



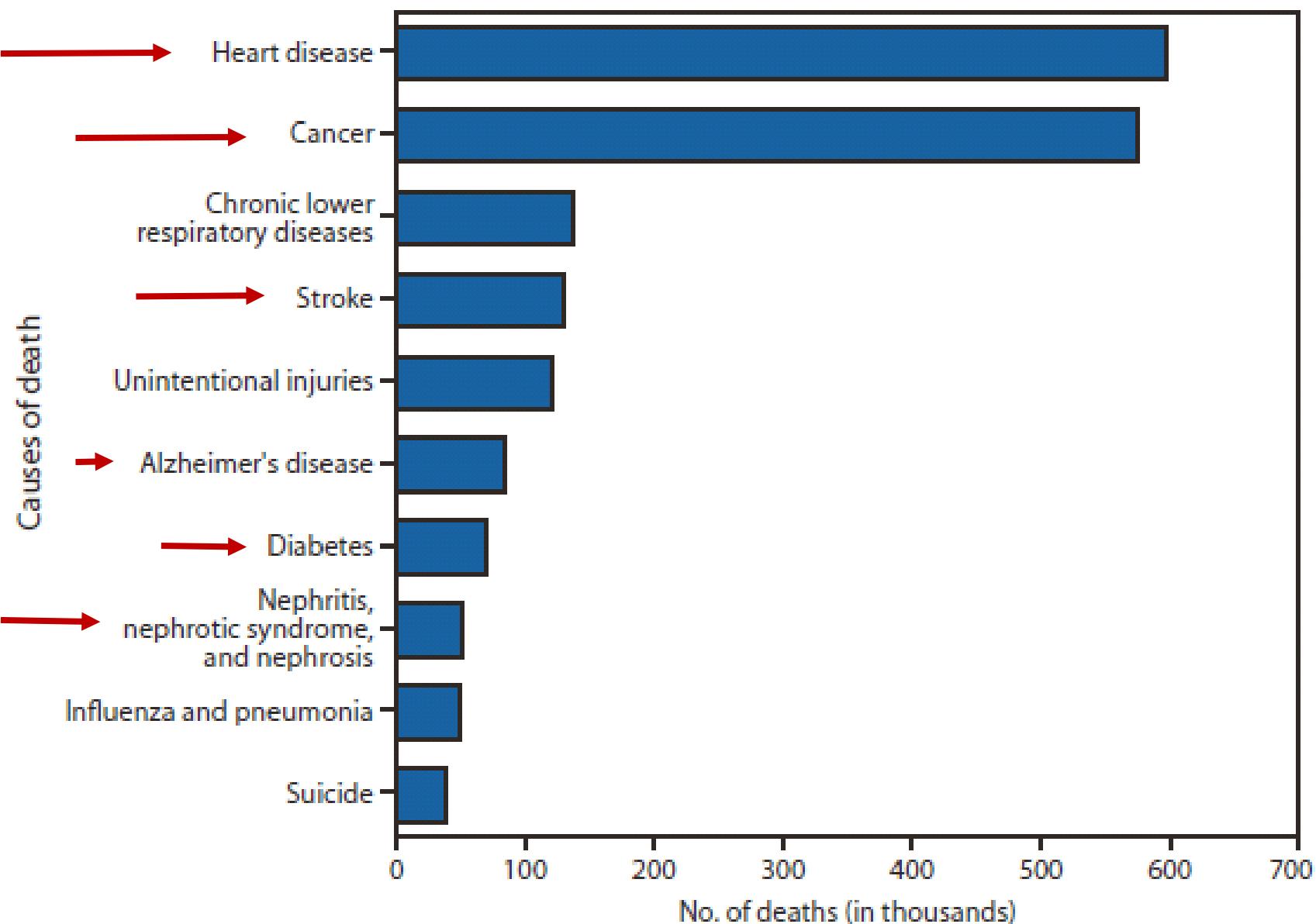
Exam 2 Review

Why Study Nutrition?

- Nutrition is a lifestyle factor key to promoting an **optimal state of health**
- Poor diet and sedentary lifestyle are risk factors for chronic disease



Leading Causes of Death in the US



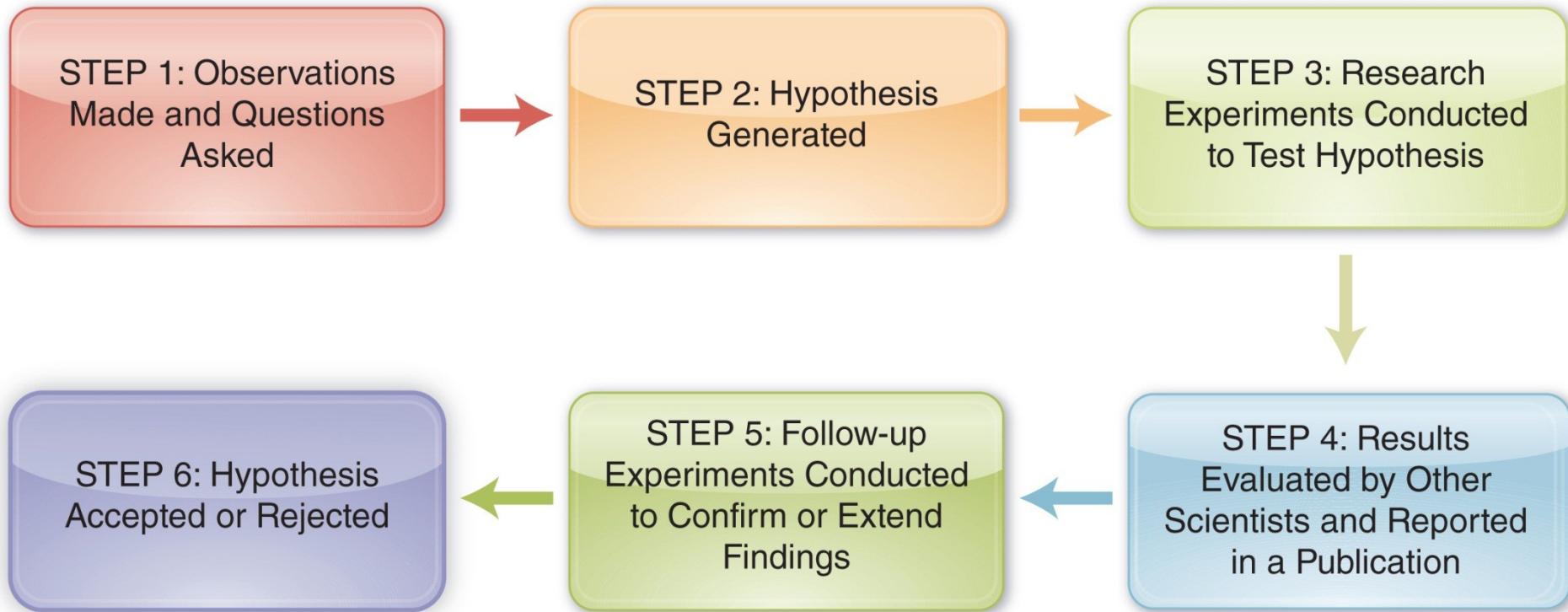
Nutrition Is...

The science that links foods to health and disease. It includes digestion, absorption, transportation, and excretion of food substances and waste products.



The Scientific Method

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- **Hypotheses:** Scientists' "educated guesses" or tentative explanations to explain phenomena

**Lomo Linda,
CALIFORNIA**

**Nicoya,
COSTA RICA**

**Sardinia,
ITALY**

**Ikaria,
GREECE**

**Okinawa,
JAPAN**

What are the common
features of healthy diets
around the world?

	Low-carbohydrate	Low-fat/ vegetarian/vegan	Low-glycemic	Mediterranean	Mixed/balanced	Paleolithic
Health benefits relate to:	Emphasis on restriction of refined starches and added sugars in particular.	Emphasis on plant foods direct from nature; avoidance of harmful fats.	Restriction of starches, added sugars; high fiber intake.	Foods direct from nature; mostly plants; emphasis on healthful oils, notably monounsaturates.	Minimization of highly processed, energy-dense foods; emphasis on wholesome foods in moderate quantities.	Minimization of processed foods. Emphasis on natural plant foods and lean meats.
Compatible elements:	Limited refined starches, added sugars, processed foods; limited intake of certain fats; emphasis on whole plant foods, with or without lean meats, fish, poultry, seafood.					
And all potentially consistent with:	Food, not too much, mostly plants^{a,b,c}.					

^aFrom Reference 135.

^bPortion control may be facilitated by choosing better-quality foods which have the tendency to promote satiety with fewer calories.

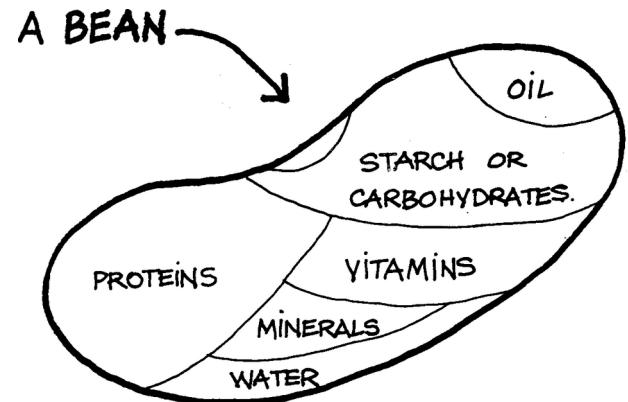
^cWhile neither the low-carbohydrate nor Paleolithic diet need be "mostly plants," both can be.

 Katz DL, Meller S. 2014.

Annu. Rev. Public Health. 35:83–103

Food Provides...

- **Calories** to meet energy needs
- **Nutrients** for:
 - Growth, development, and maintenance
 - Regulate body processes
 - Essential Nutrient
 - Has a biological function
 - Omission results in decline of function
 - Replenishing restores biological function



WHAT ARE MACRONUTRIENTS AND MICRONUTRIENTS?

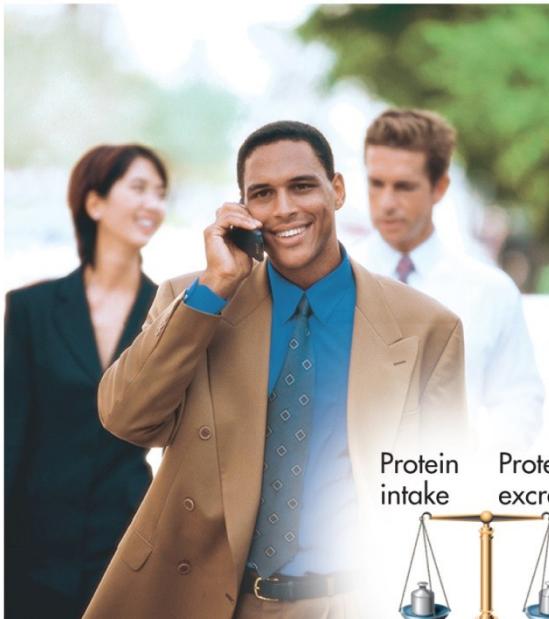




Positive Protein Balance

- Growth
- Pregnancy
- Recovery stage after illness, injury
- Athletic training**

(a)



Protein Equilibrium

- Healthy adult meeting nutrient needs, notably protein and calorie needs

(b)



Negative Protein Balance

- Inadequate protein intake (e.g., fasting, intestinal tract diseases)
- Inadequate calorie intake
- Fevers, burns, infections
- Increased protein loss (e.g., kidney disease)

(c)

*Based on losses of urea and other nitrogen-containing compounds in the urine, as well as protein lost from feces, skin, hair, nails, and other minor routes.

**Only when additional lean body mass is being gained. Nevertheless, the athlete is probably already eating enough protein to support this extra protein synthesis; protein supplements are not needed.

Water

- Acts as solvent and lubricant
- Transports nutrients and waste
- Medium for temperature regulation
- Majority of our body weight (~60%)
- Found in foods (fruits and vegetables)
- Provides no calories/energy



Water, Hydration, Electrolyte Case Studies

- What happened?
 - Radio station contestant?
 - Fraternity men on their hike?
 - The thirsty swimmer?

What tool sets the basis for menu planning and healthy eating guidelines in the US?

Dietary Guidelines—the Basis For Menu Planning

- Nutrition and physical activity advice based on the latest and strongest scientific information to improve the health of all Americans **age 2 and older**
- USDA and U.S. Department of Health and Human Services (DHHS) have published Dietary Guidelines since 1980 to aid diet planning
- Direction for the development of educational materials, aid policy makers, and serve as the basis for consumer nutrition messages

The Guidelines

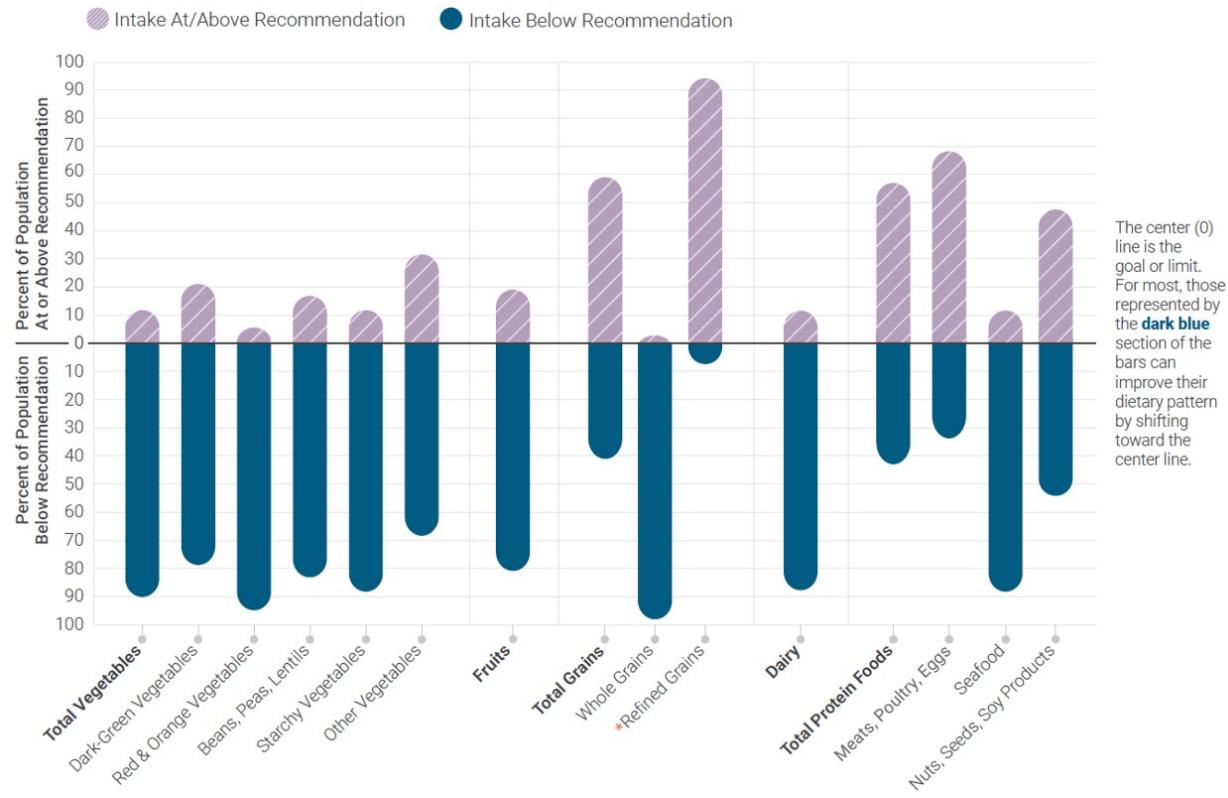
Make every bite count with the *Dietary Guidelines for Americans*. Here's how:



What do Americans need to eat more of and what do they need to eat less of?



Dietary Intakes Compared to Recommendations

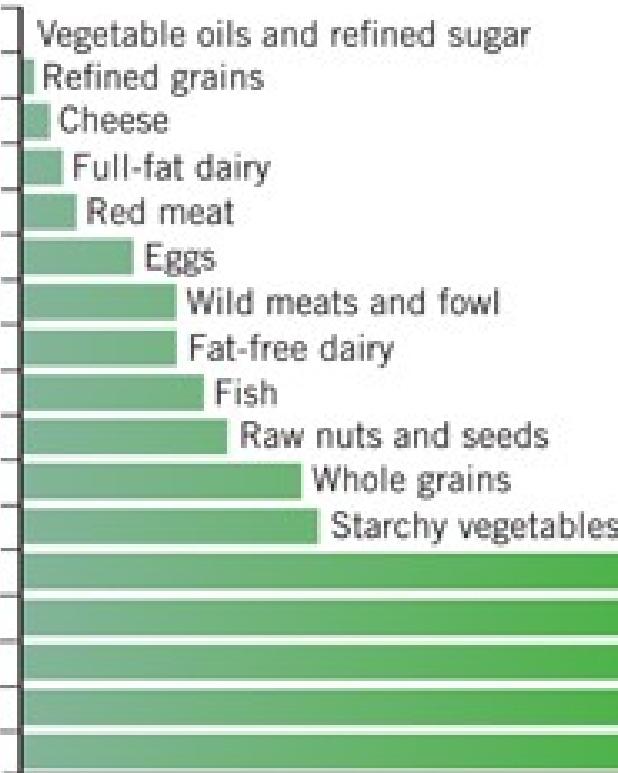


The center (0) line is the goal or limit. For most, those represented by the dark blue section of the bars can improve their dietary pattern by shifting toward the center line.

Data Source: Analysis of What We Eat in America, NHANES 2013-2016, ages 1 and older, 2 days dietary intake data, weighted.
Recommended Intake Ranges: Healthy U.S.-Style Dietary Patterns

What is nutrient density vs energy density?

SAD is Low in Nutrient Density



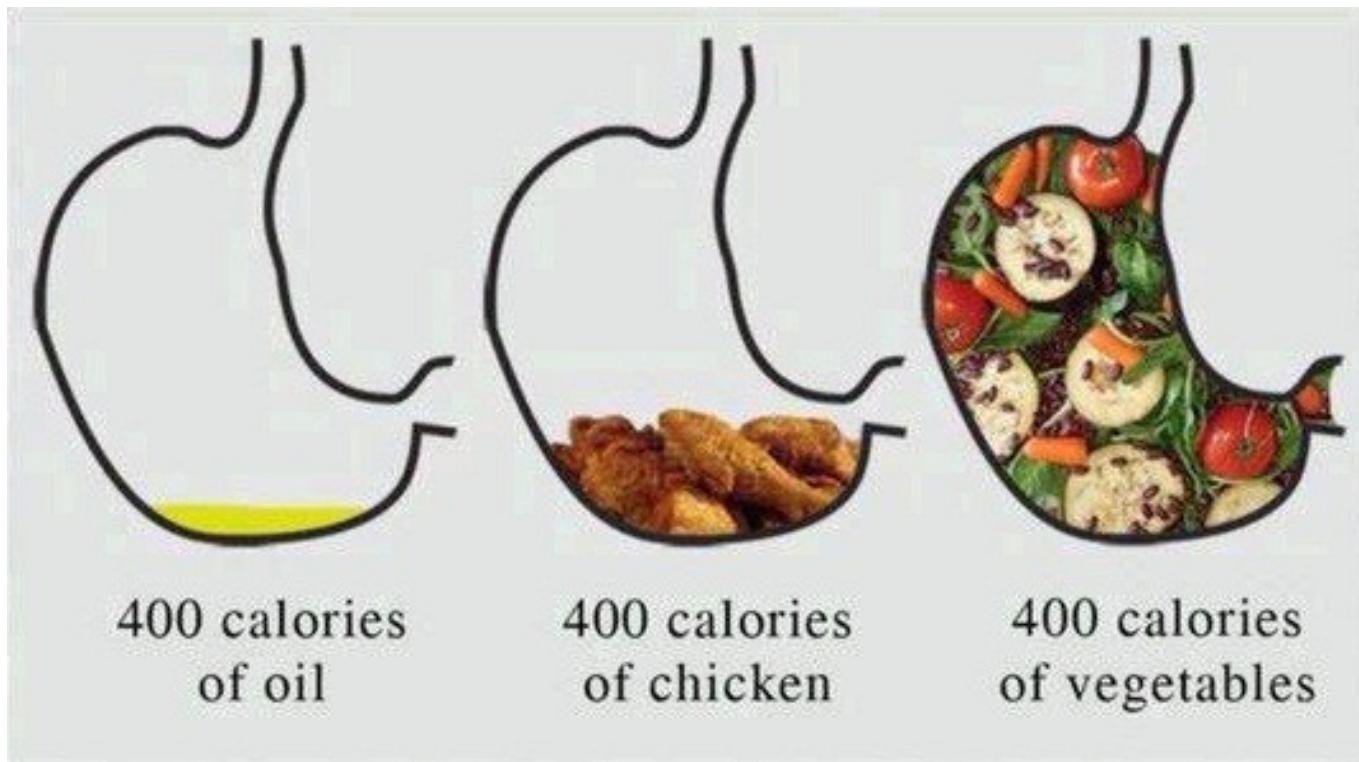
Nutrient Density.
per calorie



Courtesy: Eat to Live by Joel Fuhrman

SAD is High in Energy Density

- Energy density of a food is determined by comparing the calorie (kcal) content with the weight of food





1575 Kcal
High Energy Density



1575 Kcal
Low Energy Density

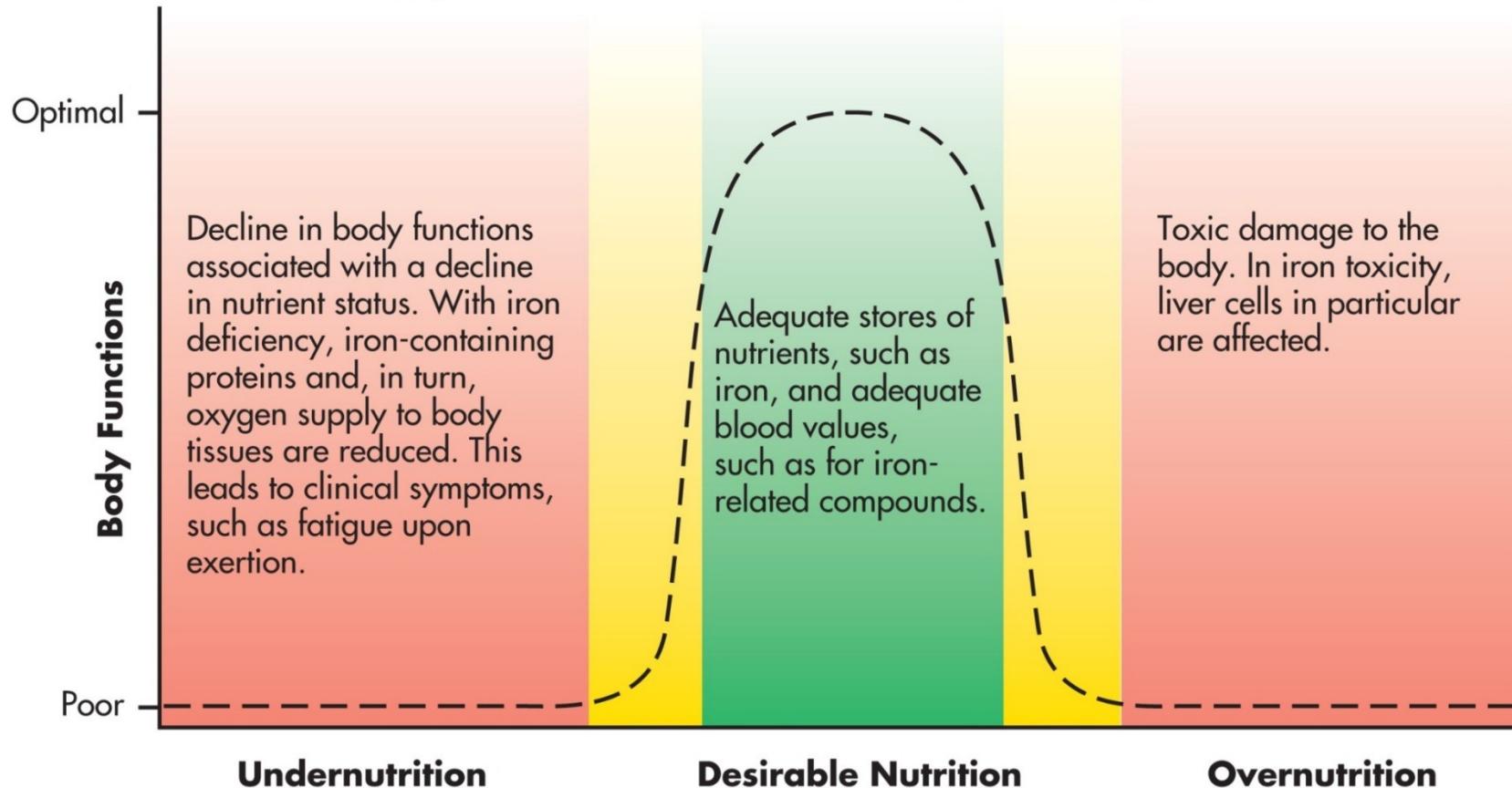
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How do we
measure
nutritional status
as it relates to
human health?



Nutritional Status

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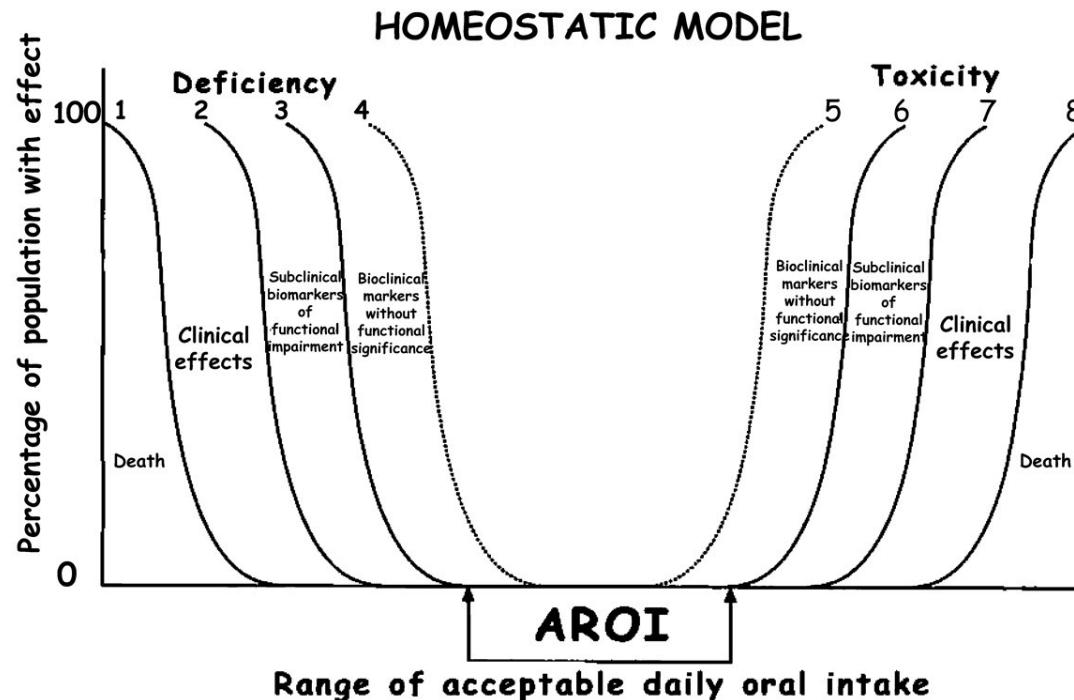


Nutritional Status

- **Nutritional state:** Nutritional health of a person determined by:
 - Anthropometric measurements
 - Biochemical measurements of nutrients
 - Clinical exam
 - Diet analysis
 - Economic evaluation
- **Malnutrition:** Failing health from long-standing dietary practices that do not coincide with nutritional needs – can refer to overnutrition or undernutrition
 - **Overnutrition:** A state in which nutritional intake greatly exceeds the body's needs
 - **Undernutrition:** Failing health that results from a long-standing dietary intake that is not enough to meet nutritional needs

Limitations of Nutritional Assessment

- A long time between poor nutritional habits and the onset of first clinical evidence health problem



Theoretical dose-response curves for various effects occurring in a population at various levels of intake (doses) of an essential trace element.

The lower end the dose response curve for such critical effects related to deficiency (curve 3) and toxicity (curve 6) defines the range of acceptable daily oral intakes.

What do you look for on labels?



Quick Foods

MICRO Mac®

Good sourceof..... calcium

A diet rich in calcium may reduce the risk of osteoporosis

Nutrient claims, such as "Good source," and health claims, such as "Reduce the risk of osteoporosis," must follow legal definitions.

Nutrients
These nutrients must appear on most labels. Labels of foods that contain few nutrients, such as candy and soft drinks, may omit some nutrients. Some manufacturers list more nutrients. Other nutrients must be listed if manufacturers make a claim about them or if the food is fortified with them.

A Quick Guide to Nutrient Sources

% Daily Value
20% or more = Rich source
10%-19% = Good source

Name and address of the food manufacturer.

Ingredients are listed in descending order by weight.

Nutrition Facts

Nutrition Facts	
Serving Size	Calories
1 Pouch (61g)	250
Calories from Fat 70	
Total Fat 7g	11%
Saturated Fat 2.5g	13%
Trans Fat 1g	**
Cholesterol 5mg	2%
Sodium 400mg	16%
Total Carbohydrate 38g	13%
Dietary Fiber <1g	3%
Sugars 6g	
Protein 7g	
Vitamin A 0% • Vitamin C 0%	
Calcium 12% • Iron 8%	

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

Calories: 2,000	2,500	
Total Fat	Less than 65g	80g
Sat Fat	Less than 20g	25g
Cholest	Less than 300mg	300mg
Sodium	Less than 2,400mg	2,400mg
Total Carb	300g	375g
Fiber	25g	30g

Servings size
Serving size is listed in household units (and grams). Pay careful attention to serving size to know how many servings you are eating: e.g., if you eat double the serving size, you must double the % Daily Values and calories.

Servings per container
The number of servings of the size given in the serving size above that are in one package of the food.

% Daily Value
This shows how a single serving compares to the DV. Recall that the DVs for fat, saturated fat, cholesterol, protein, and fiber are based on a 2000-calorie diet.

Sugars DV
There is no % Daily Value for sugar. Limiting intake is the best advice.

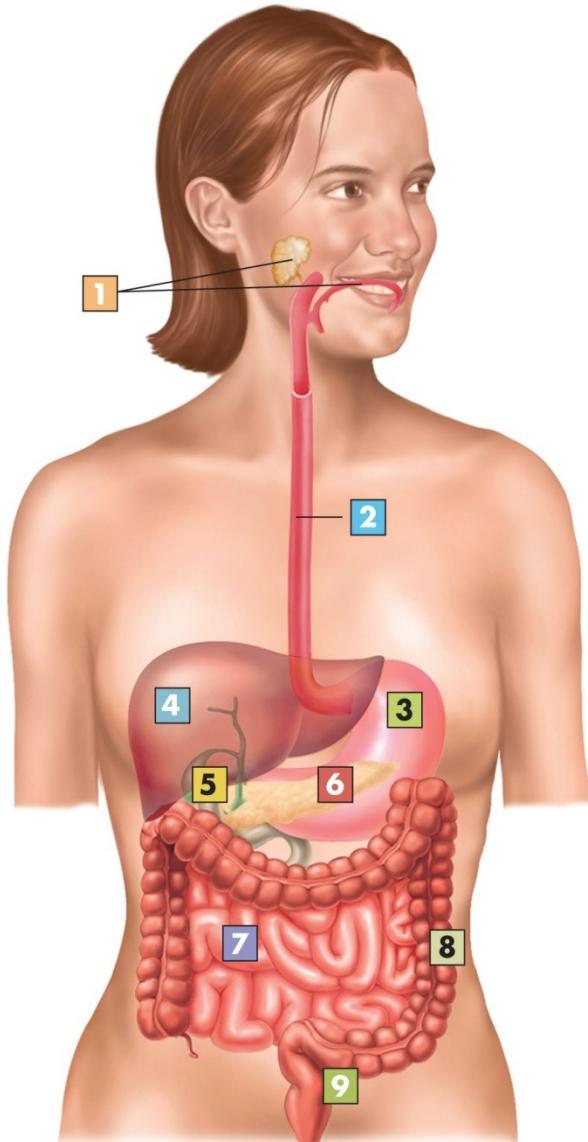
Protein DV
% Daily Value for protein is generally not included due to expensive testing required to determine protein quality.

Daily Value Footnote
This footnote appears on many labels. It is omitted when there is too little space on the label to print it. The footnote reports the DVs used to compute the % Daily Value for a 2000- and 2500-calorie diet.

Digestive System - Terms

- **Gastrointestinal (GI) tract:** sites in the body for digestion and absorption of nutrients; consists of mouth, esophagus, stomach, small intestine, large intestine, rectum, and anus
- **Motility:** movement of food through the GI tract
- **Digestion:** process by which large ingested molecules are mechanically and chemically broken down producing basic nutrients that can be absorbed across the wall of the GI tract
- **Absorption:** process by which substances are taken up from GI tract and enter bloodstream or lymph system

Where does digestion begin?



Organ	Digestive Functions
1 Mouth and salivary glands	Chew food Perceive taste Moisten food with saliva Lubricate food with mucus Release small amount of starch-digesting (amylase) and fat-digesting (lipase) enzymes Initiate swallowing reflex
2 Esophagus	Lubricate with mucus Move food to stomach by peristaltic waves (swallowing)
3 Stomach	Store, mix, dissolve, and continue digestion of food Dissolve food particles with secretions Kill microorganisms with acid Release protein-digesting (pepsin) and fat-digesting (lipase) enzymes Lubricate and protect stomach surface with mucus Regulate emptying of dissolved food into small intestine Produce intrinsic factor for vitamin B-12 absorption
4 Liver	Produce bile to aid fat digestion and absorption
5 Gallbladder	Store, concentrate, and later release bile into the small intestine
6 Pancreas	Secrete sodium bicarbonate and enzymes for digesting carbohydrate (amylase), fat (lipase), and protein (trypsin and chymotrypsin)
7 Small intestine	Mix and propel contents Lubricate with mucus Digest and absorb most substances using enzymes made by the pancreas (see above) and small intestinal cells (lactase, sucrase, maltase, peptidases)
8 Large intestine	Mix and propel contents Absorb sodium, potassium, and water House bacteria Lubricate with mucus Synthesize some vitamins and short-chain fatty acids Form feces
9 Rectum	Hold feces and expel via the anus, which is the opening to the outside of the body

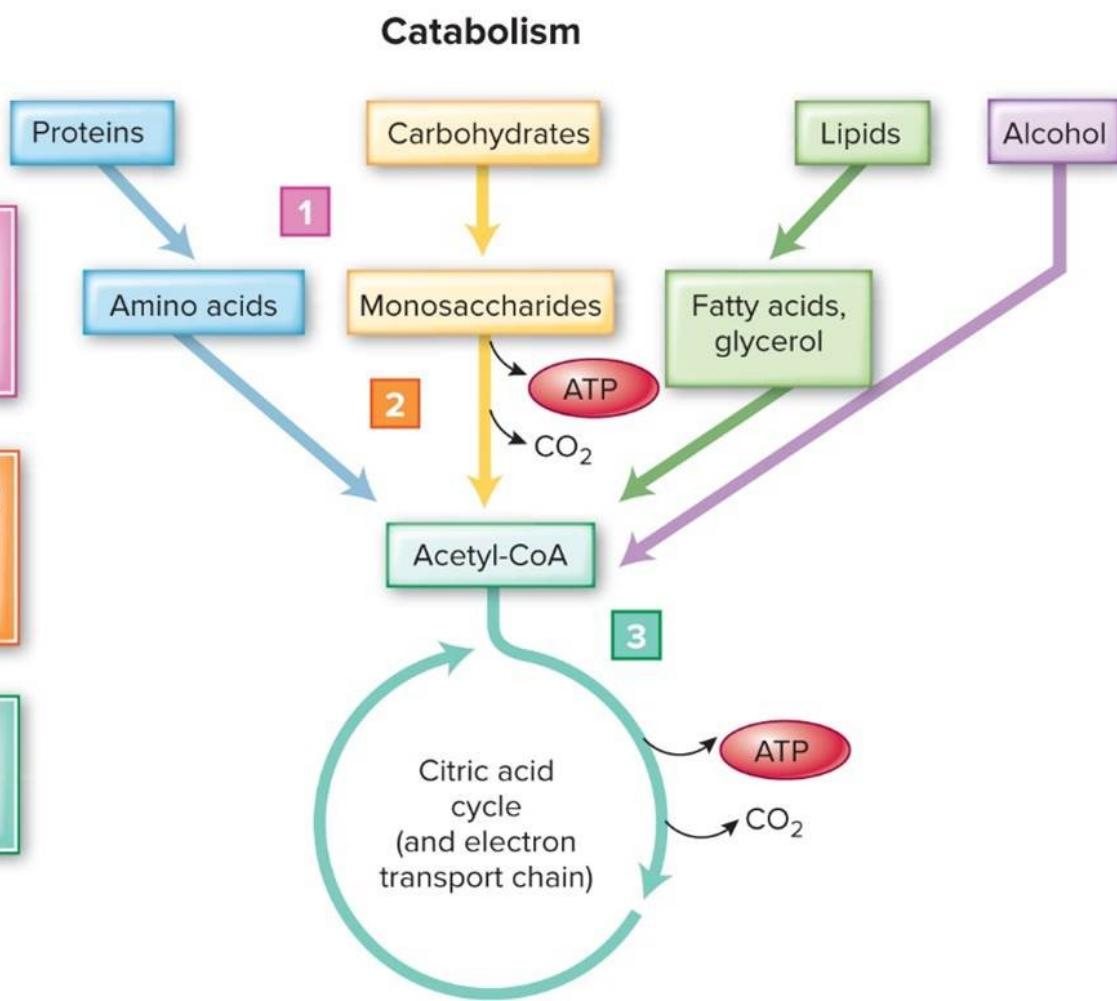
Metabolism

- Metabolism refers to the chemical processes involved in maintaining life
 - Enable us to release energy from carbohydrate, fat, protein, and alcohol
 - Permit us to synthesize new substances and excrete waste products
- A metabolic pathway is a group of reactions that occur in a progression



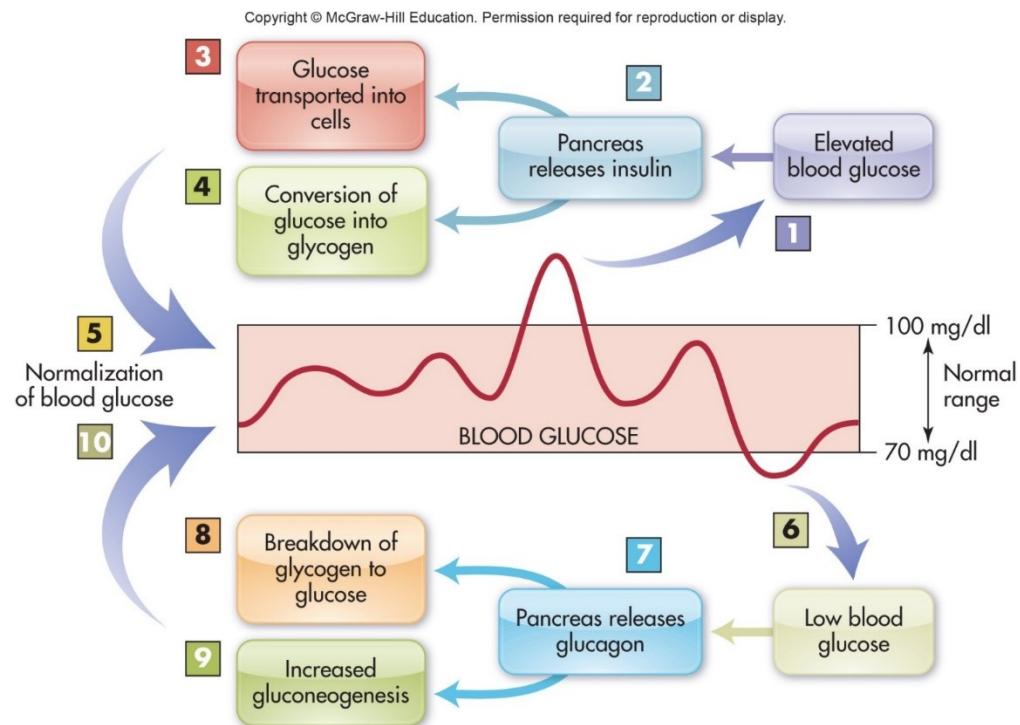
The 3 Stages of Catabolism

- Stages**
- 1 Digestion: breakdown of complex molecules to their component building blocks
 - 2 Conversion of building blocks to acetyl-CoA (or other simple intermediates)
 - 3 Metabolism of acetyl-CoA to CO₂ and formation of ATP



Regulation of Energy Metabolism

- Hormones
 - Low levels of insulin promote:
 - Gluconeogenesis
 - Protein breakdown
 - Lipolysis
 - Increased insulin promotes synthesis of:
 - Glycogen
 - Fat
 - Protein



Regulation of Energy Metabolism

- Many vitamins and minerals are needed for metabolism:
 - Thiamin
 - Riboflavin
 - Niacin
 - Pantothenic acid
 - Vitamin B-6
 - Biotin
 - Folate
 - Vitamin B-12
 - Iron
 - Copper



Fasting and Feasting

- Both affect metabolism.
- The form of each macronutrient and the rate at which it is used varies when calorie supplies are insufficient or exceed needs.



Fasting

- During prolonged fast:
 - Body protein is depleted
 - Fatty acids cannot be used for gluconeogenesis
 - Sodium and potassium are depleted (lost in urine with ketone bodies)
 - Blood urea levels increase



Feasting

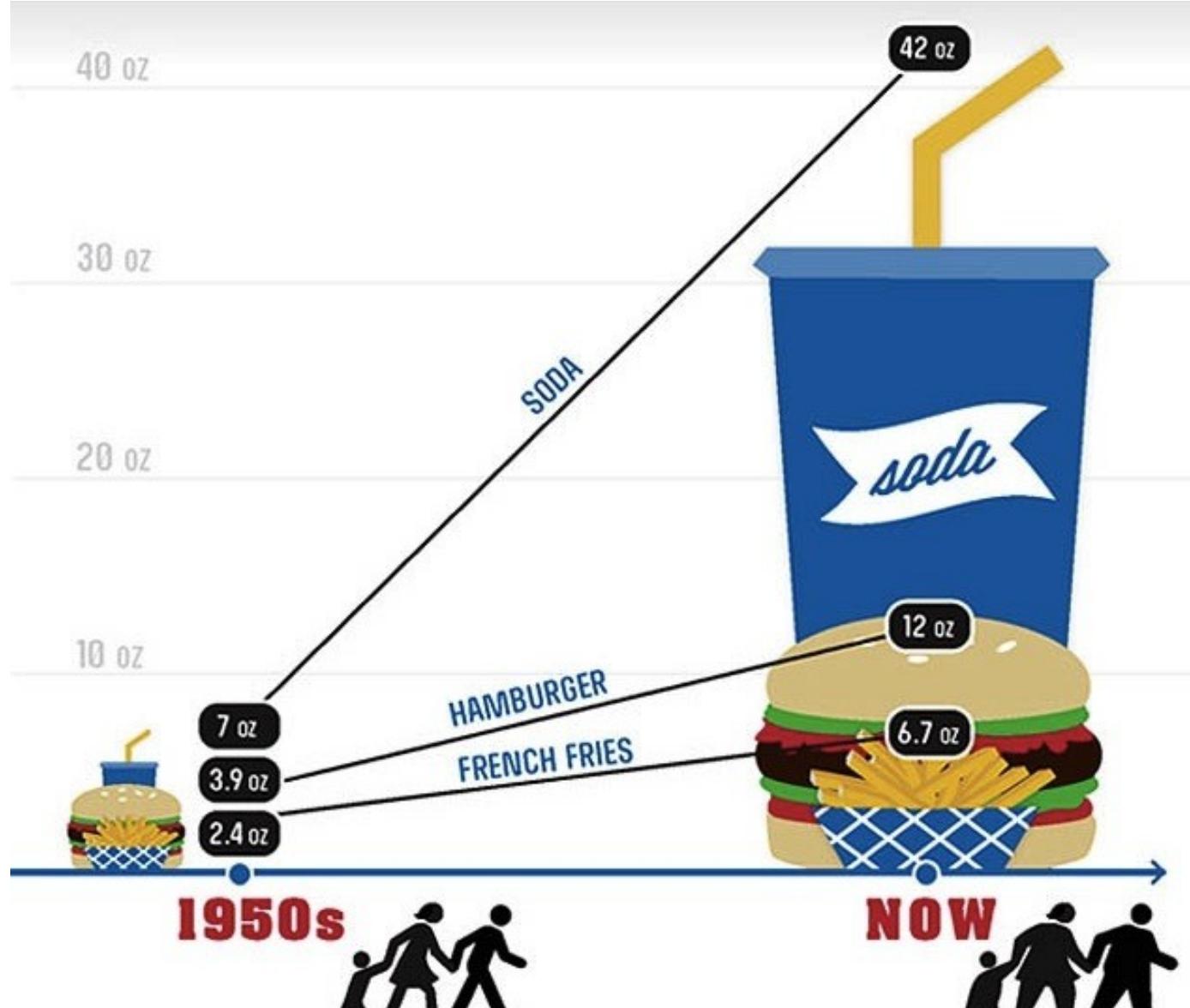
- Feasting's most obvious result is fat tissue.
- Also increases:
 - Insulin production
 - Burning of glucose for energy
 - Production of glycogen
 - Synthesis of protein and fat



What factors contribute to the obesity epidemic?

- Cheap cost
- Availability of palatable food in vending machines
- Drive-up windows
- Social gatherings
- *Supersized* portions
- Physical inactivity
- High glycemic foods
- Sugar and refined grains dominating the food supply



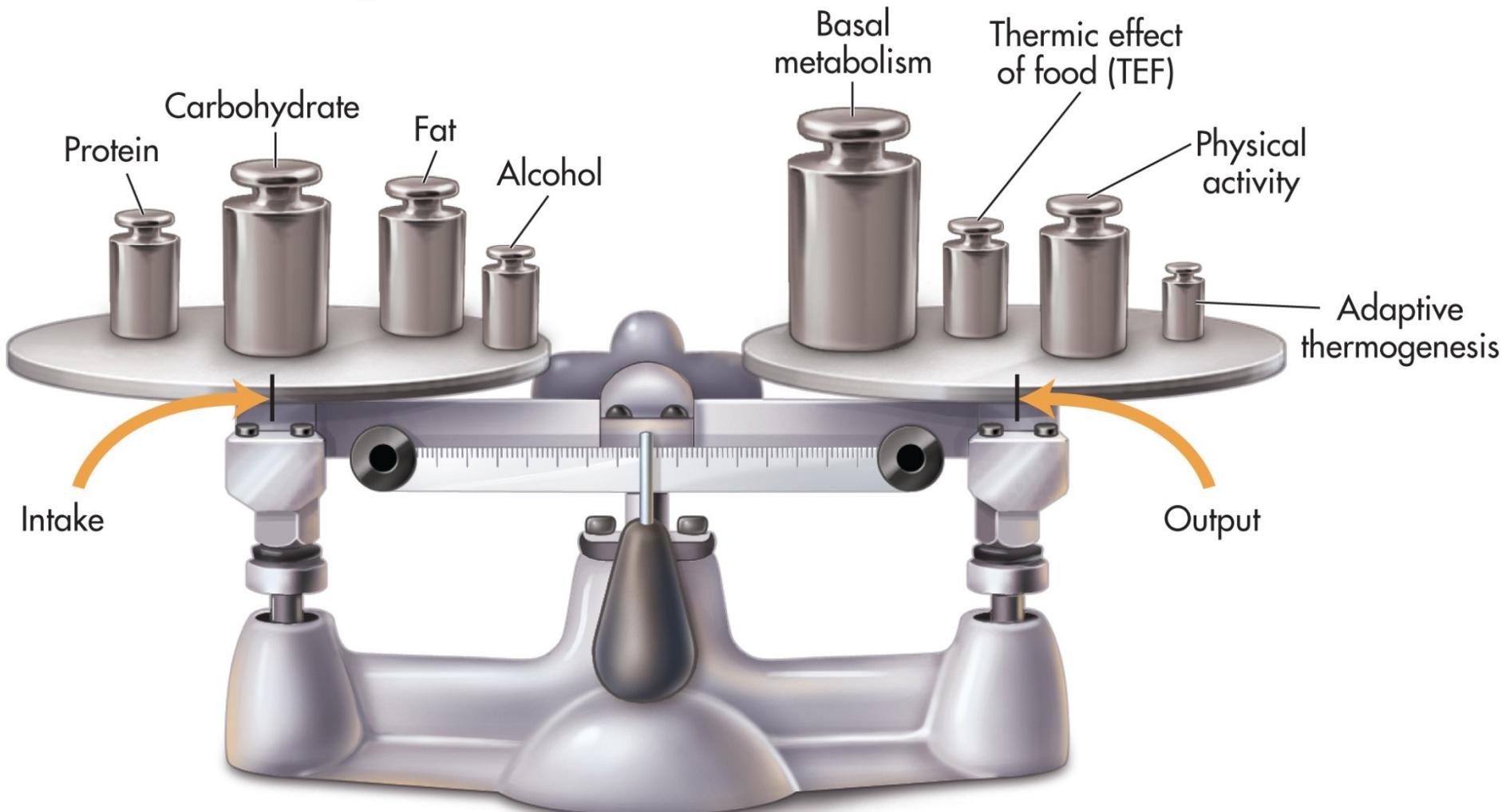


FOR MORE INFORMATION, VISIT MakingHealthEasier.org/NewAbNormal



Energy Intake vs. Expenditure

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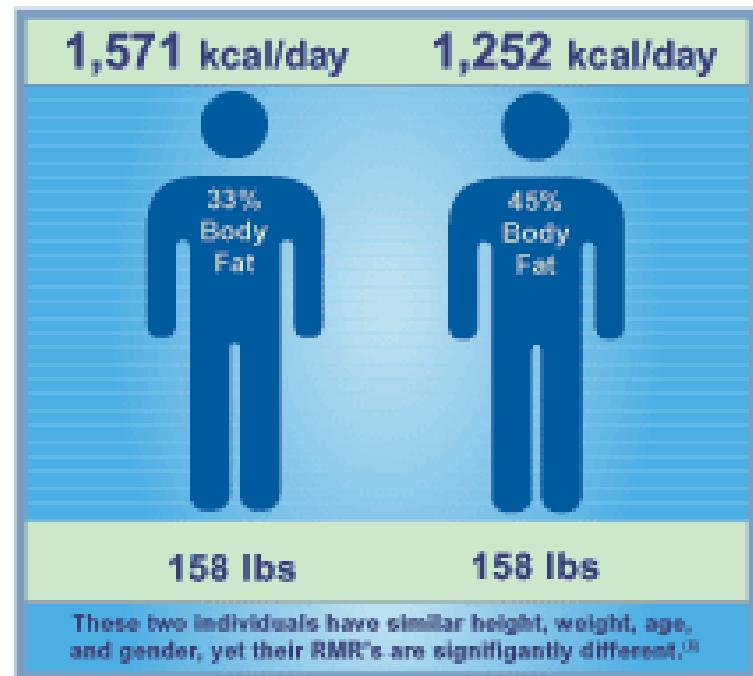
Basal Metabolism

- Minimal amount of calories body uses to support itself in a fasting state when resting and awake in warm, quiet environment
 - ~60-75% of total energy needs
 - Includes energy needed for maintaining heartbeat, respiration, body temperature
 - Varies between individuals
 - Approximately 1 kcal/minute
-



Factors That Influence Metabolism

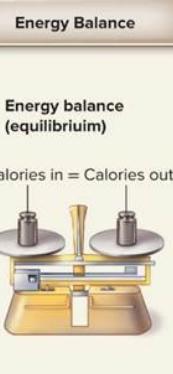
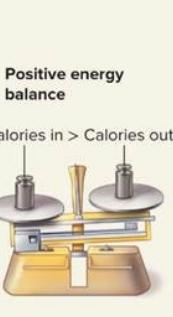
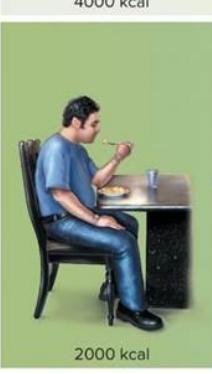
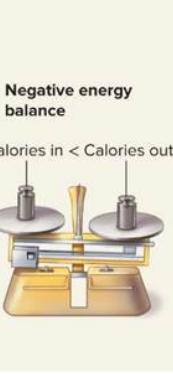
- Body surface area (weight, height)
- Lean body mass
- Gender
- Body temperature
- Thyroid hormone
- Stress, norepinephrine
- Age
- Calorie intake
- Pregnancy
- Use of caffeine and tobacco



What happens when energy is not balanced?

States of Energy Balance

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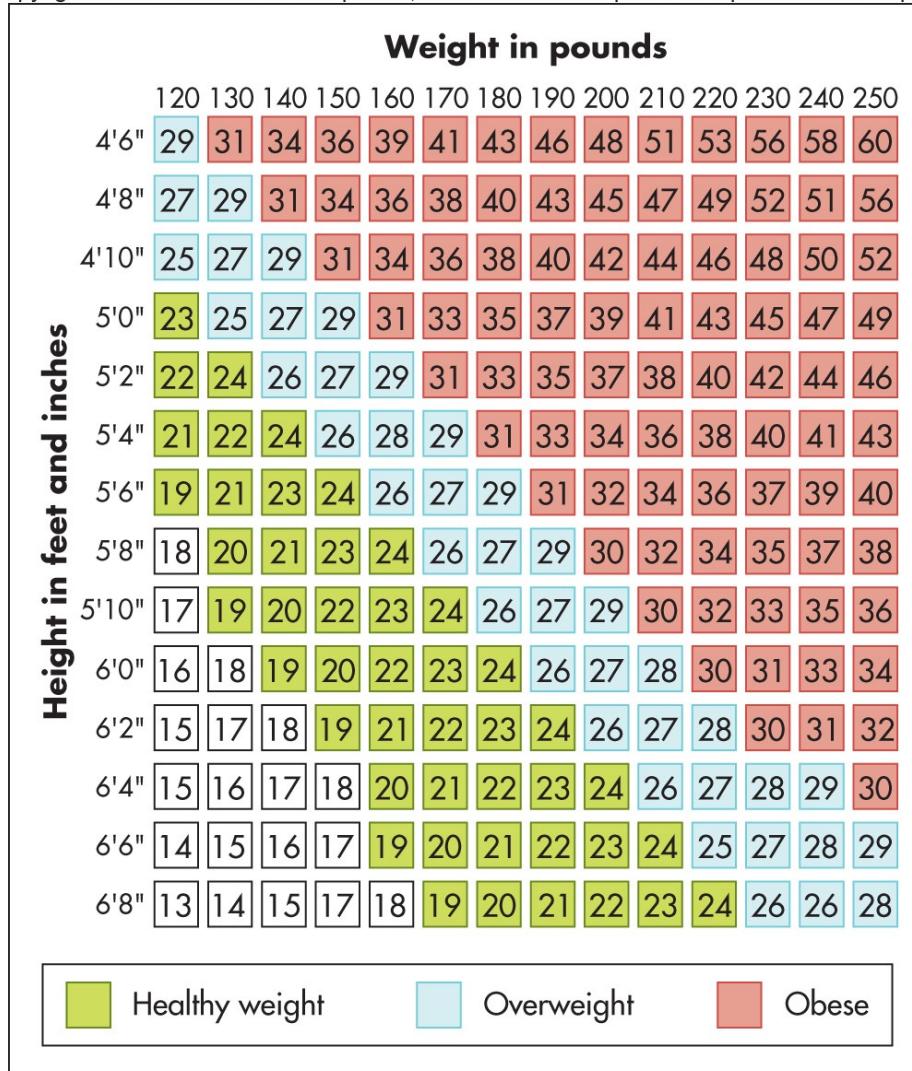
Intake	Output	Weight Change	Energy Balance
 3000 kcal	 3000 kcal	 No change	Energy balance (equilibrium) Calories in = Calories out 
 4000 kcal	 2000 kcal	 Increase	Positive energy balance Calories in > Calories out 
 2000 kcal	 3000 kcal	 Decrease	Negative energy balance Calories in < Calories out 

[Jump to long description](#)

What is defined as a healthy body weight?

Height / Weight Table

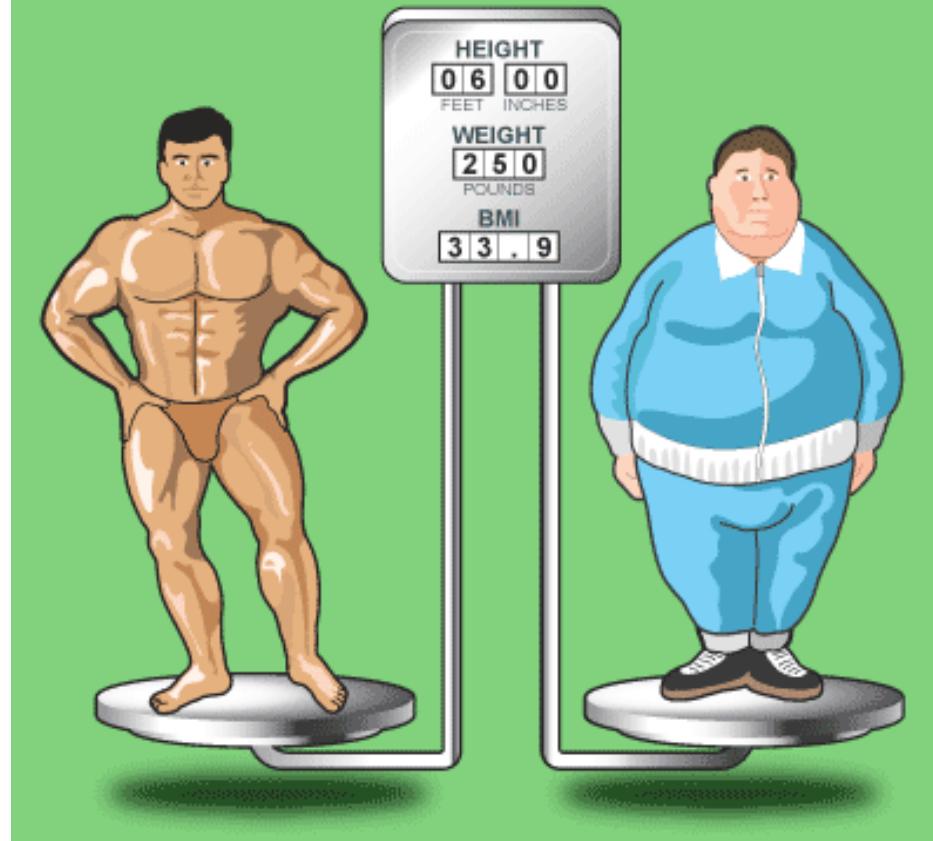
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Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion

BMI Body Comparison

©2005 HowStuffWorks



Lean mass can vary between individuals of the same weight

Body Fat Content

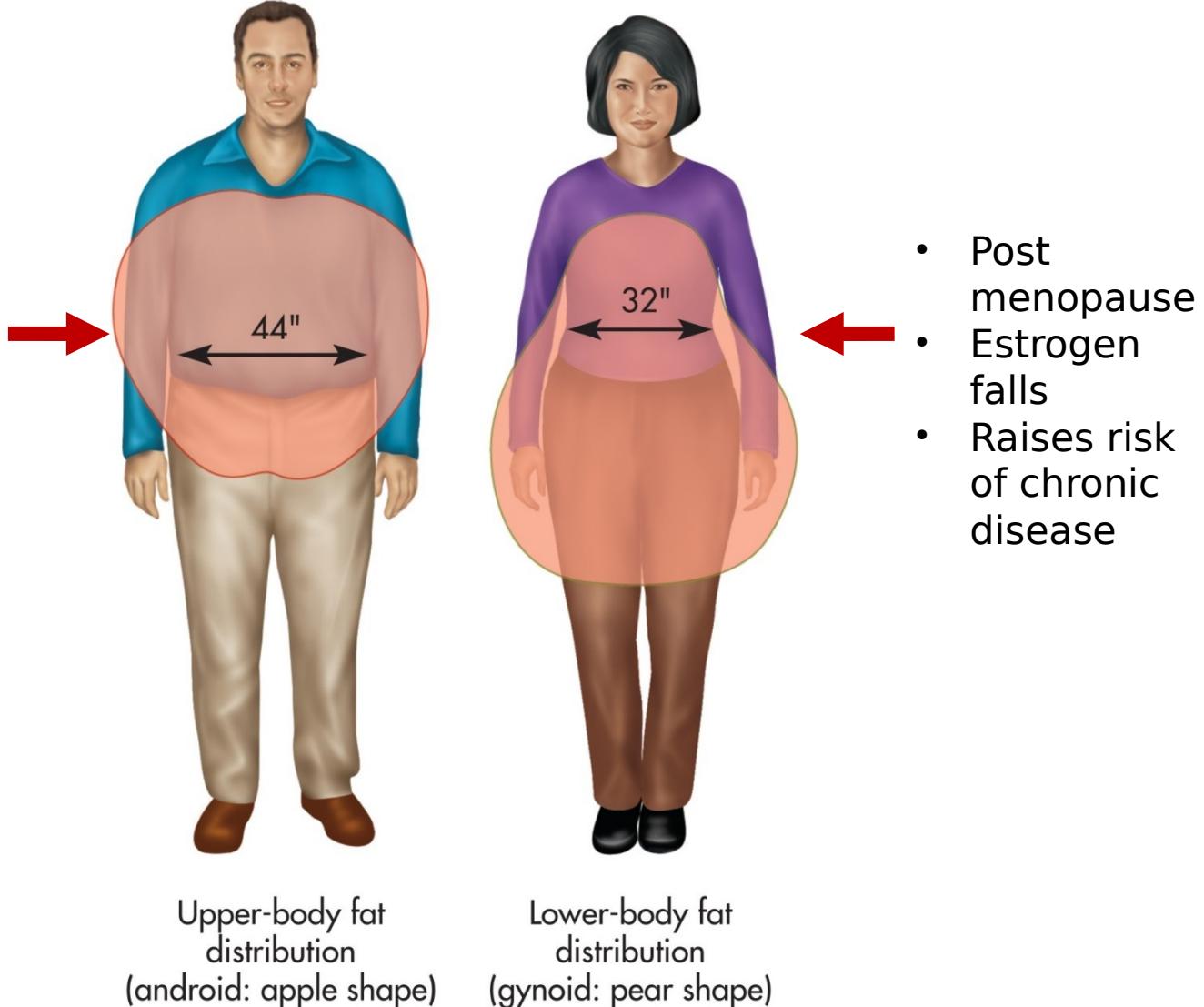
Desirable amounts of body fat:

- Men: 8% to 24%; over 24% considered obese
- Women: 21% to 35%; over 35% considered obese
 - Need more body fat because of reproductive functions

Using Body Fat Distribution to Further Evaluate Obesity

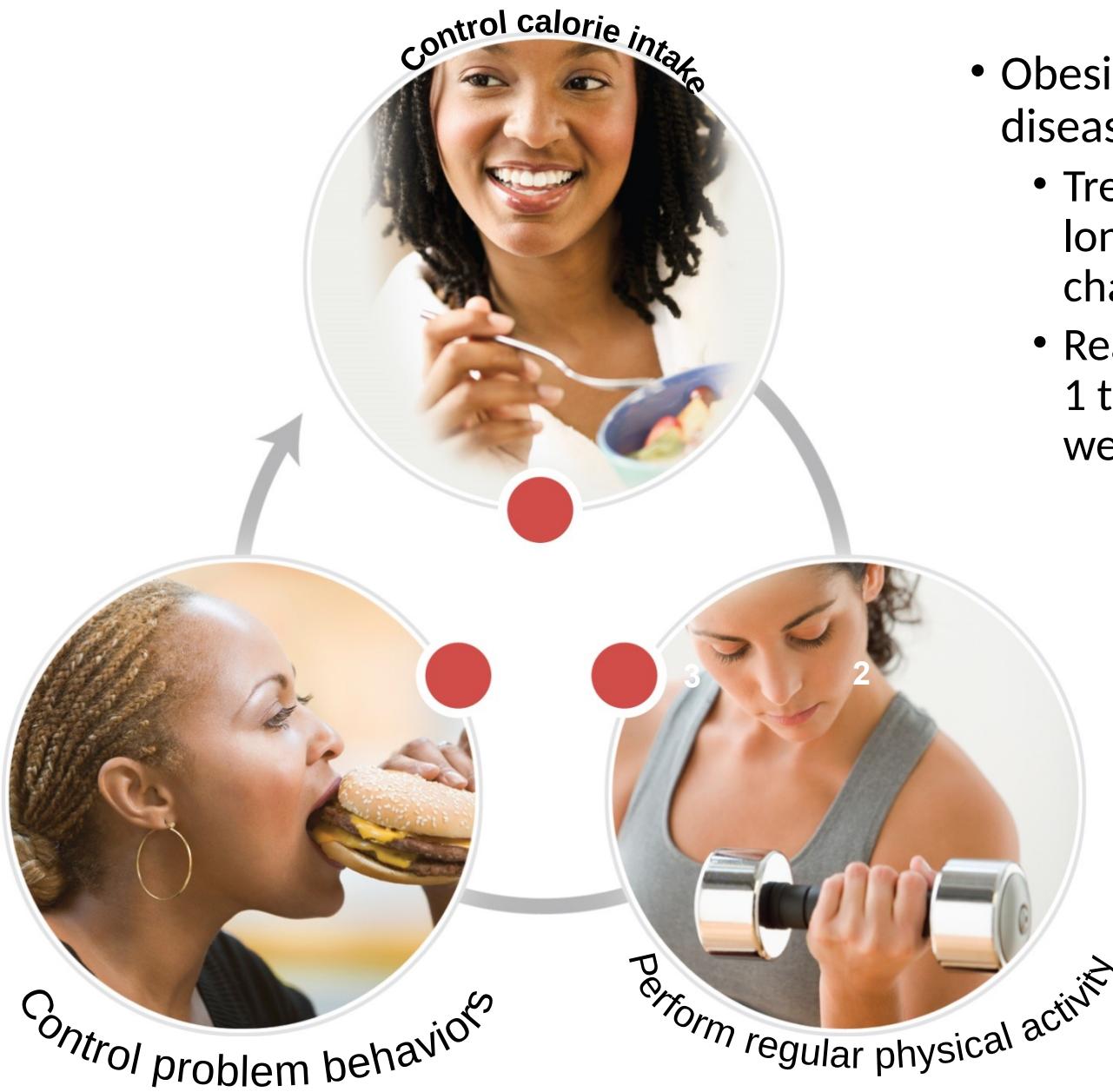
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- Insulin resistance, fatty liver
- Cardiovascular disease, hypertension, type 2 diabetes
- Testosterone and excessive alcohol
- Abdominal fat is released into the liver and promotes inflammation in the body



Weight-Loss Triad

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- Obesity is a chronic disease
- Treatment requires long-term lifestyle changes
- Realistic expectation of 1 to 2 pounds per week for long-term



Vitamins and minerals work together to perform various physiological functions

Essential Nutrients

- Essential: can't be synthesized by body
- To be a vitamin:
 1. Body can't make enough to maintain health
 2. Absence → deficiency that can be cured if vitamin is resupplied in time



Exceptions to Essential Vitamins “Conditional”

- Vitamin A can be synthesized from plant pigments
 - Beta carotene to vitamin A
- Vitamin D can be synthesized by skin in the presence of sunlight
- Niacin can be synthesized from the amino acid tryptophan
- Vitamin K and biotin can be synthesized by gut bacteria to some extent

Vitamins Classification

- Fat Soluble Vitamins

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K



- Water Soluble Vitamins & Choline

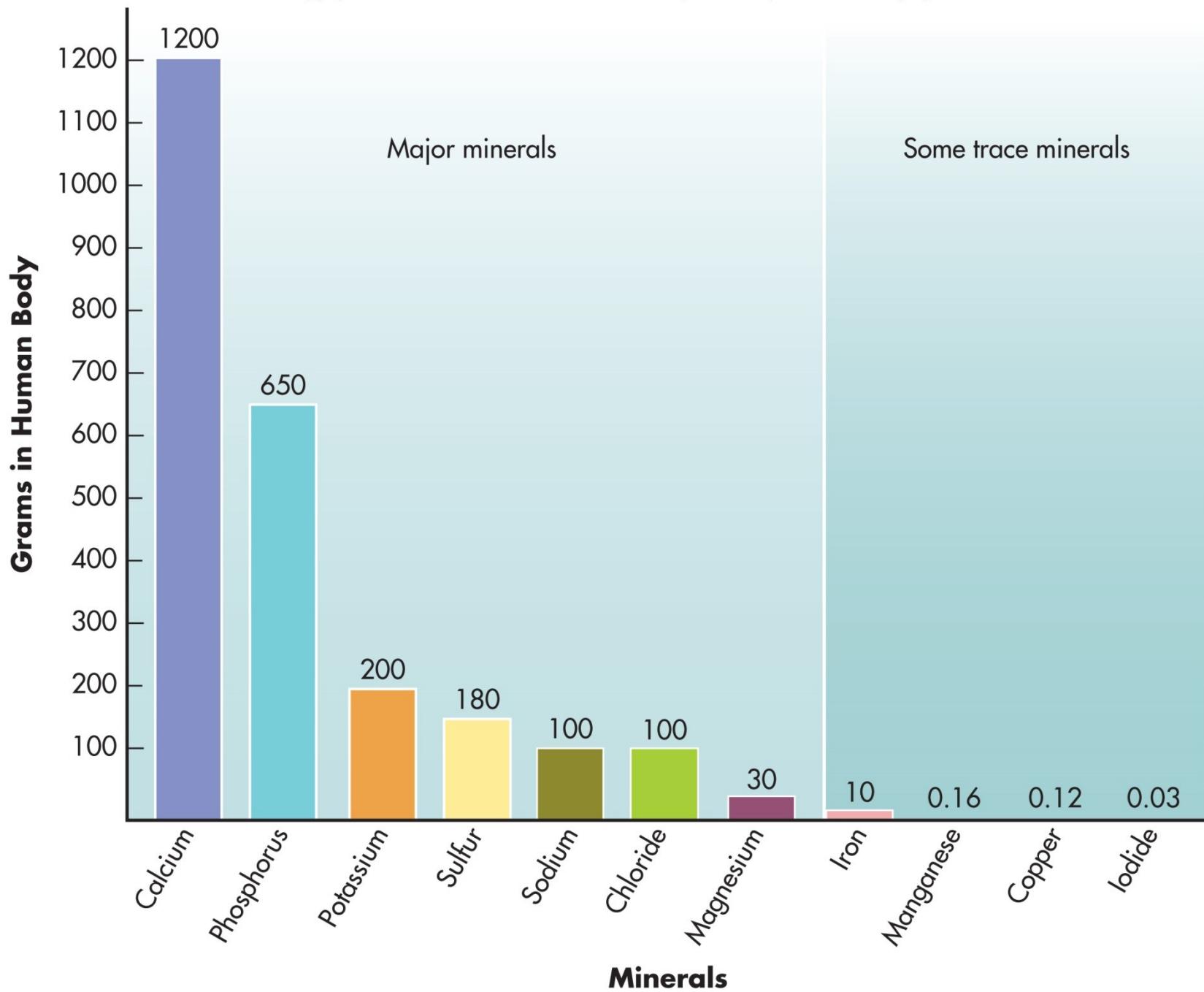
- Vitamin C
- B Vitamins
 - Thiamin
 - Riboflavin
 - Niacin
 - Pantothenic acid
 - Biotin
 - Vitamin B-6
 - Folate (folic acid)
 - Vitamin B-12
- Choline

Do water or fat soluble vitamins pose a greater toxicity risk?



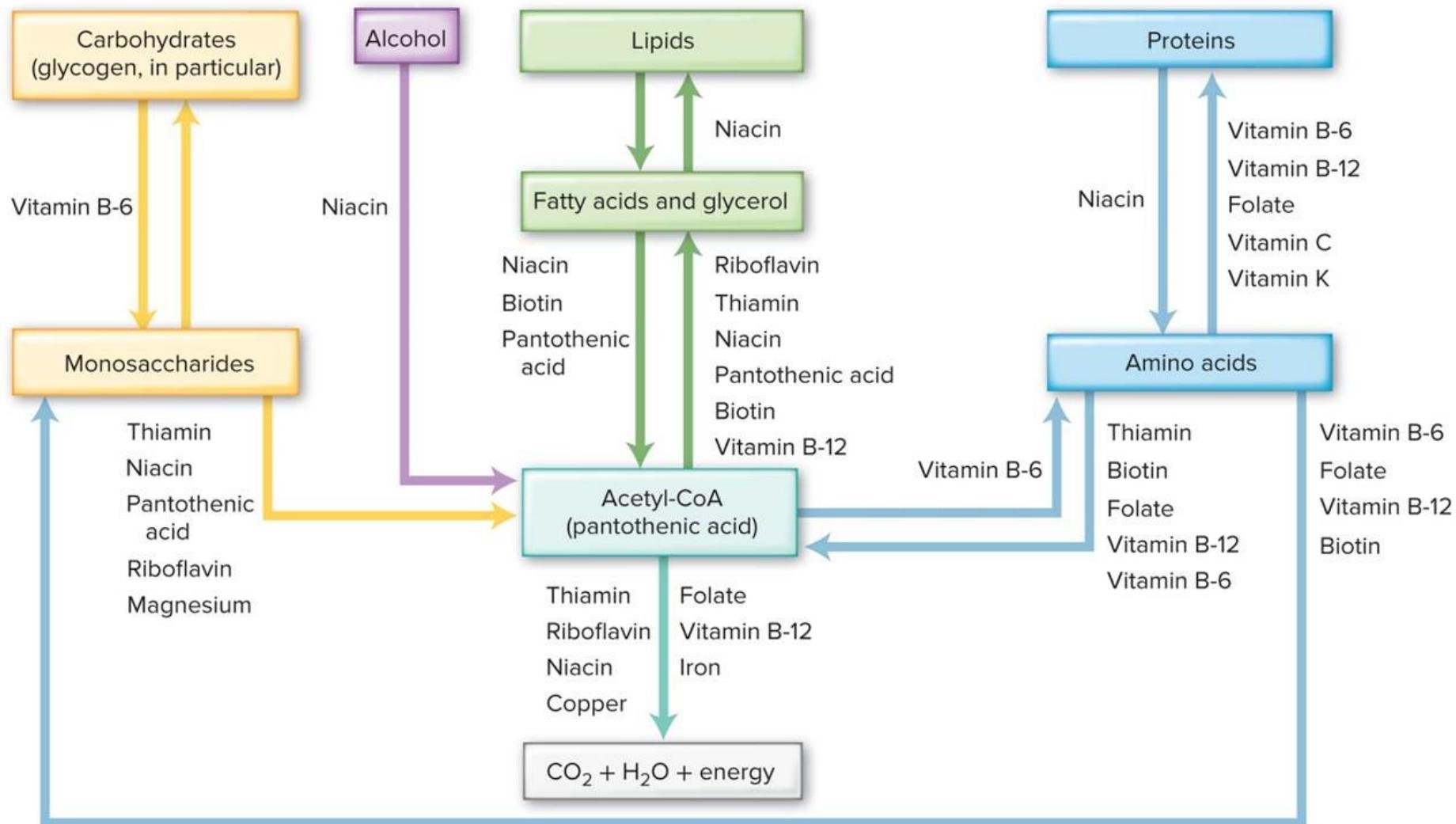
Minerals Overview

- Individual chemical elements: can't be broken down further
- Essential when:
 - Dietary inadequacy → physiological or structural abnormality
 - And addition to diet reinstates health
- Categorized by amount needed in diet each day:
 - **Major:** need 100 mg+ per day
 - **Trace:** need less than 100 mg per day
 - **Ultratrace:** trace amounts in diet, not essential to human health



Vitamins and Minerals Involved in Metabolic Pathways

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Micronutrients - Questions to ask

- Is it fat soluble or water soluble?
- What is the primary function?
- What are one or two food sources?
- What happens in the case of too much (toxicity) or too little (deficiency)?
- How does cooking impact fat and water-soluble vitamins?
- How does digestion impact fat and water-soluble?
 - Diarrhea?
 - Fat malabsorption?

Lifecycle Nutrition



The Growing Infant

- Rapid growth rate
- Weight
 - Doubles by 4–6 months
 - Triples by 1 year
- Length
 - Increases by 9–11 inches in the first year
- Nutrients needed to support proper growth
 - Calories, protein, calcium, iron, zinc, and other nutrients
- Inadequate nutrition (including fat) can inhibit growth
 - Overnutrition more prevalent in North America



Assessment of Growth

- Growth charts
 - Height and weight correspond to a percentile
 - 50th percentile is considered average
- Head circumference
 - Brain growth is fastest in infancy
- Over- and underfeeding
 - Overfeeding increases number of adipose cells
 - Underfeeding may affect organ development
 - Unwise to restrict diet



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Failure to Thrive

- About 5% to 10% infants and children do not grow as expected
- Failure to thrive is defined as decelerated or arrested physical growth and is associated with abnormal growth and development.
- Can have specific medical cause (heart issues, infection)
- 80% have no apparent disease
 - Poverty, food insecurity
 - Poor parent-infant interactions
 - Parent inexperience with infant feeding
- Infants need
 - Physical contact, eye contact
 - Proper nutrition without restrictions



Vitamin Needs

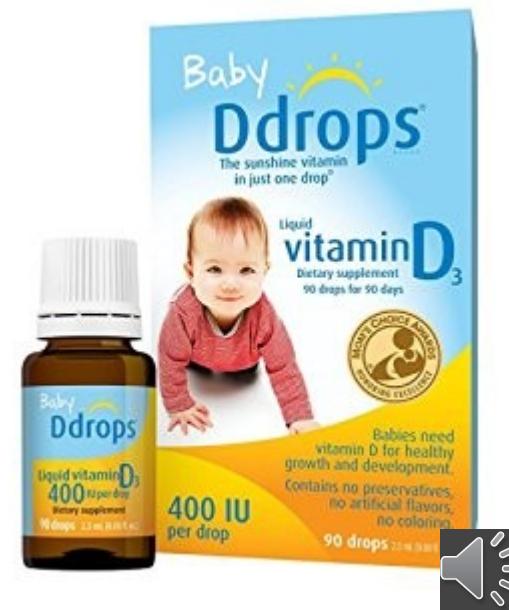
- Vitamin K

- Routinely given as injection at birth
 - Intestinal bacteria then begin to synthesize

- Vitamin D

- All infants and children should consume 400 IU/day
 - Supplements for breastfed infants, formula-fed infants who consume < a quart/day

- Vitamin B-12 supplements for breastfed infants of vegan moms



Mineral Needs

- Iron stores depleted by 4 - 6 month of age
 - Iron-fortified formula for bottle fed infants
 - Iron supplementation for breast fed infants until solid foods introduced
- Introduction of iron-containing solid foods ~ 6 months
- Fluoride supplement after 6 months if not provided by tap water, toothpaste, food



Nutrients of Concern - Toddlers

Iron

- Iron deficiency anemia most likely between 6 to 24 months
 - Poor oxygen supply to cells: decreased stamina, compromised learning ability
- Iron-fortified cereals, lean meats
- Avoid over-consumption of milk (calcium/iron interaction)

Calcium

- Vital to maximize bone mass during childhood and adolescence
 - Periods of rapid bone growth and mineralization
- Dairy
 - Milk (cow or plant milk)

Sodium

- Toddlers consume ~ 1000 mg/day more than needed
- Reduce sodium intake by
 - Limiting salt added during cooking
 - Limiting processed foods, fast foods
 - Rinsing canned vegetables



© Andrew Oaney/age fotostock



School-Age Children

- Survey of U.S. schoolchildren showed:
 - 40% ate no vegetables, except for potatoes or tomato sauce
 - 20% ate no fruit
 - Less than 20% girls consume adequate calcium
- Use My Plate for diet planning
 - Limit sat fat, trans fat, sugar and sodium
 - Increase in serving size as child ages
- Schools support sound nutrition
 - 2010 Healthy Hunger-Free Kids Act
 - School lunch provides at least 1/3 of the DRI
 - Nutrition education



The Teenager

- Rapid growth spurt
 - Between ages 10-13 in girls
 - Between ages 12-15 in boys
 - Girls gain ~10 inches
 - Boys gain ~12 inches
 - Girls gain fat and lean tissue
 - Boys gain lean tissue
- Increase in appetite
- Peer pressure
- Greater responsibility for food choices
- Don't often think about long term health

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Nutrients of Concern

Calcium and Vitamin D

- Needed to maximize bone mineralization
- Less than 10% of adolescent girls and 25% of boys meet calcium intake recommendations (1300 mg/day)
- 1 in 5 children deficient in vitamin D
- 3 servings/day of dairy or nondairy alternative

Iron

- ~ 10% of teens have low iron stores or iron deficiency anemia
- Leads to fatigue and decreased concentration
- Lean meats, fortified grains
- Menstruating teenage girls may need multivitamin with iron



Graying of America

- 85+ fastest growing population
 - 2050 will reach 19 million
- People over 65:
 - Account for 13% of the US population
 - Account for ~25% of all prescription medication
 - Account for 40% of all hospitalizations
 - Account for 50% of federal health budget
- 80% or more have chronic conditions, such as cardiovascular disease, type 2 diabetes, hypertension, and osteoporosis
- Many can be prevented or managed



Usual and Successful Aging

- Body cells age, no matter what
- Speed of aging largely within our control:
 - **Usual aging** –increasing fatness, decrease lean body mass, unhealthy lifestyle influenced
 - **Successful aging** – declines that occur only because we grow older, healthy lifestyle throughout life
- **Compression of morbidity**, greatest number of healthy years, and fewest years of illness
 - Achieved through consistent healthy lifestyle



Life Expectancy vs Life Span

- **Life Span:** maximum number of years a human can live
 - Record
 - 122 years (woman)
 - 116 years (man)
- **Life Expectancy:** Number of years an average person, born in a specific year, is expected to live
 - In North America:
 - 76 yrs for men
 - 81 yrs for women
 - Only 64 “healthy” years



Nutrients of Concern

- Many older adults fail to consume adequate water
 - Results in constant state of dehydration, electrolyte imbalance
 - Disorientation, dizziness, fatigue
- Causes?
 - Fading sensation to thirst sensation
 - Intentional to reduce frequency of urination
 - Medications can increase fluid output
 - Diuretics



Nutrients of Concern

- Calcium and Vitamin D:
 - When low?
- Iron:
 - Due to blood loss, ulcers, hemorrhoids, impaired absorption
- Magnesium:
 - Due to limited intake, bone loss, weakness, mental confusion
- Sodium:
 - Usually excess is issue
- Folate, B-6 and B-12:
 - B-12 absorption declines with age
 - Some may require supplements
- Vitamin E, phytonutrients



polypharmacy

,pälē'färməsē/

noun

the simultaneous use of multiple drugs by a single patient, for one or more conditions.

- Half those 65+ take several medications daily
 - May affect appetite – decreased taste/smell acuity, increase nausea
 - Some alter nutrient needs, utilization:
 - Antibiotics kill bacteria, limiting vitamin K synthesis
 - Iron supplements interfere with zinc and copper
 - Diuretics leach potassium out of the body
 - Long-term aspirin use can lead to anemia



Decline of Health in Older Adults

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Social isolation; perhaps spouse has died.

Loses interest in food: diet deteriorates.

Poor diet leads to weakness; this increases a feeling of isolation and abandonment.

Further isolation can then decrease desire for self-care.

Health declines visibly; weakness remains.

Self-care is seriously hampered.



Is There a Fountain of Youth?

- Avoid smoking and excess alcohol
- Maintain weight throughout adulthood
- Consume many fruits and vegetables
- Daily physical activity
- Challenge their minds
- Positive outlook
- Close friendships
- Marriage - especially men
- Get good sleep
- Higher HDL-C levels
- [http://www.ted.com/talks/dan buettner how to live to be 100](http://www.ted.com/talks/dan_buettner_how_to_live_to_be_100)

