Chapter One

**Nutrition**: how the body uses food

- Science of food and the nutrients they contain, their actions in body (digestion, absorption, transport, metabolism, excretion)
- Social, economic, cultural and psychological implications of foods and eating

What’s a nutrient?

Chemical substances obtained from food and used in the body to provide energy, structural materials, and regulating agents to support growth, maintenance, and repair of body’s tissues

Carbohydrates, lipids, protein – energy (calories); macronutrients

Vitamins, minerals – no calories; micronutrients

Essential nutrient --> ones that your body doesn’t make (must get from diet)

<table>
<thead>
<tr>
<th>Inorganic nutrients</th>
<th>C</th>
<th>H</th>
<th>O</th>
<th>N</th>
<th>minerals</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Minerals</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>- Waters</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Organic nutrients</th>
<th>C</th>
<th>H</th>
<th>O</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Carbohydrates</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Lipids (Fats)</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>- Proteins</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>- Vitamins</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Vitamins

- 13 different vitamins including fat soluble (E, D, A, K) and water soluble (B & C)
- No calories but vital to life
- Organic (carbon containing)

Minerals

- Do not provide calories but essential for functions:
  - Structure of bones and teeth
  - Fluid and electrolyte balance in body
  - Synthesis of hemoglobin (iron)
  - Inorganic
  - Indestructible

Water

- Indispensable
- Transports nutrients
3.4 The Health and Regulation of the GI Tract

Lumen (middle of tube like structures)

Enterocytes: name of cells in stomach

Simple diffusion: when you have a membrane; stuff goes from high concentration to low until equilibrium is reached

Facilitated diffusion

If we use ATP to pump nutrient (low to high) = active transport

Gastrointestinal Microbes

A healthy GI tract is home to a community of some 100 trillion microbes

Microbes: microscopically small organisms including bacteria, viruses, fungi, and protozoa

Microbiota: collection of microbes found in the GI tracts; sometimes called the microflora or gut flora

The GI microbiota changes in response to diet

Fibers and some other food components are called prebiotics b/c they encourage growth and activity of bacteria

Some foods contain probiotics, live microbes that change conditions in GI tract in ways that seem to benefit health

Prebiotics: food components that are not digested by human body but are used as food by the GI bacteria to promote their growth and activity

Probiotics: living microorganisms found in foods and dietary supplements that, when consumed in sufficient quantities, are beneficial to health

Hepatic (Liver) Portal Circulation

Once through the intestinal wall (into blood) products of absorption are sent to the liver for filtering

Chapter 4

The Carbohydrates

- source of energy: 4 kcals/gram
- all our cells can use carbohydrate (glucose) for fuel
- (fats and meat don’t give us carbs) **

Simple Carbs

A. Monosaccharides (C6H12O6)
a. Glucose  
b. Fructose  
c. Galactose  

B. Disaccharides  
a. Maltose (glucose + glucose)  
b. Sucrose (glucose + fructose)  
c. Lactose (glucose + galactose)  

Ose = sugar  
Ase = enzyme  

Complex Carbohydrates  
- Chains of glucose molecules  
  o Oligosaccharides  
  o Polysaccharides  
    ▪ Glycogen (mammal produced)  
      • Contains hundreds of glucose units in long, highly branched chains  
    ▪ Starches (plant produced)  
      • Contains hundreds of glucose molecules in either occasionally branched chains (amylopectin) or unbranched chains (amylose)  
    ▪ Fibers  
      • Undigestible carbohydrates  

Liver & muscles store glycogen  

CHO Recommendations  
- 55-60% of total daily calories  
- Dietary Guidelines  
  o 5-9 servings/day – fruit & veg  
    ▪ Fresh, frozen, canned, dried  
    ▪ Add legumes to soups, salads, casseroles  
  o 6-11 servings/day – grains, breads, cereal  
    ▪ Whole grains  
- Limit pure refined sugar: have many kcal, but no other nutrients  
- Eat whole fruit rather than juice  
- Eat raw veggies and fruits  

In your body, carbs are used for:  
1) Energy  
2) Stored as glycogen  
3) If there are still excess carbs in your diet, then the rest is converted to and stored as fat
Chapter 6 – Proteins

General Characteristics

- Major constituent of the body (1/5 of body weight)
- Tens of thousands of different proteins in the human body
- Composed of amino acids that are linked together
- Amino acids (and thus proteins) contain: carbon, hydrogen, oxygen, and NITROGEN
- Dietary protein provides 4kal/g

- Proteins are made from 20 different amino acids, 9 of which are essential
- The sequence of amino acids in each protein determines its unique shape and function
- Each amino acid has an amino group, an acid group, a hydrogen atom, and a side group
  - It is the side group that makes each amino acid unique

Animal proteins have all 9 essential amino acids
Most plant proteins are deficient in at least 1 essential amino acid

** Complementing proteins: mixing different types of plant proteins
If tyrosine is not consumed in diet, phenylalanine can be used to make it
If dietary phenylalanine is not adequate, then tyrosine becomes essential (must be provided in diet)

Amino acids are held together by peptide bonds.
Polypeptide = protein
Goal of protein digestion is to take polypeptide and break it down into individual amino acids.

Protein structure

- Chain of amino acids
  - Sequence of amino acids determines shape
  - Shape determines function

\[ \text{Amino acids} \]
Denaturation of Proteins

- Denaturation:
  - 3D structure is altered
  - Function is lost
- Causes:
  - Heat
  - Acid
  - Alkaline
  - Enzymes
  - Oxidation

Functions of Protein

- Structure
- Enzymes (all enzymes are proteins)
- Hormones
  - Insulin and glucagon \(\rightarrow\) peptide hormone
- Antibodies
  - Fight off disease/bad bacteria in your body
- Fluid balance
- Acid-base balance
- Channels and pumps
- Transport

Protein Function: Acid-Base Regulators

- How acidic or basic the blood (or other solution) is depends on the concentration of H+ and OH-
- Proteins act as buffers by accepting or donating H+ and OH-
  - Concentration of H+ and OH- in the blood will not change= the pH will not change
Ergogenic aids
Work producing
• Performance enhancers

NO FDA approval
Structure-function claims
- Can’t mention specific disease
- No FDA approval

Chapter 8 – Energy Balance and Body Composition

Energy balance
Energy intake (macronutrients + alcohol) vs. energy output
Energy output → 1) BMR: cal needed to keep you alive (heart, brain, lungs, immune
2) Physical activity
3) Thermic effect of food (energy we need to digest, absorb, transport food)

Protein – most satiating nutrient.

Calorie = energy = heat
Calorie is the amount of energy it takes to raise 1 cc of water, 1°C

Measuring the kCalories we expend
Direct calorimetry measures the heat energy produced
Indirect calorimetry measures the amount of oxygen consumed and CO2 production

For women 19 years and older:
EER = [354 – (6.91 x age)] + PA x [(9.36 x wt) + (726 x ht)]

Weight in Kg: divide pounds by 2.2
Height in Meters: divide inches by 39.37

Use PA factor from chart (p. 257)
[354 – (6.91 x 18)] + 1.12 x [(9.36 x 63.6 ) + (726 + 1.65)]
1,624
Viability: gestation at which a child born has a chance to survive ex-utero

Maternal Weight

Recommendation: 25-35 pounds gain
- 1 pound/month for first 3 months
- 1 pound/week for last 6 months

If pregravid (before pregnancy) weight is 10% below desirable or 20% above → higher risk pregnancy

Critical Periods

Times of rapid development and cell division
- Finite periods of fetal development
- If anything gets ‘screwed up’ during this time, it can cause permanent problems

Key Nutrients During Pregnancy

Calories:
Increase by 340/day during 2nd trimester
Increase by 450 during 3rd trimester
Nutrient dense foods should be eaten to meet higher caloric needs:
- Whole grains, breads, and cereals
- Legumes
- Dark green veggies
- Citrus fruits
- Low fat milk and milk products
- Lean meat such as turkey and chicken

Macronutrients

Protein
Extra 25g/day
Meats, low fat milk and milk products, legumes, whole grains, nuts and seeds

Carbohydrate
Will help maintain appropriate blood glucose during pregnancy

Total fat
PUFAs very important for growth and development of fetus

Foods high in PUFAs:
Food-borne illnesses

- Illnesses transmitted to human beings through food and water caused by either:
  - An infectious agent (*food borne infection*)
  - A poisonous substance (*food intoxication*)

Food safety in the marketplace

USDA and FDA and food processing industries

HAACCP

Kitchen safety = Food safety

Keep hot foods hot

Keep cold folds cold

Keep hands, utensils and kitchen clean

- Keep foods at temperature to kill bacteria and prevent growth
- Take caution to prevent cross contamination
- Seafood

Technologies to solve problems

- **Pasteurization**
  - Kills part but not all of the microorganisms present in the food
- **Irradiation**
  - Sterilizing food by exposure to energy waves
- **Ultrahigh temperature treatment UHT**

Natural chemicals can cause harm

Pesticides

- Pesticides are chemicals used to control insects, diseases, weeds, fungi and other pests on plants
- Residues – amount of chemicals that remain when people buy foods
- Tolerance level is set by EPA (environment protection agency)