamins B6, B12, D, glucosamine and chondroitin. Exercise</td>
</tr>
<tr>
<td>Condition</td>
<td>Diet Recommendations</td>
</tr>
<tr>
<td>----------------------</td>
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</tr>
<tr>
<td>Pancreatitis</td>
<td>High protein, high carbohydrate with fat added to tolerance.</td>
</tr>
<tr>
<td></td>
<td>Eliminate gastric stimulants such as coffee, tea, alcohol, and pepper.</td>
</tr>
<tr>
<td></td>
<td>Withhold oral feedings during exacerbations.</td>
</tr>
<tr>
<td>Peptic ulcer</td>
<td>Bland diet with small, frequent feedings if ulcer is active.</td>
</tr>
<tr>
<td></td>
<td>Avoid meat extract, pepper, caffeine, and alcohol.</td>
</tr>
<tr>
<td>Phenylketonuria</td>
<td>Control phenylalanine (an essential amino acid) in diet.</td>
</tr>
<tr>
<td></td>
<td>Breast-feeding is contraindicated.</td>
</tr>
<tr>
<td>Renal dialysis</td>
<td>Generous calories.</td>
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<tr>
<td></td>
<td>Supplement of water-soluble vitamins.</td>
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<tr>
<td></td>
<td>Limit fluids, protein, potassium, sodium, and phosphates.</td>
</tr>
<tr>
<td>Renal failure, acute</td>
<td>Restrict protein until BUN and serum creatinine are normal.</td>
</tr>
<tr>
<td></td>
<td>Restrict fluids during oliguric phase.</td>
</tr>
<tr>
<td></td>
<td>Replace electrolyte deficits. (Avoid giving potassium during oliguric phase.)</td>
</tr>
<tr>
<td>Renal failure, chronic</td>
<td>Restrict protein proportionate to kidney function.</td>
</tr>
<tr>
<td></td>
<td>Prevent weight loss by including sufficient calories.</td>
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<tr>
<td></td>
<td>Amino acids may be given.</td>
</tr>
<tr>
<td></td>
<td>Restrict potassium and phosphate intake.</td>
</tr>
<tr>
<td>Scurvy</td>
<td>Intake of Vitamin C rich food like peppers, guavas, kiwi, broccoli, citrus fruits, and tomatoes.</td>
</tr>
<tr>
<td></td>
<td>Vitamin C supplementation.</td>
</tr>
<tr>
<td>Surgery</td>
<td>Adequate protein, calories, iron, and vitamin C.</td>
</tr>
<tr>
<td>Ulcerative colitis</td>
<td>Low-lactose and low-residue diet. (Avoid dairy products and residue, no alcohol, no fried foods, no raw or cooked whole vegetables.)</td>
</tr>
<tr>
<td></td>
<td>Regular diet during remission.</td>
</tr>
<tr>
<td>Wilson disease</td>
<td>Limit the amount of copper you consume in diet.</td>
</tr>
<tr>
<td></td>
<td>Foods that contain high amounts of copper include: liver, shellfish, mushrooms, nuts, and chocolate.</td>
</tr>
</tbody>
</table>

**Good Luck!**

Mr. Adham I. Ahmed. BSN, RN, MCN, PhD Candidate

**References**
