
Nutrition

The Basis of Healthy Living

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II. Caloric need

1 food Calorie = 1000 calories = 1 kcal

Nutrient		U.S.	% of calories	%Goal
Protein	4 Cal/g	80- 120 g	10-15	12
Carbohydrate	4 Cal/g	300-400	34-45	58
Fat	9 Cal/g	100-150	30-50	30

- **Basal Metabolic Rate (BMR) - kcal needed for maintenance of life**
- **BMR = weight x 10**

I. Classes

- A. **Carbohydrates - stored**
- B. **Lipids (fats) - stored**
- C. **Proteins - not stored**
- D. **Vitamins - not produced by the body, some stored, some not**
- E. **Minerals - elements other than C,H, O, N**
- F. **Water**

Digestion

Carbohydrates

- Mouth - salivary amylase (ptyalin) causes starches to hydrolyze to maltose
- Stomach - no enzymes due to acidity
- Intestinal tract - acidity is neutralized by secretion from pancreas, other pancreatic juices hydrolyze poly and disaccharides to mono saccharides

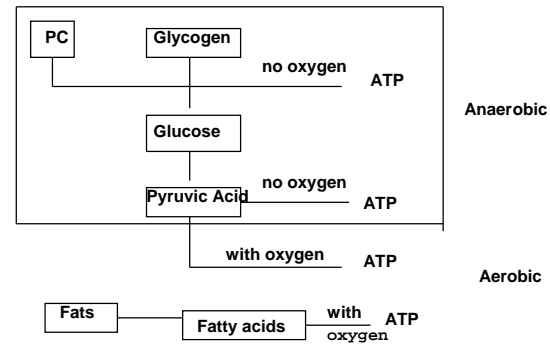
Fats and Oils

Intestinal tract - bile salts emulsify and allow other enzymes to hydrolyze fat and oil to fatty acids and glycerol

Protein

- Stomach - pepsin begins hydrolysis
- Intestinal tract - the hydrolysis is completed to amino acid fragments

After absorption through the intestinal walls the water soluble products are sent to the liver for storage and conversion. Glycogen is assembled from excess glucose, fatty acids are sent for storage or prepared for metabolism, and amino acids are assembled into enzymes. The liver is the central nutrient bank of the body.



The anaerobic series of complex reactions is called the Embden-Meyerhof pathway. The aerobic series is called the Krebs cycle.

Energy Transfer

Energy to drive muscles comes from

$ATP \Rightarrow ADP + P + \text{energy}$

Thus ADP must be replenished

$ADP + P + \text{energy} \Rightarrow ATP$

How do we get the energy to make ATP?

Anaerobically (without oxygen)

Aerobically (with oxygen)

III. Proteins

- Needed for structure, enzymes, hormones, transport proteins, antibodies, nucleic acids**
- 10 amino acids essential, meat is a complete protein, vegetables are not**
- Few problems in U.S. diet**
- Kwashiorkor - protein deficiency disease**

IV. Fats

- A. Foods contain triglycerides, phospholipids (a complex lipid), and steroids (cholesterol)**
- B. The only essential fatty acid is *linoleic acid*, an unsaturated C₁₈ fatty acid**
- C. Uses**
 - energy
 - insulation and padding
 - building blocks for other molecules
 - store vitamins A, D, E, K

D. Problems

- Obesity
- Too much fat and too little carbohydrates lead to ketosis - too many ketones from breakdown of fats
- Hydrogenation of oils to form margarine produces trans fatty acids in triglyceride; natural fatty acids are cis. Trans acids are not broken down well and tend to let cholesterol levels increase in the blood. Cis acids tie up cholesterol.

E. Fat substitutes

- Simplese, Olestra, emulsified starch, emulsified protein

V. Carbohydrates

- A. Energy molecules.**
- B. Excess digestible carbs are stored as glycogen, may be converted into fat. Indigestible carbs serve as roughage.**
- C. Problems**
 - Lack of undigestible fiber contributes to diverticulitis, rectal cancer
 - Too much digestible carbs (especially refined sugar) can lead to obesity and diabetes - among others. One type of diabetes is caused by insufficient insulin production by the pancreas; another is caused by excess fat preventing receptors from using insulin appropriately.
 - Refined sugar and flour have removed coexisting natural nutrients and fiber - a dietary problem.

VI. Minerals

- A. Elements other than C, H, O, N**
- B. Major minerals - Ca, P, Mg**
- C. Electrolytes - K, Na, Cl**
- D. Trace - Fe, I, Zn, Cu, Mn, Mo, Se, Cr, F, Co, Ni, V, Si, Sn, As, Cd**
- E. Uses**
 - Enzyme components
 - Structural components
 - Electrolyte balance (Ca/P = 2.5/1) (K/Na >1/1)
Problems result with excess Na - high blood pressure, water retention
 - Transport

VII. Vitamins

- A. Organic components that are needed in small amounts and function as catalysts**
- B. Not synthesized, must be ingested, and are absorbed directly without digestion.**
- C. Fat-soluble = A, D, E, F, K**
These are stored and should not be ingested in megadoses.
 - A - prevention of infection by bacteria by maintenance of mucous
 - D - absorption of calcium
 - E - antioxidant with varied uses; involved in proper functioning of the kidneys, lungs, liver, genitals; protects integrity of cell membranes

VIII. Why Should You Eat A Balanced Diet?

- **Thousands of virtually unknown chemicals “phytochemicals” are produced by plants in small quantities. These chemicals are natural anticarcinogens and provide one of the best advantages of the balanced diet. (*Newsweek*, April, 94)**
- **Examples**
 1. Tomatoes - keep carcinogens from forming
 2. Broccoli - boot carcinogens out of cells
 3. Cabbage - disarms carcinogens
 4. Garlic and onions - protect against stomach cancer
 5. Soybeans - prevent tiny tumors from growing
 6. Hot chili peppers - keep carcinogens from binding to DNA

- F - essential fatty acid for production of prostaglandins
- K - blood clotting
- D. Water-soluble = B, C**
These are not stored, must be ingested daily.
Much fewer problems with megadoses.
 - B complex- growth and energy production
 - C - antioxidant; involvement in the immune system through production of interferon

IX. Food Additives

- A. Maintain or improve nutritional value**
 - Add iodide to salt
 - Add Vitamin D to milk
 - Add Vitamin A to margarine
 - Add Vitamin C to fruit drinks
 - Add Vitamin B to cereals

B. Maintain freshness, color, flavor

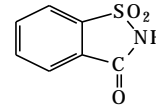
1. Tie up metal ions that catalyze decomposition reactions- sequestrants (EDTA, citric acid)
2. Antioxidants - Keeps fats and oils from turning rancid (BHA, BHT, ascorbic acid, lecithin)
3. Prevent spoilage caused by molds, bacteria, fungi, etc. (sodium nitrite, salt, sodium benzoate, sodium propionate)

C. Processing or preparation aid

- Emulsifiers, stabilizers, thickeners (carrageenan and other polysaccharides, cholic acid in egg yolks, polysorbate 80)
- Hygroscopic agents (calcium silicate, silicon dioxide, magnesium silicate)
- Retain moisture (glycerine in candy)

E. Sweeteners

- Sucrose
- Glucose
- Sorbitol
- Saccharin



D. Make foods more appealing

- Colors - most are synthetic and are produced from crude oil
- Flavorings - oil of wintergreen, peppermint, orange, lemon, etc.
- Flavor enhancer - monosodium glutamate

- Aspartame

