Lecture: Chapters 7 & 8 (Vitamins and Minerals)

Definition & Classification and Characteristics

<table>
<tr><td colspan="2">Definition of a VITAMIN- an essential ____caloric (for us) ____ganic nutrient needed in tiny amounts in the diet</td><td>Definition of a MINERAL- an essential ____caloric ____ganic nutrient needed in tiny amounts in the diet</td></tr>
<tr><td>FAT-SOLUBLE VITAMINS
Absorbed with fats from food into lymph then travel hooked to protein carriers (“boats”). Stored in fatty tissues.</td><td>WATER-SOLUBLE VITAMINS
Absorbed directly into blood where they travel freely (NOT hooked to protein carriers). Not stored in body but tissues can be “saturated”.</td><td>MINERALS

Absorbed directly into blood
Always _____-soluble</td></tr>
<tr><td>1. _____
2. _____& beta carotene
3. _____
4. _____</td><td>B complex Vitamins:
1. B_1 (_____)
2. B_2 (_____)
3. B_3 (_____)
4. _____
5. B_{12} (_____)
6. B_6 (_____)
7. Biotin
8. Pantothenic acid
Vitamin C</td><td>1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____</td></tr>
</table>

Looking only at the information just above, how are minerals different than vitamins?

Also looking only at the information just above, what do vitamin A and vitamin C have in common?

Also looking only at the information just above, how are vitamin A and vitamin C different?

How do plants get vitamins?

Why do plants make vitamins?

Why do carrot plants make more carotene than parsnip plants?

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Vitamins that can be made in the body:

1. from ***precursors*** something that can be changed into an active _____.
    a. niacin (from the amino acid _____)
    b. retinol (the active form of Vit. A) (from _____ in plant food)
    c. vitamin D (from _____, which can be made by the body)
2. made by bacteria in _____
    a. vitamin K
    b. biotin
    c. pantothenic acid

Some Categories of Involvement

Vitamins and Minerals Involved:	
1. as **ANTIOXIDANTS** Beta Carotene Vitamin E Vitamin C Selenium	4. in **BLOOD HEALTH** Vitamin K Folate Vitamin B12 Vitamin B6 Vitamin C Iron Zinc Copper
2. in **CERTAIN SPECIALIZED CELLS/TISSUES** Vitamin A Vitamin C Vitamin D	5. in **FLUID & ELECTROLYTE BALANCE** Sodium Potassium Chloride Phosphorus
3. in **ENERGY METABOLISM** Thiamin Riboflavin Niacin Pantothenic Acid Biotin Vitamin C Iodine Chromium Manganese Phosphorus	6. in **BONE HEALTH** Vitamin D Vitamin K Vitamin A Calcium Magnesium Fluoride Manganese Phosphorus Potassium

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THE NUTRI-CHARTS

1 Nutrients that can be **ANTIOXIDANTS**

Antioxidants- Protect cell substances from damage by oxygen. 02 can combine with substances, forming free radicals, which damage cell substances. **Free radical** means- _____

Antioxidants seem to be able to scavenge & quench free radicals & may offer some protection against _____ and effects of _____.

Studies showing benefits have been done on _____, not _____

	TOO MUCH	TOO LITTLE	JUST RIGHT
Beta-carotene	changed slowly in body to retinol, so _____toxic	May elevate _____ risk	Beta carotene can be changed in the body to _____ and then it can perform the functions of vit. A, but beta-carotene has functions as anti-ox in body that _____ cannot accomplish.
Vitamin E	Can increase the effects of (or interfere with) _____ medication	premature infants without vit. E- some blood cells _____, because oxidation destroys the cell's membrane	antioxidant for cell's _____and _____, especially those in: 1. lungs 2. _____ blood cells (because lungs & RBCs have high _____ concentrations)
Vitamin C	Can interfere with medical tests	Suppressed _____ system	Protects cell substances by becoming oxidized itself
Selenium	Nausea, Liver damage	Uncommon form of _____ disease	Assists Vitamin __

2 Nutrients Involved in **CERTAIN SPECIALIZED CELLS/TISSUES**

	TOO MUCH in diet/body	TOO LITTLE in diet/body	JUST RIGHT in diet/body
Vitamin A	_____ toxic in excess	w/o vit. A, the cells make a dry, hard protein called _____	**1- Epithelial tissue**.
		Blind- keratin builds up	EYES- ***cornea***.
		Lung infection- Why?	LUNGS
		Night Blind	**2- Retina**. (Vit. A also works in the ***retina*** to help see in _____ light.)
Vitamin C	See above	Pinpoint hemorrhages just below skin	**Connective Tissue**-production of _____ This is why vit. C helps you _____.
Vitamin D	Calcification of soft tissues like _____	May increase risk of a variety of diseases	▪ Affects how cells grow, proliferate & specialize. ▪ Can help keep cells from becoming malignant or have autoimmune responses & when do go bad, perhaps causes them to self-destruct.

3 Nutrients Involved in **ENERGY METABOLISM**

	TOO MUCH	**TOO LITTLE**	**JUST RIGHT**
VITAMINS			
B-complex 1. _____ 2. _____ 3. _____ 4. _____ 5. _____	• None known except liver damage, glucose intolerance & blurry vision from very large doses <u>niacin</u>	Fatigue	Part of coenzymes needed for cellular respiration ("step ____")
<u>Vitamin C</u>			Production of _____ (hormone that regulates basal metabolic rate).
MINERALS P, Ch, Mn I, P			
<u>Iodine</u> ***FOODS:*** Seafood, milk Iodized salt	Goiter	• Goiter • Infants- cretinism • Deceased body temp. • Fatigue	Thyroid hormone to regulate • Resting metabolic rate (rate of cellular respiration ("step ____") • Body temp. • Reproduction & growth
<u>Chromium</u> ____ ***FOODS:*** Whole grains, nuts, dark chocolate	Appear to be no toxicity symptoms but 2 problems with supplements • May compete with other minerals for absorption • Distraction from eating well	Uncommon	Enhances ability of insulin to transport glucose
<u>Manganese</u> ____ ***FOODS:*** Whole grains	Inhaled Mn dust- spasms & tremors	Impaired growth	Coenzyme for cellular respiration
<u>Phosphorus</u> ____ ***FOODS:***	Muscle spasms	Rare	Part of ATP
<u>Iron</u> _____			As part of _____, iron is a coenzyme involved in energy metabolism.

4 Nutrients Involved in **BLOOD HEALTH**

	TOO MUCH	TOO LITTLE	JUST RIGHT
MINERALS: Zn. Fe, Cu			
Iron ____ ***FOODS:*** • Heme better _____ than non-heme Legumes • Vit. C helps absorption of non-heme	• Constipation (vit. C can help) • Too much iron from supplements can decrease body's ability to absorb _____ Poisoning from _____ in _____ can damage heart	• Iron- deficiency anemia- Most common nutritional deficiency in world • Fatigue • Difficulty concentrating	Part of hemoglobin
Zinc ____ ***FOODS:*** Meat Whole grains	• Headache, appetite loss • Depressed immune function • Too much zinc from supplements can decrease body's ability to absorb _____	• Frequent illness • Appetite loss	• Assists production of hemoglobin • Immune system
Copper ____ seafood, wh gr, nuts	• Vomiting • Liver damage	• fatigue	• Helps make a protein needed for proper transportation of iron
VITAMINS			
Folate ***FOODS:*** Foliage	• Nerve damage • May accelerate growth of _____ cells	• M**a**crocytic anemia • Fatigue • Neural tube birth defects like _____	Helps make red blood cells
B_{12} Animal foods Needs *intrinsic factor* for _____	None known	Pernicious anemia Fatigue	Helps make • red blood cells • (also myelin sheath)
B_6 ***FOODS:*** meat starchy veg.	Sensory neuropathy	M**i**crocytic anemia	Helps make hemoglobin Helps make ALL cells
Vitamin C Fruits & veg.	Megadose is level _____ recommendation	Iron deficiency anemia	Enhances iron absorption immune system Most animals (not humans) make their own vitamin C from _____
Vitamin K	Rare; RBCs break open releasing pigment	Blood doesn't _____	Helps make the _____ for blood to _____

5 Nutrients Involved in **FLUID & ELECTROYTE BALANCE**

	TOO MUCH	**TOO LITTLE**	**JUST RIGHT**
WATER 50-70% of body try for 6-8 glasses/day	Water Intoxication: causes dilution of Na	• Overheating • Fatigue, Cramping • Problems due to loss from diarrhea, vomiting, heavy exercise • Esp. dangerous in _____ & _____ • Problems from too little water often come from what you drink instead of water, like _____ and _____	• w/adequate BP, water dissolves & transports • Helps maintain body temp. Want pale yellow urine at least once a day
ELECTROLYTES Def. – substance that in solution separates into ions (_____) **Na, K, Cl, P**			Help regulate: • Fluid balance • Nerve response • Muscle contraction
<u>Sodium</u> ____ ***FOODS:*** Roughly ___% of the sodium Ameri-cans consume may come from fast & processed foods	• Maybe hypertension if among _____% of people with HT who are salt sensitive • May cause _____ excretion in some	• Headaches • Confusion • Muscle cramps	See above plus • Glucose transport into cells (Na/ K "pump") • Helps keep correct amount of water ___ side cells
<u>Potassium</u> ____ ***FOODS:*** Fruits & veg. Whole grains (abbreviation for **k**alium (Arabic word for alkaline **ashes**)	• Can alter heart rhythm (usually something wrong with kidney)	• Weak, confused • Loss of appetite • Often caused by abuse of 3Ps (laxatives, diuretics, emetics)	See above plus • In food, can help prevent hy-pertension, as can calcium&magnesium • Helps keep correct amount of water ___ side cells
<u>Chloride</u> ____	• Maybe hypertension if salt sensitive	Rare	See above plus • Hydrochloric acid
<u>Phosphorus</u> ____	Muscle spasms	Rare	See above

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6 Nutrients Involved in **BONE HEALTH**

Bone Health depends on

1. Genes	2. Sun exposure	3. Exercise	4 Not smoking	5. Estrogen/Testosterone

	TOO MUCH	**TOO LITTLE**	**JUST RIGHT**
MACROnutrient Already Mentioned- _____	High _____ diet can promote calcium excretion (what mineral can also? _____)	Rare in U.S.	Bone ***crystals*** form around a ***matrix*** of <u>collagen</u> fibers
Vitamin already Mentioned- _____	• Not possible fr. sun • Weak, appetite loss, calcium deposits in kidney	Osteoporosis	Helps absorb calcium
Vitamin already Mentioned- _____ ***FOODS:*** Green leafies, broccoli, cabbage	No known problems	Osteoporosis?	Helps make <u>osteocalcin</u>, a _____ associated with bone ***matrix*** remodeling
MINERALS Ca, P, Mg, K, Fl, Mn			
<u>Calcium</u> ____ ***FOODS:*** pkt. p. 101 why *<u>canned</u>* salmon?	Can interfere with absorption of Fe, Zn, Mg	Osteoporosis	• hydroxyapatite ***crystals*** give hardness to bones & teeth (also nerves, muscles, clotting)
<u>Magnesium</u> ____ ***FOODS:*** Whole grains, nuts, dark green leafies	Excess magnesium antacids (Gaviscon, Maalox, Mylanta)- maybe diarrhea, abdominal pain	Osteoporosis? HT, type 2 diabetes	Influences formation of bone ***crystals***
<u>Fluoride</u> ____	Fluorosis of teeth & bones (just cosmetic?)	Osteoporosis? Dental caries	Strong bones & teeth (fluorhydroxyapatite ***crystals*** are more resistant to decay)
<u>Manganese</u> ____ wh gr, frt, veg	Rare unless inhaled	Rare Osteoporosis?	Helps make bone ***matrix***
<u>Phosphorus</u> ____	Muscle spasms too many vit. D supplements	• Antacids (aluminum-containing antacids (such as Di-Gel, Riopan, Maalox, or Mylanta) reduce absorb. • _____ can replace bone Ca with phosphoric acid • Muscle weakness	Part of hydroxyapatite ***crystals***
<u>Potassium</u> ____	Too much from supplements- heart arrhythmia	Maybe decreased bone density	Seems to decrease calcium excretion

DSHEA (Dietary Supplement Health and Education Act of 1994)

This law says that dietary supplements are permitted to make **structure/function claims** for the body (For example: "Glucosamine helps support healthy joints.").

Dietary supplements cannot claim to cure, lessen, or treat a disease.

This law also says the FDA **does not need to approve** dietary supplements based on their safety and effectiveness and the FDA can take action only **after** a dietary supplement has been proven harmful.

The law's rationale for a lack of regulation is that this gives a freedom to choose to the consumer, but there are economic benefits as well. By not strictly regulating dietary supplements, lengthy and costly clinical trials are avoided, as are the costs associated with enforcement of stricter regulation. This law assumes that the supplement is considered beneficial unless problems arise.

In **June 2007**, the U.S. Food and Drug Administration announced a final rule establishing regulations to require current good manufacturing practices (cGMP) for dietary supplements. Manufacturers will have to test for:

- purity
- identity
- strength
- and report adverse events.

7 Guidelines for Choosing Supplements:

1. Don't substitute for _____ foods.
2. Pay attention to the _____. (Keep it about 100% of the DV)
3. Add together the _____ .
4. Simple _____.
5. Don't let nutrient levels _____ the Upper Intake Level.
6. Get _____ from foods, not supplements.
7. Look for the _____ label when purchasing a supplement.