Vitamin/Mineral Reference Material CLASS SET - DO NOT REMOVE

I. Minerals:
Inorganic- Can't destroy by burning foods.

Macronutrients - most abundant in body.
Calcium, Potassium
Phosphorous, Chloride
Magnesium, Sodium

Micronutrients - less abundant in body.
trace elements(minerals)
Iron, Copper
Zinc
Selenium
Chromium

MACRONUTRIENTS:

1. Calcium -
99% = Bones and teeth
1% = Circulates in blood
stored in long bones

Factors in absorption-
30 to 40% is absorbed
other is excreted in feces

Chemical Binders- bind calcium in foods and prevent absorption
examples of chemical binders:
1. Oxalic Acid (oxalates) Spinach + rhubarb
2. Phytic Acid (phytates), eg. Unleavened bread (no yeast)
eg. Mideastern countries
3. Protein - increase protein in diet; decrease calcium absorption
4. Phosphorous - increase phosphorous; decrease calcium absorption

Functions of Calcium:
1. Provides rigidity- skeleton
2. Muscle contraction and relaxation eg. Muscle cramps at night because of decreased Ca^{2+} levels; tremors and twiches; foot cramps; Menstrual cramps
3. Blood clotting
4. Activates enzymes

*** RDA:**
Up to age 25: 1200 mg/day
over 25 years of age: 800 mg/day
max- 2000mg/day (kidney stones)

Sources-
Milk-Dairy
1 cup milk/yogurt-> 300mg
cheese
dark grain vegetables (collard greens/mustard)
7 cups broccoli -> 300mg
tofu - soy bean
animals get calcium from eating other animal's skeletons.

Supplements-
Calcium carbonate
Tumms 2/day

Avoid-
Oyster shell (shell matrix collects pollutants)
Bone meal from ground skeleton can contain harmful chemicals.
Calcuim deposits in damaged joints or muscle tissue.

Deficiency- soft bones
Rickets - kids
Osteomalcia - adults

Carbonated drinks- (carbonated with phosphorous) increase phosphorous, decrease calcium adsorption.

Osteoporosis- porous bones
Females five times more likely than males
-poor milk drinkers
-smaller frames
-decrease estrogen levels during menopause

Increase risk - Caucasian
Decrease risk - Black
Decrease risk - Asian

Hypothesized- an increase in protein, increases calcium loss. Some countries never have taken in a high protein diet, so less calcium loss. e.g. Asian countries vs. US

Prevention-
1. 1200 - 1500 mg/day
2. Avoid increase protein diet
3. No smoking
4. Moderate caffeine and alcohol
5. Regular weight bearing exercise

Skeleton- $Ca(PO_3)_2$

2. Phosphorous
-second most abundant mineral
-eg. bones/teeth
-ATP (energy)
-acts as a buffer to maintain normal pH of bodily fluids
-DNA and RNA

***RDA -** same as calcium 1:1 balance
Deficiency - very rare

Sources
Dairy products
Nonfat plain yogurt (fortified)
Meat
Soft drinks

3. Magnesium - 60 % in bones
1. Healthy bone met.
2. Protein synthesis.
3. Normal nerve and muscle action.

Deficiency -
Not many
Muscle twitching.

Sources -
Peanuts (Bean!)
Bananas
Avocado & Dairy products

4. Sodium (Na)
Found outside of cells.
1. Water balance.
2. Acid - base balance.

Natural Sources
Animal products - tissues.
Veggies - celery
Softened water

Processed foods increase salt
eg. soups (1 can) Campbells => 2500mg
eg. MSG

Recommended range: 1100 - 3300 mg
*if you don't salt food you are in the middle.

RDA - none

1 tsp. NaCl => 2,132 mg
average American consumes 6000 - 24,000 mg

Alternatives:
1/2 KCl and NaCl => Lite Salt
Use spices
Use vinegar or lemon
Eat fresh fruits; decrease sodium intake

Health Risks:
1. increase sodium; increase water retention; increase Hypertension=> increase risk for stroke
2. increase Hypertension; increase pressure in cranial arteries.

-NaCl is the original preservative before refrigerators.

5. Potassium
Inside the cell has the same function as Sodium.

Sources:
fruits

Health Risks - any excess or deficiency can effect heart.
RDA - 2000 mg

6. Chloride (Cl^-)
Acid/Base balance -> HCl in stomach!
Sources -
NaCl, easy to come by; especially processed foods

MICRONUTRIENTS: trace elements

1. Iron (Fe^{2+})

RDA - 15 mg for females; 10mg for males

Sources:
liver
red meat
legumes
Bran cereals
dark grain veggies
dried fruit
molasses -> first true sweet source

Iron skillets - used for years and no Fe^{2+} deficiencies
eg. glass container of spaghetti sauce => 3.5 mg vs. Fe^{2+} skillet 87.5 mg
*increase Fe^{2+}deficiency when cook were changed and processed sugars came to be.
Shellfish too!

Iron Deficiency :
fatigue
increase infections
increase headaches
pale skin
some people get spoonshaped nails or ridges
pull lower eyelid down and check for whitish tissue.

Supplements -
ferrous sulfate
ferrous gluconate

Hemochromatosis - excessive Fe^{2+} die of cerosis of liver
eg. kids can over dose from eating all kids vitamins

2. Copper: (Cu)
needed for iron adsorption and metabolism.

Sources -
same as Fe^{2+}
liver
cocoa
nuts
legumes
dried fruits
whole grains bread/cereals

3. Zinc: (Zn)
-Part of insulin and carbohydrates metabolism.
-Wound healing.
-Protein synthesis
-DNA and RNA synthesis

Deficiency -
shows up when loss of taste and smell.

Boys going through puberty need an increase in zinc.
*Found in large amounts in male reproductive organs.

Sources -
oysters (aphrodisiac?)
red meat
whole wheat bread and cereals
fruits and veggies are very low!

RDA females 12mg; males 15mg

OD on zinc:
2 - 3X over RDA will decrease immune function.

4. Iodine (I)
Part of thyroxin (thyroid gland)

Deficiency -
Goiter; more problems in areas where no oceans (reversible).
Cretinism - a baby born from a woman who had Iron deficiency, can have no brain.

RDA: 150 mg

Sources:
Iodized salt
Sea salt
Saltwater fish

5. Chromium (Cr)
Works with insulin to pick up glucose and transport into cell. ie. carbohydrate metabolism.

Claims: Chromium dissolves fat and increases muscle mass. No grand effects like the claims state => no research supports this claim.

Supplements:
Chromium picolinate 50 - 200 mg
Diabetics and hypoglycemics use this to help deliver glucose!

Excess can be stored in liver and it is a heavy metal!

6. Selenium (Se)
a. Antioxidant; similar to vitamin E and spares vitamin E.
b. No one knows for sure what the upper limit is, but it is toxic!
c. Not a lot in the San Diego soil, much around California River.

Sources:
whole wheat breads/cereals
fish
II. VITAMINS: organic molecules; can be destroyed when burn food.

B Vitamins:
- RDA's for vitamins vary depending on wt.
OD- 10X over RDA
- Take supplements that contain 100-200% of RDA for vitamin and minerals. eg. centrum
Vitamins- vital to life
organic- contain carbon
- needed in small amounts
- absorbed in small intestine
- water soluble; fat soluble
H2O soluble Vitamins - B complex and C; Fat soluble Vitamins - A, D, E, and K

1. Thiamine- B1
- acts as a coenzyme to accept electrons from oxidized proteins, fats and carbos.

RDA - male- 1.5 mg; female- 1.1 mg

Deficiency- Beri-Beri
- affects nervous system, heart convulsions = death

Sources
- Liver
- Brewers yeast
- Lean Pork
- Legumes
- Watermelon
- Sunflowers

Bread & Cereals
- Whole Wheat - less in whole breads
- White bread is enriched

Enriched
Thiamine
Riboflavin
Niacin
Iron

2. Riboflavin - B2
- makes urine bright green
- acts as two coenzymes to release energy

Deficiency- riboflavinosis

Sources-
light sensitive and can be broken down
eg. milk, cheese, yogurt (dairy products) and all protein foods (beef, chicken, fish)

RDA- male- 1.7 mg female- 1.3 mg

3. Niacin B3
- acts as 2 coenzymes to release energy

Procedure- Tryptophan --> Niacin (a.a)
60 mg TRY ----> 1 mg Niacin

Deficiency: Pellegra (aka 3-Ds)
1. Diarrhea
2. Dermatitis
3. Dementia

#1 cause of mental disease in the early 1900 in the South.
* many B vit. deficiencies affect the brain!!

OD - causes vasodilation; flushed; hot flashes; cardiologists use to dilate vessels.

* lower cholesterol levels (Dr. recommended)

Sources:
Peanuts
Liver
Brewers yeast
Avocados
Tuna
Chicken
Breads and cereals

RDA- men: 19 mg; women: 15 mg

4. Pyridoxinal - B6
- coenzyme in protein metabolism
i.e. deamination of proteins and making essential a.a's (11 a.a's)

Deficiencies:
Dermitis of the eyes, nose, and mouth. Can retard growth.

Sources-
watermelon
liver
b. yeast
avocados
bananas
pork
beans
protein foods

RDA- men: 2 mg; women: 1.6 mg

Clinical:
higher doses to treat PMS (diuretic)
less than 100 mg = toxic (nerve damage)

5. Pantothenic Acid (B- vitamin)
- greek Panto = everywhere
- needed to make coenzyme - A (CoA); used in Kreb's Cycle
no RDA
-
Deficiencies:
Fatigue; muscle spasms; neuromuscular degeneration

Sources:
royal jelly (athletes take this)
eggs

6. Biotin
- coenzyme involved in many metabolic pathways

Sources:
raw egg yolk; liver; kidneys
intestinal bacteria produces Biotin

7. Folic Acid
coenzyme to produce DNA & RNA
needed for production of RBC's & WBC's
- more needed during pregnancy and on B.C. pills

Deficiencies:
- during pregnancy can cause spina bifida
- anemia (megaloblastic) = abnormally large RBC's; tired and sleepy

Sources:
green leafy vegetable
dark green lettuce
proteins; liver

* alcohol impairs folic acid!!

RDA- male: 200 mg female: 180 mg

8. Cobalamin B12
- cobalt in middle of molecule
- coenzyme to make RNA & DNA and RBC's
used to make Ach (acetylcholine)

to absorb it you need:
1) calcium
2) Intrinsic factor; mucoprotein made in the stomach and joins up with B12
* intrinsic factor lowers with age and so the elderly get B12 shots (circulatory system)

Deficiencies:
Pernicious Anemia-
effects the CNS (memory loss)
e.g. Elderly & vegans (strict veg.) (not all people?)

Sources:
- animal flesh or animal products

RDA- 2 mg. (very low amount)

9. Vitamin C - ascorbic acid

- not a coenzyme like B- vitamins (see functions A - E below)

A. Antioxidants - a role in cancer prevention?
- donates missing electrons in a free radical
- free radical = an unpaired electron in an atom or molecule; they are electron seeking

B. Collagen synthesis - in skin

C. Adrenalin synthesis - AKA "epinephrine"
- higher fat metabolism and higher glucose metabolism
- "flight or fight"
- need to replace vitamin C after using adrenaline

D. Thyroxine synthesis
- needed for normal production

E. Causes a higher absorption of Fe & Ca

higher needed amounts during:
infection
surgery
wounds
smoker needs 2x RDA

higher vitamin C pulls Fe2+ out of blood & microbes need Fe2+ to survive;
also higher vitamin C; higher body temp.
-*Dentin- second layer in teeth use vit. C for calcification of teeth
*** too much vitamin C during pregnancy can cause baby to develop scurvy after birth**

*** RDA** 60 mg

Deficiencies: Scurvy 10 mg or less
bruises
gums bleed
cuts don't heal
develop anemia ---> scurvy ---> death

Sources:
citrus
bell peppers
tomatos
strawberries
kiwi
many tropical fruits
melons
* potatoes & cabbage
echinacea (an herb)- contains vitamin C.

* dont buy or make up OJ more than you can use in a day because vitamin C gets lost to O_2(oxidation)

Kidney stones develop > 3000 mg/day

10. Vitamin A:
maintains general health of epithelial cells
vision

Deficiencies:
dry skin and hair; skin sores
night blindness or decreased ability for dark adaptation

Sources:
Carotene from green and yellow vegetables is converted to Vit. A in the GI tract
Liver, milk, broccoli, squashes

RDA not known

11. Vitamin D:
essential for absorption of calcium & phosphorous from GI tract into blood
controls calcium metabolism

Deficiencies:
See calcium deficiencies

Sources:
In the presence of UV light, it is made by the skin and liver.
Foods: fortified milk, fish -liver, oils, and egg yolk

RDA

12. Vitamin E: "Tocopherol"

A. Antioxidant - donates electrons to free radicals
B. Wound healing -
C. Prevents scarring -
D. Believed to help protect the liver from toxic chemicals

Deficiencies:
May cause the oxidation of cell membranes and cell organelles; results in abnormal cell function.

Sources:
Fresh nuts, wheat germ, seed oils, and green leafy vegetables

RDA

13. Vitamin K:
Important for the clotting of blood

Deficiencies:
Individual can hemorrhage; bleed excessively

Sources:
Produced by intestinal bacteria (e. coli)
Trace amounts in spinach, cauliflower, cabbage, and liver

RDA: none