NUTRITION BASICS
Life Cycle Nutrition I (NUTD 238)
Chapter 1

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Define NUTRITION

- Nutrition is the study of foods, their nutrients and other chemical constituents, and the effects of food constituents on health.

TABLE 1.1 Principles of human nutrition

PRINCIPLE #1	Food is a basic need of humans.
PRINCIPLE #2	Foods provide energy (calories), nutrients, and other substances needed for growth and health.
PRINCIPLE #3	Health problems related to nutrition originate within cells.
PRINCIPLE #4	Poor nutrition can result from both inadequate and excessive levels of nutrient intake.
PRINCIPLE #5	Humans have adaptive mechanisms for managing fluctuations in food intake.
PRINCIPLE #6	Malnutrition can result from poor diets and from disease states, genetic factors, or combinations of these causes.
PRINCIPLE #7	Some groups of people are at higher risk of becoming inadequately nourished than others.
PRINCIPLE #8	Poor nutrition can influence the development of certain chronic diseases.
PRINCIPLE #9	Adequacy, variety, and balance are key characteristics of healthy dietary patterns.
PRINCIPLE #10	There are no "good" or "bad" foods.

Principles of the Science of Nutrition

- **Principle#1** Food is a human need

- **Principle#2** Foods provide energy "**calories**", **nutrients**, and other substances needed for growth and health

Essential & Non Essential Nutrients

- **Essential Nutrients?**
  - **Include:** carbs, certain aa "His, Ile, Leu, Lys, Met, Phe, Thr, Tryp, and Val", fatty acids "linoleic acid and alpha-linolenic acid, vitamins, minerals, and water
- **Nonessential Nutrients?**
  - **Include**: cholesterol, glucose, creatine

Dietary Intake Standards

- *Dietary Reference Intakes (DRIs):* general term used for the nutrient intake standards for healthy people.
- *Recommended Dietary Allowance (RDA)*: the avg daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all healthy individuals in a group.
- *Adequate Intake (AI)*: a value based on observed or experimentally determined estimates of nutrient intake by a group of healthy people- used when an RDA cannot be determined.
- *Tolerable Upper Intake Level (UL)*: the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the risk of adverse effects increases.
- *Estimated Average Requirement (EAR)*: the intake level for a nutrient at which the needs of 50 percent of the population will be met.

Standards of Nutrient Intake for Nutrition Labels

- ***Daily Values (DVs)*** are used to identify the amount of a nutrient provided in a serving of food compared to the standard level.

- The "% DV" listed on nutrition labels represents the % of the standards obtained from one serving of the food product.

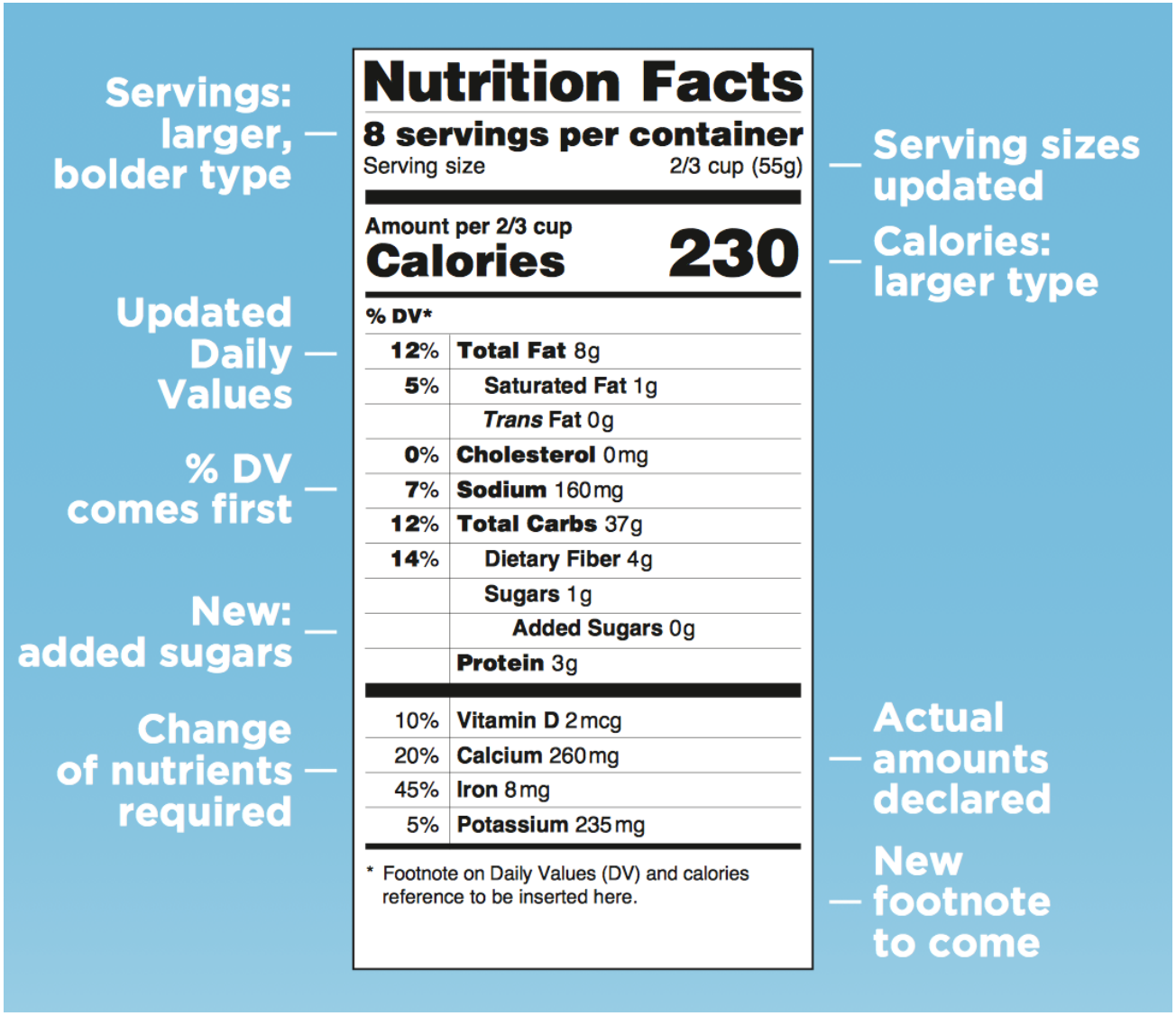


Table 1.3 Daily Values (DVs) for nutrition labeling based on intakes of 2000 calories per day in adults and children aged 4 years and above

Mandatory Components of the Nutrition Label

Food Component	Daily Value (DV)
Total fat	65 g[a]
Saturated fat	20 g
Cholesterol	300 mg[a]
Sodium	2400 mg
Total carbohydrate	300 g
Dietary fiber	25 g
Vitamin A	5000 IU[a]
Vitamin C	60 mg
Calcium	1000 mg
Iron	18 mg

[a]g = grams; mg = milligrams; IU = International Units

Trans fat, sugars, and protein do not have DV values !

Table 1.2 The six categories of nutrients

1. Carbohydrates Chemical substances in foods that consist of a single sugar molecule or multiples of sugar molecules in various forms. Sugar and fruit, starchy vegetables, and whole grain products are good dietary sources.
2. Proteins Chemical substances in foods that are made up of chains of amino acids. Animal products and dried beans are examples of protein sources.
3. Fats (Lipids) Components of food that are soluble in fat but not in water. They are more properly referred to as "lipids." Most fats are composed of glycerol attached to three fatty acids. Oil, butter, sausage, and avocado are examples of rich sources of dietary fats.
4. Vitamins Fourteen specific chemical substances that perform specific functions in the body. Vitamins are present in many foods and are essential components of the diet. Vegetables, fruits, and grains are good sources of vitamins.
5. Minerals In the context of nutrition, minerals consist of 15 elements found in foods that perform particular functions in the body. Milk, dark, leafy vegetables, and meat are good sources of minerals.
6. Water An essential component of the diet provided by food and fluid.

Carbohydrates 4kcal/g

- Most readily available E source
- 45-65% of total E intake
  - Added sugar ≤25% of caloric intake

- **Monosaccharides:** Glucose, fructose, galactose
- **Disaccharides:** Sucrose, maltose, lactose
- **Polysaccharides:** Starches, glycogen

Glycemic Index (GI) of carbs

- ***GI:*** a measure of the extent to which blood glucose is raised by a 50g portion of a carb containing food compared to 50g of glucose or white bread

- I***nsulin resistance*** and ***type 2 diabetes***

Table 1.4 Glycemic Index (GI) of selected foods[8,9]

High GI (70 and Higher)		Medium GI (56–69)		Low GI (55 and Lower)	
Glucose	100	Breadfruit	69	Honey	55
French bread	95	Orange soda	68	Oatmeal	54
Scone	92	Sucrose	68	Corn	53
Potato, baked	85	Taco shells	68	Cracked wheat bread	53
Potato, instant mashed	85	Angel food cake	67	Orange juice	52
Corn Chex	83	Croissant	67	Banana	52
Pretzel	83	Cream of Wheat	66	Mango	51
Rice Krispies	82	Quaker Quick Oats	65	Potato, boiled	50
Cornflakes	81	Chapati	62	Muesli	48
Corn Pops	80	French bread with butter and jam	62	Green peas	48
Gatorade	78	Couscous	61	Pasta	48
Jelly beans	78	Raisin Bran	61	Carrots, raw	47
Doughnut, cake	76	Sweet potato	61	Cassava	46
Waffle, frozen	76	Bran muffin	60	Lactose	46
French fries	75	Just Right cereal	60	Milk chocolate	43
Shredded Wheat	75	Rice, white or brown	60	All Bran	42
Cheerios	74	Blueberry muffin	59	Orange	42
Popcorn	72	Coca-Cola/cola	58	Peach	42
Watermelon	72	Power Bar	56	Apple juice	40
Grape-Nuts	71			Plum	39
Wheat bread	70			Apple	38
White bread	70			Pear	38
				Tomato juice	38
				Yam	37
				Dried beans	25

Protein 4kcal/g

- 10-35% of total E intake
- High protein quality→ balanced collection of EAA
  - Milk, cheese, meat, eggs
  - Plant sources (except soybeans) do not provide all 9EAA
- Protein deficiency leads to:
  - Loss of muscle tissue, growth failure, weakness, reduced resistance to disease, kidney and heart problems, protein-energy malnutrition→ ***kwashiorkor***, heart abnormalities, severe diarrhea

Fats 9kcal/g

- 20–35% of total E intake
- Fats: Triglyceride (TG)= 3fatty acid (FA)+1 glycerol
  - **Fatty Acids:** the fat-soluble components of fats in foods
  - **Glycerol:** soluble in water/ can be converted to glucose
- Saturated and unsaturated fatty acids?

B. Saturated Fats

	Portion Size	Grams of Saturated Fat		Portion Size	Grams of Saturated Fat
Fats and Oils			Haddock, breaded, fried	3 oz	3.0
Margarine	1 tsp	2.9	Rabbit	3 oz	3.0
Butter	1 tsp	2.4	Pork chop, lean	3 oz	2.7
Salad dressing, ranch	1 Tbsp	1.2	Steak, round, lean	3 oz	2.0
Peanut oil	1 tsp	0.9	Turkey, roasted	3 oz	2.0
Olive oil	1 tsp	0.7	Chicken, baked, no skin	3 oz	1.7
Salad dressing, thousand island	1 Tbsp	0.5	Prime rib, lean	3 oz	1.3
Canola oil	1 tsp	0.3	Venison	3 oz	1.1
Milk and Milk Products			Tuna, in water	3 oz	0.4
Cheddar cheese	1 oz	5.9	Fast Foods		
American cheese	1 oz	5.5	Croissant w/ egg, bacon, & cheese	1	16.0
Milk, whole	1 c	5.1	Sausage croissant	1	16.0
Cottage cheese, regular	½ c	3.0	Whopper	1	11.0
Milk, 2%	1 c	2.9	Cheeseburger	1	9.0
Milk, 1%	1 c	1.5	Bac'n Cheddar Deluxe	1	8.7
Milk, skim	1 c	0.3	Taco, regular	1	4.0
Meats, Fish			Chicken breast sandwich	1	3.0
Hamburger, 21% fat	3 oz	6.7	Nuts and Seeds		
Sausage, links	4	5.6	Macadamia nuts	1 oz	3.2
Hot dog	1	4.9	Peanuts, dry-roasted	1 oz	1.9
Chicken, fried, with skin	3 oz	3.8	Sunflower seeds	1 oz	1.6
Salami	3 oz	3.6			

C. Unsaturated Fats

	Portion Size	Grams of Unsaturated Fat		Portion Size	Grams of Unsaturated Fat
Fats and Oils			Haddock, breaded, fried	3 oz	6.5
Canola oil	1 tsp	4.1	Chicken, baked, no skin	3 oz	6.0
Vegetable oils	1 tsp	3.6	Pork chop, lean	3 oz	5.3
Margarine	1 tsp	2.9	Turkey, roasted	3 oz	4.5
Butter	1 tsp	1.3	Tuna, in water	3 oz	0.7
Milk and Milk Products			Egg	1	5.0
Cottage cheese, regular	½ c	3.0	Nuts and Seeds		
Cheddar cheese	1 oz	2.9	Sunflower seeds	1 oz	16.6
American cheese	1 oz	2.8	Almonds	1 oz	12.6
Milk, whole	1 c	2.8	Peanuts	1 oz	11.3
Meats, Fish			Cashews	1 oz	10.2
Salmon, fresh	3 oz	10.9			

Essential Fatty Acids

- **Linoleic acid** (omega-6 or n-6) fatty acid
  - Sources: Most vegetable oils, meats, and human milk
- Major derivative→ arachidonic acid: a primary structural component of the CNS

- **Alpha-linolenic acid (omega-3 or n-3) fatty acid**
  - Sources: dark green vegetables, vegetable oils, and flaxseed

- Derivatives of n-3: eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)
  - Relatively little EPA and DHA are produced in the body from omega-3 because the conversion process is low
  - Sources fatty cold-water fish, shellfish, and human milk

Hydrogenation and Trans Fats

- Hydrogenation: adding hydrogen to double bonds in UFA; form solid
  - Change the molecular structure of the FA *cis (naturally occurring)* structure→ *trans* form
  - Enhance shelf life and baking qualities

- Trans fats raise blood LDL-C > saturated fatty acids
  - Trans fats are naturally present in dairy products and meats; primary dietary sources are hydrogenated products

Cholesterol

- Dietary cholesterol is a fat-like, clear liquid substance primarily found in lean and fat components of animal products
  - Our body produces 1/3 of the cholesterol our body uses
  - Component of animal cell membranes, the brain, and nerves

- It is the precursor of estrogen, testosterone, and vitamin D

- Fats that ↑ levels of LDL-C are considered **unhealthful**
  - Trans fats, saturated fats, and cholesterol

- Fats that ↓ LDL-C and ↑ blood levels of HDL-C are considered **healthful**
  - MUFAs, PUFAs, alpha-linolenic acid, DHA, and EPA

D. *Trans* Fats

	Portion Size	Grams *Trans* Fats		Portion Size	Grams *Trans* Fats
Fats and Oils			Milk		
Margarine, stick	1 tsp	1.3	Whole	1 c	0.2
Margarine, tub (soft)	1 tsp	0.1	Other Foods		
Shortening	1 tsp	0.3	Doughnut	1	3.2
Butter	1 tsp	0.1	Danish pastry	1	3.0
Margarine, "no *trans* fat"	1 tsp	0	French fries, small serving	1	2.9
Meats			Cookies	2	1.8
Beef	3 oz	0.5	Corn chips	1 oz	1.4
Chicken	3 oz	0.1	Cake	1 slice	1.0
			Crackers	4 squares	0.5

E. Cholesterol

	Portion Size	Milligrams Cholesterol		Portion Size	Milligrams Cholesterol
Fats and Oils			Ostrich, ground	3 oz	63
Butter	1 tsp	10.3	Pork chop, lean	3 oz	60
Vegetable oils, margarine	1 tsp	0	Hamburger, l0% fat	3 oz	60
Meats, Fish			Venison	3 oz	48
Brain	3 oz	1476	Wild pig	3 oz	33
Liver	3 oz	470	Goat, roasted	3 oz	32
Egg	1	212	Tuna, in water	3 oz	25
Veal	3 oz	128	Milk and Milk Products		
Shrimp	3 oz	107	Ice cream, regular	1 c	56
Prime rib	3 oz	80	Milk, whole	1 c	34
Chicken, baked, no skin	3 oz	75	Milk, 2%	1 c	22
Salmon, broiled	3 oz	74	Yogurt, low fat	1 c	17
Turkey, baked, no skin	3 oz	65	Milk, 1%	1 c	14
Hamburger, 20% fat	3 oz	64	Milk, skim	1 c	7

Vitamins

- Play critical roles as ***coenzymes*** in chemical changes (metabolic rxns) that take place in the body

- *Water-soluble:* stores in the body are limited (except for vitamin B12)→ run out within a few weeks to a few months after intake becomes inadequate

- *Fat-soluble*: stored in the body's fat tissues and the liver/ stores can last from months to years when intake is low

Table 1.9 Summary of the vitamins

The Water-Soluble Vitamins

	Primary Functions	Consequences of Deficiency
Thiamin (vitamin B_1) AI[a] women: 1.1 mg men: 1.2 mg	• Coenzyme in the metabolism of carbohydrates, alcohol, and some amino acids • Required for the growth and maintenance of nerve and muscle tissues • Required for normal appetite	• Fatigue, weakness • Nerve disorders, mental confusion, apathy • Impaired growth • Swelling • Heart irregularity and failure
Riboflavin (vitamin B_2) AI women: 1.1 mg men: 1.3 mg	• Coenzyme involved in energy metabolism of carbohydrates, proteins, and fats • Coenzyme function in cell division • Promotes growth and tissue repair • Promotes normal vision	• Reddened lips, cracks at both corners of the mouth • Fatigue
Niacin (vitamin B_3) RDA women: 14 mg men: 16 mg UL: 35 mg (from supplements and fortified foods)	• Coenzyme involved in energy metabolism • Coenzyme required for the synthesis of body fats • Helps maintain normal nervous system functions	• Skin disorders • Nervous and mental disorders • Diarrhea, indigestion • Fatigue

Table 1.9 Summary of the vitamins (continued)

The Water-Soluble Vitamins (Continued)

Consequences of Overdose	Primary Food Sources	Highlights and Comments
• High intakes of thiamin are rapidly excreted by the kidneys. Oral doses of 500 mg/day or less are considered safe	• Grains and grain products (cereals, rice, pasta, bread) • Ready-to-eat cereals • Pork and ham, liver • Milk, cheese, yogurt • Dried beans and nuts	• Need increases with carbohydrate intake • There is no "e" on the end of *thiamin* • Deficiency rare in the U.S.; may occur in people with alcoholism • Enriched grains and cereals prevent thiamin deficiency
• None known. High doses are rapidly excreted by the kidneys	• Milk, yogurt, cheese • Grains and grain products (cereals, rice, pasta, bread) • Liver, poultry, fish, beef • Eggs	• Destroyed by exposure to light
• Flushing, headache, cramps, rapid heartbeat, nausea, diarrhea, decreased liver function with doses above 0.5 g per day	• Meats (all types) • Grains and grain products (cereals, rice, pasta, bread) • Dried beans and nuts • Milk, cheese, yogurt • Ready-to-eat cereals • Coffee • Potatoes	• Niacin has a precursor—tryptophan. Tryptophan, an amino acid, is converted to niacin by the body. Much of our niacin intake comes from tryptophan • High doses raise HDL-cholesterol levels, decrease LDL-cholesterol, and lower triglyceride levels

Table 1.9 Summary of the vitamins (continued)

The Fat-Soluble Vitamins (Continued)

	Primary Functions	Consequences of Deficiency
Vitamin D (Vitamin D_2 = ergocalciferol, Vitamin D_3 = cholicalciferol) AI women: 5 mcg (200 IU) men: 5 mcg (200 IU) UL: 50 mcg (2000 IU)	• Required for calcium and phosphorus metabolism in the intestines and bone, and for their utilization in bone and teeth formation, nerve and muscle activity • Inhibits inflammation	• Weak, deformed bones (children) • Loss of calcium from bones (adults), osteoporosis • Increased risk of heart disease, type 1 diabetes, metabolic syndrome, and other inflammatory diseases
Vitamin K (phylloquinone, menaquinone) AI women: 90 mcg men: 120 mcg	• Regulation of synthesis of blood-clotting proteins • Aids in the incorporation of calcium into bones	• Bleeding, bruises • Decreased calcium in bones • Deficiency is rare; may be induced by the long-term use (months or more) of antibiotics

Table 1.9 Summary of the vitamins (continued)

The Fat-Soluble Vitamins (Continued)

Consequences of Overdose	Primary Food Sources	Highlights and Comments
• Mental retardation in young children • Abnormal bone growth and formation • Nausea, diarrhea, irritability, weight loss • Deposition of calcium in organs such as the kidneys, liver, and heart • Toxicity possible with long-term dose levels over 10,000 IU per day	• Vitamin D–fortified milk and margarine • Butter • Fatty fish • Eggs • Mushrooms • Milk products such as cheese and yogurt, and breads and cereals may be fortified with vitamin D	• Vitamin D_3 is the most active form of this vitamin • Vitamin D is manufactured from cholesterol in cells beneath the surface of the skin upon exposure of the skin to sunlight • Poor vitamin D status is common in all age groups • The AI for vitamin D may be increased in 2009 • Breastfed infants with little sun exposure benefit from vitamin D supplements
• Toxicity is a problem only when synthetic forms of vitamin K are taken in excessive amounts; that may cause liver disease	• Leafy, green vegetables • Grain products	• Vitamin K is produced by bacteria in the gut; part of our vitamin K supply comes from these bacteria • Newborns are given a vitamin K injection because they have "sterile" guts and consequently no vitamin K–producing bacteria

Minerals

- Part of bone, teeth, cartilage
- Stimulate muscles contraction (e.g., heart beat) and nerves to react
- Control PH
- Maintain adequate water content in body

Table 1.13 Summary of minerals

	Primary Functions	Consequences of Deficiency
Calcium AI* women: 1000 mg men: 1000 mg UL: 2500 mg	• Component of bones and teeth • Required for muscle and nerve activity, blood clotting	• Poorly mineralized, weak bones (osteoporosis) • Rickets in children • Osteomalacia (rickets in adults) • Stunted growth in children • Convulsions, muscle spasms
Phosphorus RDA women: 700 mg men: 700 mg UL: 4000 mg	• Component of bones and teeth • Component of certain enzymes and other substances involved in energy formation • Required for maintenance of acid-base balance of body fluids	• Loss of appetite • Nausea, vomiting • Weakness • Confusion • Loss of calcium from bones
Magnesium RDA women: 310 mg men: 400 mg UL: 350 mg (from supplements only)	• Component of bones and teeth • Needed for nerve activity • Activates enzymes involved in energy and protein formation	• Stunted growth in children • Weakness • Muscle spasms • Personality changes

Table 1.13 Summary of minerals (continued)

Consequences of Overdose	Primary Food Sources	Highlights and Comments
• Drowsiness • Calcium deposits in kidneys, liver, and other tissues • Suppression of bone remodeling • Decreased zinc absorption	• Milk and milk products (cheese, yogurt) • Broccoli • Dried beans • Calcium-fortified foods (some juices, breakfast cereals, bread, for example)	• The average intake of calcium among U.S. women is approximately 60% of the DRI • One in four women and one in eight men in the U.S. develop osteoporosis • Adequate calcium and vitamin D status must be maintained to prevent bone loss
• Muscle spasms	• Milk and milk products (cheese, yogurt) • Meats • Seeds, nuts • Phosphates added to foods	• Deficiency is generally related to disease processes
• Diarrhea • Dehydration • Impaired nerve activity due to disrupted utilization of calcium	• Plant foods (dried beans, tofu, peanuts, potatoes, green vegetables) • Milk • Bread • Ready-to-eat cereals • Coffee	• Magnesium is primarily found in plant foods, where it is attached to chlorophyll • Average intake among U.S. adults is below the RDA

Water

- Adults are about 60–70% water by weight
- Medium for most chemical rxns in the body
- Plays a role in E transformation, the excretion of wastes, and temp regulation

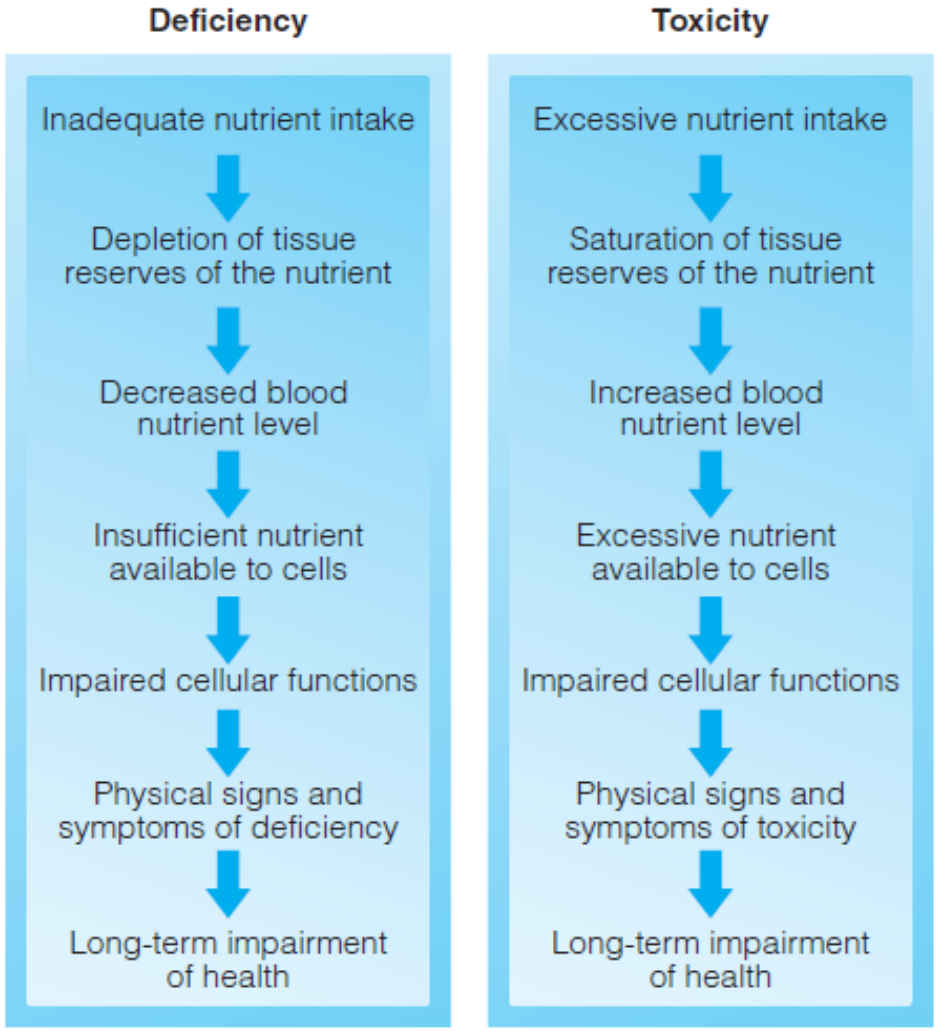
- **Principle #3** Health problems related to nutrition originate within cells
  - The functions of each cell are maintained by the nutrients it receives. **Problems arise when a cell's need for nutrients differs from the amounts that are available**

  - Disruptions in the availability of nutrients/ homeostasis, or the presence of harmful substances in the cell's environment, initiate diseases and disorders that eventually affect tissues, organs, and systems

- **Principle #4** Poor nutrition can result from both inadequate and excessive levels of nutrient intake

Steps in the Development of Nutrient Deficiencies and Toxicities

The length of time a deficiency or toxicity takes to develop depends on the type and amount of the nutrient consumed and the extent of body nutrient reserves.



Principle #5 Humans have adaptive mechanisms for managing fluctuations in food intake

- Mechanisms act to conserve nutrients when dietary supply is low and to eliminate them when it is high
  - Excess vitamin A- store– too much- toxicity "limited storage capacity"
  - Too little Ca- increase intestinal absorption- prolonged deficiency- bone resorption
  - Fluctuations in E intake:
    - Low E intake: use stores (glycogen and fat), prolonged low intake body down-regulates its E needs by lowering body temp and the capacity for physical work
    - High intake: Stored as fat or glycogen

- <u>These mechanisms do not protect from all consequences of a bad diet</u>

Principle #6 Malnutrition can result from poor diets and from disease states, genetic factors, or combinations of these causes

- **Malnutrition:** poor nutrition resulting from an excess or lack of calories or nutrients

- Malnutrition can result from poor diets as well as from diseases that interfere with the body's ability to use the nutrients consumed.

- **Examples** :
  - Niacin toxicity
  - Obesity
  - Iron deficiency

Malnutrition

- **Primary Malnutrition** results directly from inadequate or excessive dietary intake of energy or nutrients.

- **Secondary Malnutrition** results from a condition (e.g., disease, surgical procedure, medication use) rather than primarily from dietary intake.
  - Diarrhea, alcoholism, AIDS, and gastrointestinal tract bleeding

Nutrient- Gene Interactions

- The study of nutrient–gene interactions and the effects of these interactions on health is called nutritional genomics or nutrigenomics

- Nutrigenomics covers the study of the effects of genes on how the body uses nutrients and the ways in which dietary components affect gene expression, function, and health status.

TABLE 1.15 Examples of single-gene disorders that affect nutrient need[75-77]

PKU (phenylketonuria)	A rare disorder caused by the lack of the enzyme phenylalanine hydroxylase. Lack of this enzyme causes phenylalanine, an essential amino acid, to build up in the blood. High blood levels of phenylalanine during growth lead to mental retardation, poor growth, and other problems. PKU is treated by low-phenylalanine diets.
Galactosemia	Galactosemia is a single-gene-defect disorder that interferes with the body's utilization of the sugar galactose found in lactose ("milk sugar"). The signs and symptoms of galactosemia result from an inability to use galactose to produce energy. If infants with classic galactosemia are not treated promptly with a low-galactose diet, life-threatening complications appear within a few days after birth. People with this condition must avoid all milk, milk-containing products (including dry milk), and other foods that contain galactose for life. It occurs in approximately 1 in 30,000 to 60,000 newborns.
Hemochromatosis	A single-gene defect disorder affecting 1 in 300 and occurring most commonly in Caucasians. It is caused by a defect in a gene that produces a protein that controls how much iron is absorbed from food. Individuals with hemochromatosis absorb more iron than normal and have excessive levels of body iron. High levels of body iron have toxic effects on tissues such as the liver and heart. Hemochromatosis is treated with medications and a low-iron and vitamin C diet. A high intake of vitamin C can make hemochromatosis worse because vitamin C increases the absorption of iron.

- **Principle #7** Some groups of people are at higher risk of becoming inadequately nourished than others.

- **Principle #8** Poor nutrition can influence the development of certain chronic diseases.

TABLE 1.16 ▸ Examples of diseases and disorders linked to diet[78-81]

DISEASE OR DISORDER	DIETARY CONNECTIONS
Heart disease	Excessive body fat, high intakes of *trans* fat, added sugar, and salt; low vegetable, fruit, fish, nuts, and whole grain intakes
Cancer	Low vegetable and fruit intakes; excessive body fat and alcohol intake; regular consumption of processed meats
Stroke	Low vegetable and fruit intake; excessive alcohol intake; high animal-fat diets
Diabetes (type 2)	Excessive body fat; low vegetable, whole grain, and fruit intake; high added sugar intake
Cirrhosis of the liver	Excessive alcohol consumption; poor overall diet
Hypertension	Excessive sodium (salt) and low potassium intake, excess alcohol intake; low vegetable and fruit intake; excessive levels of body fat
Iron-deficiency anemia	Low iron intake
Tooth decay and gum disease	Excessive and frequent sugar consumption; inadequate fluoride intake
Osteoporosis	Inadequate calcium and vitamin D, low intakes of vegetables and fruits
Obesity	Excessive calorie intake, overconsumption of energy-dense, nutrient-poor foods
Chronic inflammation and oxidative stress	Excessive calorie intake; excessive body fat; high animal-fat diets; low intake of whole grains, vegetables, fruit, and fish
Alzheimer's disease	Regular intake of high-fat animal products; low intake of olive oil, vegetables, fruits, fish, wine, and whole grains

Principle #9 Adequacy, variety, and balance are key characteristics of a healthy diet.

- **Nutrient-Dense Foods vs. Energy Dense Foods**
  - Excess intake of energy-dense and empty-calorie foods increases the likelihood that calorie needs will be met or exceeded before nutrients needs are met.

- **Nutrient-Dense Foods** contain relatively high amounts of nutrients compared to their caloric value→ Vegetables, fruits, lean meats, dried beans, breads, and cereals

- **Empty-Calorie Foods** provide an excess of calories relative to their nutrient content→ beer, chips, candy, pastries, sodas, and fruit drinks

- **Principle #10** There are no "good" or "bad" foods

  - Ice cream can be a "good" food for physically active, normal-weight individuals with high calorie needs who have otherwise met their nutrient requirements by consuming nutrient-dense foods.

Nutritional Labeling and Education Act

- Provides FDA with specific authority to require **nutrition labeling** of most foods regulated by the agency

- Requires that all nutrient content claims i.e., 'high fiber', 'low fat', '*trans* fat–free' and health claims be consistent with FDA regulations
  - Products labeled "no *trans* fat" or "*trans* fat–free," must contain < 0.5g of *trans* fat and of SF
  - Products labeled "low sodium" must contain <140mg Na/ serving

Ingredient Label List

- Must always begin with the ingredient that contributes the greatest amount of wt
- **Enrichment**: pertains only to refined grain products and covers some of the vitamins and minerals lost during refinement
  - Replacement of thiamin, riboflavin, niacin, and Fe
- **Fortification:** the addition of one or more vitamins or minerals to a food product
  - Refined grain flours must be fortified with folic acid, milk with vitamin D, and low-fat and skim milk with vitamins D and A

Prebiotics: certain fiber-like forms of indigestible carbs that support the growth of beneficial bacteria in the lower intestine

Probiotics: Strains of lactobacillus and bifidobacteria that enter food products during fermentation and aging processes and have beneficial effects on the body

Benefits of pre and probiotics

- Prevention and treatment of diarrhea and other infections in the GIT
- Prevention of colon cancer
- Decreased blood levels of TG, cholesterol, and glucose
- Decreased dental caries

Table 1.17 Food and other sources of prebiotics and probiotics

Probiotics

Fermented or aged milk and milk products
- Yogurt with live culture
- Buttermilk
- Kefir
- Cottage cheese
- Dairy spreads with added inulin

Other fermented products
- Soy sauce
- Tempeh
- Fresh sauerkraut
- Miso

Breast milk

Probiotic tablets, powders, and nutritional beverages

Prebiotics

Chicory
Jerusalem artichokes
Wheat
Barley
Rye
Onions
Garlic
Leeks
Prebiotic tablets, powders, and nutritional beverages

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Healthy individuals require the same nutrients throughout life, but amounts of nutrients needed vary based on age, growth, and development