Istituto di Scienze dell'Alimentazione
Consiglio Nazionale delle Ricerche, Avellino

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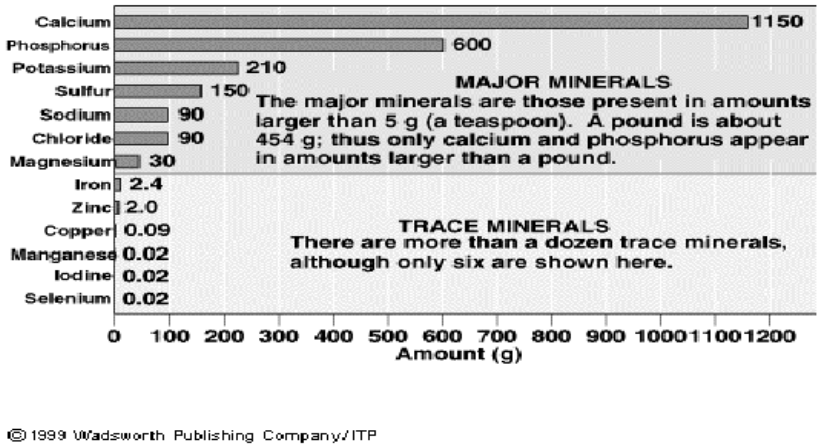
MINERALS

- The 6th and final! class of nutrients
- Major Minerals
  - Present in the body in the greatest amounts
  - Needed by the body in the greatest amounts
- Trace Minerals



Characteristics of Minerals

- Inorganic
- Retain chemical identity
- Not easily destroyed by heat, air, acid, mixing
- Absorbed at varying rates
- Require varying degrees of special handling
- Varying bioavailability
- Varying roles

The Major Minerals

Sodium

- Chemical Symbol - Na
- 1989 Estimated Minimum Requirement – 500 mg/day
- Salt (NaCl) = 40% sodium
- Current health recommendations:
  - <2400 mg Na daily
  - <6 grams SALT or 1 ¼ ts SALT

Functions of Sodium

- Maintains fluid and electrolyte balance
- Maintains acid-base balance
- Needed for nerve transmission
- Needed for muscle contraction

Negative effects of Sodium

- High SALT intake may raise blood pressure
- High Sodium intake may increase calcium excretion and bone loss
- Some people are SALT sensitive

- Rather than focusing on sodium restriction, weight loss REALLY is effective in treating hypertension!!!

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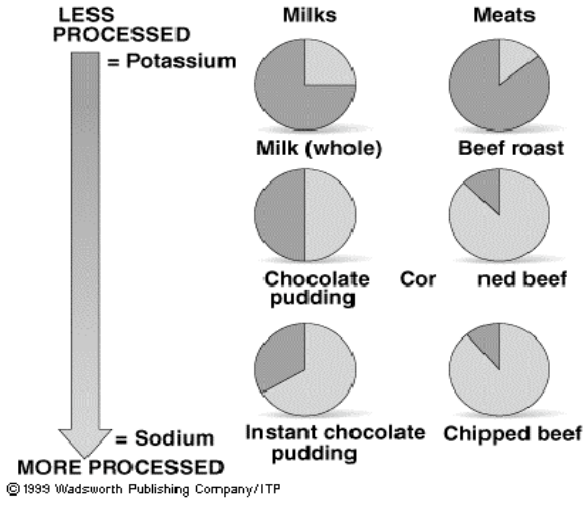
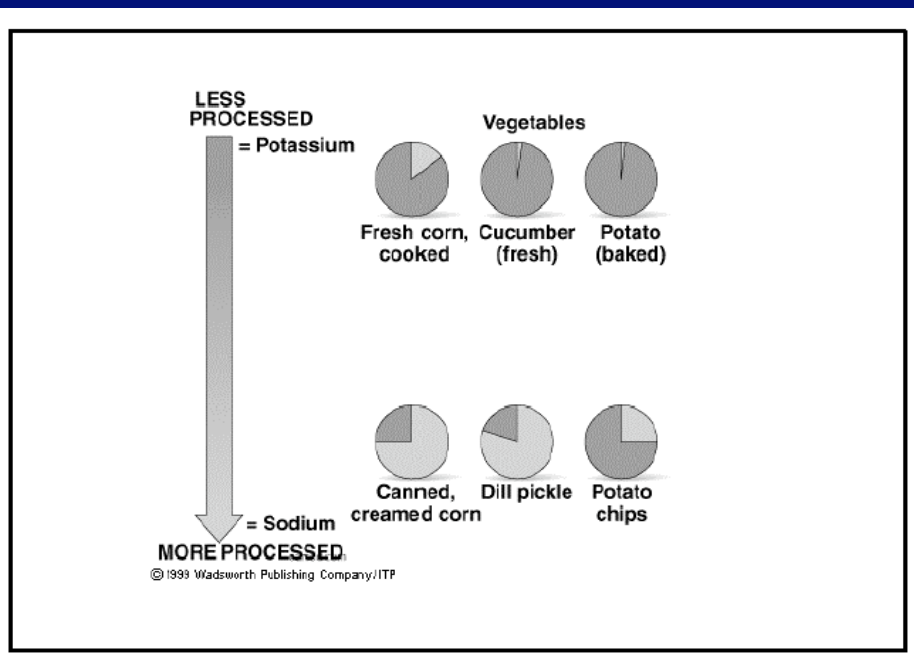
Sodium Deficiency

- Hyponatremia – low blood sodium levels
- Caused by excessive fluid loss – vomiting, diarrhea, heavy sweating
- Replace with a fortified beverage and/or foods

Sodium in Foods




LESS PROCESSED
= Potassium
Vegetables
Fresh corn, cooked
Cucumber (fresh)
Potato (baked)
Canned, creamed corn
Dill pickle
Potato chips
= Sodium
MORE PROCESSED
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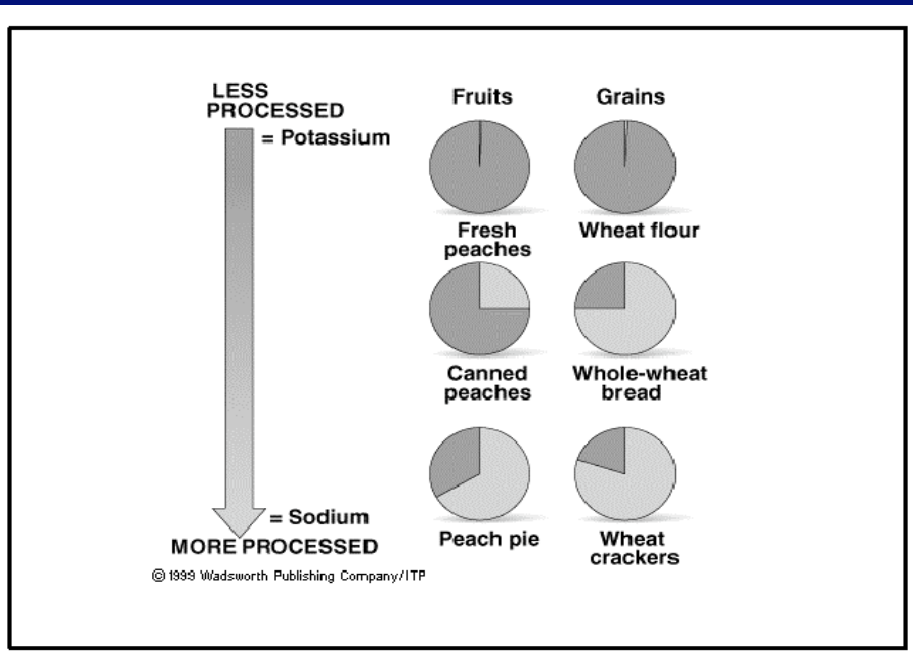
LESS PROCESSED
= Potassium
Fruits
Grains
Fresh peaches
Wheat flour
Canned peaches
Whole-wheat bread
Peach pie
Wheat crackers
= Sodium
MORE PROCESSED
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Major Sources of Sodium in the U.S. Diet

Sodium Source	Contribution to Sodium Intake (%)
Processed foods	77
Fresh foods	12
Salt added at the table	6
Salt added during cooking	5

How to reduce the sodium in your diet

- Use fresh herbs, vinegars, lemon juice, hot sauces and other spices to season foods, ie. Mrs. Dash's seasoning blends
- Use reduced sodium soups and soy sauce if you eat these foods often
- Eat more unprocessed foods
- Taste before you add salt!

Chloride

- Chemical Symbol – Cl
- This is the negative chloride ion, not the poisonous gas, Cl_2
- 1989 Estimated Minimum Requirement – 750 mg/day
- Salt (NaCl) = 60% chloride
- Deficiencies do not normally occur

Food Sources

- Processed foods (as part of salt)
- Table salt and soy sauce
- Meats, milks, eggs

Functions of Chloride

- Maintains fluid and electrolyte volume
- Part of HCl, found in gastric juice
- Closely associated with sodium

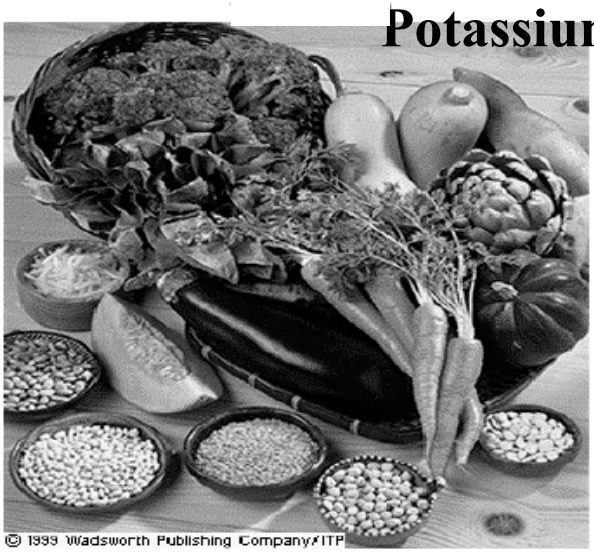
Potassium

- Chemical symbol – K
- 1989 Estimated Minimum Requirement – 2000 mg/day
- Deficiencies occur mainly due to losses, not low intakes – loss of fluid, use of drugs like diuretics, laxatives. First symptom – muscle weakness
- Toxicity results from overusing potassium salt

Potassium Functions

- Maintains fluid and electrolyte balance
- Maintains cell integrity
- Facilitates many reactions
- Assists in nerve transmission and muscle contraction
- Diets low in potassium raise blood pressure!

Food Sources – **Potassium**



Calcium

- Chemical Symbol – Ca
- 1997 AI – Adults (19-50) 1000 mg/day, adults (51+) 1200 mg/day
- Upper Level – 2500 mg/day

Calcium Functions

- 99% in bones and teeth
  - Part of bone structure
  - Serves as calcium bank
- 1% in body fluids
  - Regulates muscle contraction and relaxation
  - Blood clotting
  - Nerve functioning
  - Helps maintain normal blood pressure
  - Immune defenses

Other Details

- Calcium may protect against hypertension
- Blood calcium balance maintained at the expense of bone density – controlled by hormones and vitamin D
- Adults absorb only 30% of dietary calcium
- Pregnant women and growing children absorb 50%+ of dietary calcium

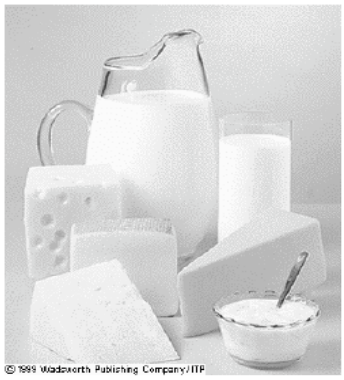
Factors That Inhibit Calcium Absorption

- Lack of stomach acid
- Vitamin D deficiency
- High phosphorus intake
- High-fiber diet
- Phytates (nuts, seeds, grains)
- Oxalates (spinach, beets, rhubarb, Swiss chard)

Factors That Enhance Calcium Absorption

- Stomach acid
- Vitamin D
- Lactose
- Phosphorus
- Growth Hormones

300 mg calcium from 8 fl oz of milk, 8 oz yogurt, 1 ½ oz cheese

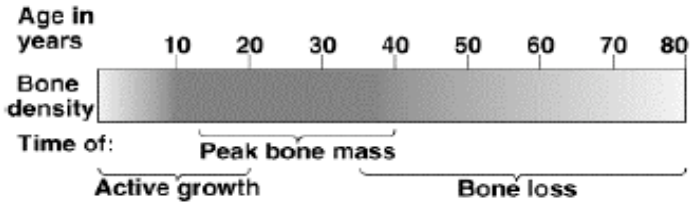


Non-dairy Calcium Sources

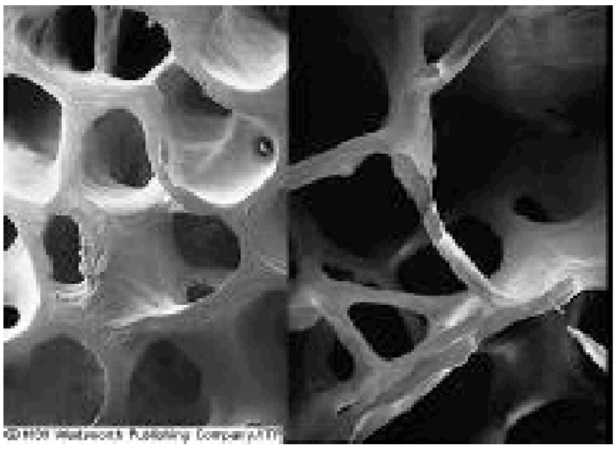
- Small fish with bones and oysters
- Tofu(some brands)
- Deep green vegetables – mustard and turnip greens, broccoli, kale, parsley, bok choy
- Some corn tortillas
- Almonds, sesame seeds
- Fortified foods like orange juice, cereals

Calcium Deficiency – the silent disease of Osteoporosis

- Peak bone mass reached at age 30
- Bone losses begin at age 40, accelerated by menopause
- Osteoporosis is a condition of porous, fragile bones which fracture under common everyday stresses

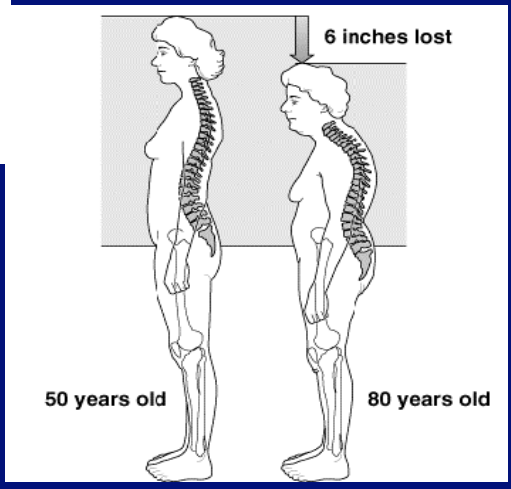


Left – Healthy bone Right - Osteoporosis



Trabecular and Cortical Bone

	Type I	Type I
Other name	Postmenopausal osteoporosis	Senile osteoporosis
Age of onset	50 to 70 years old	70 years old and older
Bone loss	Trabecular bone	Both trabecular and cortical bone
Fracture sites	Wrist and spine	Hip
Gender incidence	6 women to 1 man	2 women to 1 man
Primary causes	Rapidloss of estrogen in women following menopause; loss of testosterone in men with advancing age	Reduced calcium absorption, increased bone material loss, increased pro-pensity to fall



Risk factors for osteoporosis. 8,10,11

- Female
- Menopause
- Deficient calcium intake
- Caucasian or Asian heritage
- Thinness ("small bones")
- Cigarette smoking
- Excessive alcohol intake
- Ovarectomy (ovaries removed) before age 45
- Physical inactivity
- Deficient vitamin D status
- High animal protein intake
- Genetic factors

Calcium Supplements

- Choose an absorbable form, like calcium carbonate or calcium citrate
- Take with meals
- Take multiple doses, rather than 1 large dose

Phosphorus

- Chemical symbol – P
- 1997 RDA – adults, 700 mg/day
- Upper Level – 4000 mg/day for adults
- Deficiencies unknown
- Toxicities also not common

Phosphorus Functions

- 85% found in bones and teeth
- In all body cells as part of a buffer system
- Part of DNA and RNA
- Part of phospholipids
- Assists in energy metabolism – part of ATP; activates enzymes and B vitamins

Food Sources

- All animal products – meat, fish, poultry, eggs, milk
- Legumes
- Soft drinks

Magnesium

- Chemical Symbol – MG
- 1997 RDA – 700 mg/day
- Upper Level – Adults – 4000 mg/day
- Deficiencies appear with diseases
- Toxicities unknown
- May protect against heart disease and hypertension

Functions

- Part of bone minerals
- Builds protein
- Participates in hundreds of enzyme systems
- Required for ATP metabolism
- Muscle contraction
- Nerve impulses

Food Sources

- Nuts
- Legumes
- Whole Grains
- Dark Green Vegetables
- Seafood
- Nuts
- CHOCOLATE! AND COCOA
- Some drinking water

Sulfur

- Chemical Symbol – S
- No recommendations
- Not used by itself as a nutrient – but it occurs in essential nutrients that the body does use like thiamin and some amino acids
- Highest content in hair, nails, skin
- Deficiencies and T

Functions

- Determines the shape of proteins by forming di-sulfite bridges
- Part of vitamins
  hormone insulin

Food Sources

- All protein-containing foods