Importance of Water

1. Forms structure of macronutrients.

2. Essential for nearly all functions in the body. Catalyst in chemical reactions. Needed in each step of energy metabolism.

3. Carries nutrients & waste products throughout body.

4. Serves as lubricant for joints, internal organs, mucous membranes, & fluid around fetus.

5. Serves as solvent for vitamins, minerals, glucose, a.a. and other small molecules


Water Needs

Most adults need 8-10 cups/day.  
- Based on 2000 diet  
- 64-80 fluid ounces/day  
- 2-3 liters  
- 1 – 1.5ml per kcal

2004 – new AI:  
- Women = 2.7 liter (91 oz)  
- Men = 3.7 liter (125 oz)

A. Body maintains constant water level.  
B. Thirst not a sensitive indicator of water need.  
C. Work performance profoundly affected by water. A 4-5% water loss results in 20-30% decline in performance.
Electrolytes

- salts that dissolve in water and dissociate into charged particles
- carry electrical current
- positive cations = negative anions
- electrolytes attract water
- water follows electrolytes
- regulation occurs chiefly at two sites: kidneys and GI tract
- body maintains fluid and electrolyte balance

Unusual circumstances:
- vomiting
- diarrhea
- heavy sweating
- burns
- wounds
**Sodium**

1. Chief extra cellular ion

2. Functions:
   - Regulate body fluids
   - Maintain pH balance
   - Nerve transmission
   - Muscle contraction

3. Deficiency: rare (only with illness)

4. Toxicity: aggravates hypertension
   Salt Sensitive individuals.

5. AI: 1500 mg, adults 19-50 yo
    1300 mg, adults 51-70 yo
    1200 mg, adults > 70 yo

   Upper limit: 2300 mg sodium (5.8 g salt)

6. Sources: salt
   #1 is processed foods – 75%
Worksheet - Sodium Content of Foods

List the following foods according to sodium content; one (1) is the highest sodium content, 7 is the lowest.

_____ Tortilla Chips - 1 oz

_____ Milk, 8 oz

_____ Mixed nuts, salted 1 oz (1/4 c)

_____ Saltine crackers, 5 each

_____ Raisin Bran Cereal, 1 c

_____ Dill Pickle, 1 each, 3”

_____ Instant Chocolate Pudding, 1 c
Chloride

1. Extra cellular ion

2. Functions:
   - Maintains normal fluid balance
   - Maintains electrolyte balance
   - Part of hydrochloric acid
   - Necessary for proper digestion

3. Deficiency: rare (only with illness)

4. Toxicity: vomiting

5. 2004 AI:
   - 2300 mg, adults 19-50 yo
   - 2000 mg, adults 51-70 yo
   - 1800 mg, adults > 70 yo

   Upper limit: 3600 mg

6. Sources: salt; meat, milks, eggs.
   Large amount in processed foods.
Potassium

1. Primary cation inside the cell

2. Functions:
   - Maintains normal fluid balance
   - Maintains electrolyte balance
   - Facilitates many reactions
   - Assists in nerve transmission
   - Assists in muscle contractions

3. Deficiency:
   Muscular weakness, paralysis, confusion.

4. Toxicity:
   Muscular weakness, vomiting. Given by injection into a vein can stop the heart.

5. 2004 AI: 4700 mg, adults 19-50 yo.

6. Sources: All whole foods: meats, milk, fruits, vegetables, grains, legumes.
**Calcium**
Most abundant mineral in the body. 2-3#

Functions:
1. 99% in bones and teeth.
2. Serves as calcium bank.
3. 1% in blood - other functions
   a. 1 of 14 factors required in blood clotting
   b. Transmission of nerve impulses
   c. Required for muscle contraction
   d. Secretion of hormones
   e. Activates a protein called calmodulin that helps maintain blood pressure.

AI: 1997, Adult 19-50 yo, 1000 mg
    Adult > 51 yo, 1200 mg
UL: 2500 mg; constipation; kidney stones

**Deficiency:**
a. Stunted growth in children
b. Osteoporosis in adults

**Toxicity:**
1. Hypercalcemia - Due to high blood Ca + vit D.
2. Constipation
3. Increased risk urinary stone formation & kidney dysfunction.
Factors Increasing Ca Absorption
Absorption about 10-30%. More if pregnant.

a. Adequate Vitamin D
b. Lactose increases solubility of Ca
c. HCL, more soluble in acid
d. Need - higher absorption when pregnant (50%)

Factors Decreasing Absorption

a. Lack of stomach acid.
b. Vitamin D deficiency
c. High fiber diet
d. Phytates
e. Oxalates in spinach, beets, rhubarb, cocoa.
f. High phosphorus/caffeine intake
## CALCIUM SUPPLEMENTS

<table>
<thead>
<tr>
<th>Form</th>
<th>% Elemental Ca</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca carbonate</td>
<td>40%</td>
<td>most common</td>
</tr>
<tr>
<td>Ca diphosphate</td>
<td>32%</td>
<td></td>
</tr>
<tr>
<td>Ca citrate</td>
<td>21%</td>
<td>low acidity</td>
</tr>
<tr>
<td>Ca malate</td>
<td>21%</td>
<td>absorption</td>
</tr>
<tr>
<td>Ca lactate</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>Ca glucomate</td>
<td>9%</td>
<td></td>
</tr>
<tr>
<td>Ca phosphate</td>
<td>8%</td>
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</tr>
</tbody>
</table>

**BEWARE**

- Oyster shell
- Dolomite 22%
- Bone meal 31%
## Calcium Foods

<table>
<thead>
<tr>
<th>Food</th>
<th>Serving Size</th>
<th>Calcium (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yogurt, plain</td>
<td>1 c.</td>
<td>415 mg</td>
</tr>
<tr>
<td>Yogurt, fruit</td>
<td>1 c.</td>
<td>345 mg</td>
</tr>
<tr>
<td>Milk, 2%</td>
<td>1 c.</td>
<td>300 mg</td>
</tr>
<tr>
<td>Tofu</td>
<td>8 oz</td>
<td>300 mg</td>
</tr>
<tr>
<td>Cheese, Swiss</td>
<td>1 oz</td>
<td>272 mg</td>
</tr>
<tr>
<td>Salmon</td>
<td>3 oz</td>
<td>250 mg</td>
</tr>
<tr>
<td>Spinach</td>
<td>1 c.</td>
<td>244 mg</td>
</tr>
<tr>
<td>Cheese, Cheddar</td>
<td>1 oz</td>
<td>204 mg</td>
</tr>
<tr>
<td>Broccoli</td>
<td>1 c.</td>
<td>178 mg</td>
</tr>
<tr>
<td>Cheese, Amer</td>
<td>1 oz</td>
<td>174 mg</td>
</tr>
<tr>
<td>Orange</td>
<td>1</td>
<td>56 mg</td>
</tr>
<tr>
<td>Bread</td>
<td>2 sl</td>
<td>46</td>
</tr>
</tbody>
</table>

To meet RDA for 19-50 yo: (1000 mg)

- 3 ½ cups milk
- 6 cups broccoli
- 20 oranges
- 3 cups yogurt
- 44 sl bread
PHOSPHORUS

Functions:
1. 85-90% bones & teeth
2. Part of phospholipid
3. ATP storage of energy
4. Acid base balance
5. Part of RNA and DNA

RDA (1997): 700 mg/day.

Upper limit: 4000 mg/day


Toxicity: No adverse effects reported.

Sources: All animal foods and processed foods.
Magnesium

Functions:
1. 60% bones & teeth
2. 40% enzyme regulation & energy metabolism
3. Muscle contraction
4. Nerve impulse transmission
5. Protein synthesis

1997 RDA:
   400 mg men
   310 mg women
Upper Limit:
   350 mg of nonfood Mg

Deficiency: Not common; weakness, confusion, convulsions, hallucinations.

Toxicity: Non-food. Diarrhea, dehydration.

Sources: Hard water, legumes, dark green vegetables, seafood, chocolate, seeds, nuts
SULFUR

Functions:
1. Part of proteins; methionine and cysteine.
2. Part of biotin and thiamin
3. Part of hormone insulin

RDA: none

Deficiency: none

Toxicity: none

Sources: Protein rich foods.
Osteoporosis

Risk factors:

1. Female
2. Genetics - small frame, thin body
3. Post menopausal.
4. Over 50 y.o.
5. Life style (no exercise)
6. Poor lifetime diet habits
   a. High intake animal protein
   b. High intake caffeinated soda pop
7. Lactose intolerant
8. Smokers
9. Medications - anticonvulsants
10. Excess alcohol intake