

Legal Pill Popping; Basic Information on Vitamins and Supplements

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Legal Pill Popping

- Building Healthy Bodies???
- Or
- Producing Expensive Urine??

What Are We Talking About?

- **Macronutrients**
 - Proteins
 - Carbohydrates
 - Fats
- **Micronutrients**
 - Vitamins
 - Minerals
 - Phytochemicals

Diseases of the Past?

- Micronutrient deficiency
 - Beriberi
 - nerve damage from low thiamin (B1)
 - Pellagra
 - Dementia, dermatitis, diarrhea, death from low niacin (B3)
 - Scurvy
 - Anemia, bleeding/ulcerated gums from low Vit C
 - Rickets
 - Poor bone density/bone formation from low Vit D

What Are We Talking About?

- Current micronutrient deficiency?
 - From standard American diet
 - Processed packaged foods
 - Few whole foods, fruits, vegetables
 - Examples:
 - inadequate B vitamins (folic acid) and birth defects like spina bifida
 - inadequate Vit D (from food and sun) and osteomalacia?
 - Related to chronic disease
 - Heart disease
 - cancer

What Are We Talking About?

- Vitamins
 - 1911, “vitamines” from “vita” (life) and “amines” (containing nitrogen) not all contain nitrogen
 - Types: fat soluble and water soluble
- Minerals
 - Macrominerals
 - Trace minerals
- Phytochemicals
 - Complex plant molecules

What Are We Talking About?

- Fiber
- Probiotics
- Essential Fats
- Nutraceuticals
- Medical Foods
- Herbs

Vitamins

- Essential nutrients
- Body can't make them
- Must get them from food
- Body cannot convert them to energy
- Transformed in the body to coenzymes or cofactors; not used in food form
- Make molecular reactions in the body possible
- Biochemical Individuality – wide variation among individuals in their unique requirements and susceptibilities

Vitamins

- Institute of Medicine's Food and Nutrition Board
 - 1941, “Recommended Dietary Allowances” (RDAs)
 - Guidelines used in creating canned and prepared foods for soldiers during the war.
 - Goal: to avoid deficiency diseases in most men
 - Last published in 1989
 - Currently, “Dietary Reference Intakes” (DRIs)
 - Still focused on preventing overt disease in a population

Fat Soluble Vitamins

- Vitamin A (Retinol, Vit A Palmitate, Vit A Acetate)
 - Function:
 - vision
 - immune function
 - bone development
 - cell differentiation, growth, reproduction
 - skin and mucus membranes
 - detoxifies xenobiotics (PCBs, Dioxins),
 - Deficiency: (low intake? decreased fat absorption?)
 - night blindness, poor dark adaptation
 - poor wound healing, infection susceptibility
 - dry eyes, dry skin
 - poor tooth and bone function
 - weight loss, loss of appetite, fatigue

Fat Soluble Vitamins

- Vitamin A (con't)
 - Food Sources: liver, egg yolk, whole milk
 - Stored in Liver
 - Supplement doses: max 3000IU/day
 - Who may need more? People with:
 - Diabetes
 - Infection (Vit A stores depleted)
 - Toxin exposure
 - Acne
 - Psoriasis
 - Cancer
 - CVD
 - Vaginal yeast (insufficient beta carotene)

Fat Soluble Vitamins

- Vitamin A (con't)
 - Who needs less?
 - Pregnancy – Vit A form is teratogenic
 - Liver disease
 - Birth control pills
 - Toxicity: (200 cases worldwide annually)
 - 50,000 IU/day for several years with healthy liver
 - weight and appetite loss
 - bone fracture
 - hair loss
 - Fatigue, headache
 - dry shedding skin
 - Emotional lability

Fat Soluble Vitamins

- Vitamin A (con't)
 - Carotenoids, (beta carotene)
 - Body converts to Vitamin A
 - Water soluble (5 – 50% absorbed)
 - Eat with fat in the meal for increased absorption
 - Sources:
 - Yellow/orange: carrots, cantaloupe, sweet potatoes
 - Green leafy; collards, kale, spinach
 - Dose: no more than 15,000 IU/day mixed carotenoids

Fat Soluble Vitamins

- Vitamin E
 - Heart disease prevention? Data conflicting
 - Family of vitamers
 - 4 tocopherols (alpha, beta, gamma, delta)
 - 4 tocotrienols (alpha, beta, gamma, delta)
 - Function: antioxidant
 - To “stabilize” cell membranes from oxygen damage
 - Used Vitamin E can be restored by Vitamin C
 - Deficiency:
 - Weakness (mitochondria), poor coordination (nerves)
 - Susceptibility to infections
 - Poor wound healing
 - Fatigue

Fat Soluble Vitamins

- Vitamin E
 - Food sources: (cooking, processing lowers intake)
 - oils of seeds and nuts
 - wheat germ
 - green leafy vegetables
 - Animal fat
 - Hard to get protective amounts from food alone
 - Stored in fat
 - Supplement doses: 100 – 1200 IU/day
 - natural form=d, Synthetic form=l (mixed=dl)
 - best: mixture of natural tocopherols, tocotrienols
 - too much alpha tocopherol may limit gamma tocopherol
 - long term use of synthetic – effect unknown?

Fat Soluble Vitamins

- Vitamin E
 - Who may need more?
 - High intake polyunsaturated fats (PUFAs)
 - Poor fat absorbers; celiac
 - Nervous system: MS, Parkinsons, neuropathy, epilepsy
 - Fatigue, Alzheimers, autoimmune, periodontal, immune
 - Toxicity, oxidative stress
 - Who may need less?
 - Some people with hypertension (may increase BP)
 - People on anticoagulants
 - Toxicity:
 - Regarded as safe
 - Retinitis pigmentosa from overdosing (rare)

Fat Soluble Vitamins

- Vitamin D (Calciferol)
 - Provitamin D in skin + sunlight = D3
 - D3 in liver becomes 25(OH)D3
 - In kidney it becomes 1,25(OH)₂D3 (needs boron)
 - Function: (hormone not a vitamin)
 - Regulation of calcium and phosphorous absorption from gut
 - Parathyroid regulation of calcium balance in the blood
 - Stimulation of bone cell mineralization
 - Decreases cell proliferation
 - Increases muscle strength
 - Deficiency:
 - Rickets in children; Osteomalacia in adults
 - Cancer? Osteoporosis? Diabetes? CHF? Hypertension? MS?

Fat Soluble Vitamins

- Vitamin D
 - Sources:
 - Sunlight (blocked by skin pigments, keratin, SPFs)
 - 10 minutes of summer sun = 400 IU D3 depending...
 - More northern latitudes (> 40) not enough sun in winter
 - Vitamin D fortified foods (dairy), fish, cod liver oil
 - Supplement Doses (400 – 2000IU/day)
 - Previously thought not to be required from pills or diet!!!!!!
 - Best form for absorption and use: D3 (cholecalciferol)
 - Most common supplement form: D2 (ergocalciferol)
 - If kidney disease, use 1,25(OH)₂D₃ (Calcitriol)
 - Check all supplements and add total daily dose

Fat Soluble Vitamins

- Vitamin D
 - Who May Need More?
 - Elderly, liver and kidney diseases
 - Inadequate sun exposure (nursing home, winter, dark skin)
 - Poor fat absorbers, celiac
 - Prevention of cancer, diabetes (IDDM), heart disease, osteoporosis
 - Persistent, nonspecific musculoskeletal pain
 - Who May Need Less?
 - People with hyperparathyroidism
 - Toxicity (will not occur with excess sunlight)
 - Calcium deposits in soft tissues
 - MUST check your Vitamin D (bloodtest 25(OH)Vit D)

Fat Soluble Vitamins

- Vitamin K
 - Function:
 - Helps form blood clotting factors (II, VII, IX, X)
 - Helps form bone proteins (osteocalcin- calcium binding)
 - Antagonists that block action of Vit K: Coumadin, heparin
 - Deficiency:
 - Can be induced by antibiotic drugs, disruption of intestinal bacteria
 - Osteoporosis
 - Hemorrhaging
 - Mild deficiency if low in dark, green leafy vegetables
 - Sources:
 - Plants (K1)
 - Gut bacteria produce it from animal foods (K2)

Fat Soluble Vitamins

- Vitamin K
 - Supplement Doses: 100 – 500 mcg/day
 - Fat soluble more beneficial than water soluble forms
 - Who May Need More?
 - Prevention of hemorrhagic disease of newborns
 - Heavy menstruation? Easy bruising?
 - People at risk of osteoporosis, low bone density
 - People who don't eat enough green leafy vegetables
 - Poor fat absorbers
 - Long term aspirin users
 - People who take too much Vitamin A and E
 - Imbalanced gut flora

Fat Soluble Vitamins

- Vitamin K
 - Who May Need Less?
 - People who are taking anticoagulant drugs like Coumadin
 - Toxicity
 - None known
 - Synthetic form (K3) may result in free radical formation; Use K1 form

Water Soluble Vitamins

- Vitamin B's
 - B1 (Thiamin)
 - **Functions:**
 - Energy production
 - Brain function (CNS)
 - Immune system
 - **Deficiency: (beriberi)**
 - Dementia, confusion, headache, memory loss
 - Neuropathy, poor coordination
 - Alcoholism
 - Depression, fatigue, muscle weakness
 - Weight loss, loss of appetite, GI distress
 - Fast heart rate, enlarged heart

Water Soluble Vitamins

- B1 Thiamin
 - Sources
 - Brewer's yeast, wheat germ
 - Peanuts, sunflower seeds, pine nuts, soybeans
 - Destroyed by sulfites, moist heat, diets high in fats/sugar
 - Supplement doses: 50 – 200mg/day
 - Who may need more?
 - People who eat processed packaged foods
 - Excessively cooked foods, foods with sulfites
 - Alcoholics and people who drink a lot of tea
 - Who may need less?
 - People with chemical sensitivities, yeast sensitivity
 - Toxicity: rare

Water Soluble Vitamins

- Vitamin B2 (Riboflavin)
 - Functions:
 - Energy production, drug and toxin elimination, fat metabolism, antioxidant protection (recycles glutathione reductase)
 - Supports metabolism of folic acid, B6, Vit K, niacin
 - Deficiency:
 - Acne, alcoholism, corners of the mouth sores, irritated eyes, dermatitis, cataracts, depression, diarrhea, vision disturbances, indigestion, nerve damage, arthritis...
 - Sources:
 - Organ meats, brewer's yeast, almonds, wheat germ

Water Soluble Vitamins

- Vitamin B2 Ribflavin
 - Supplement Doses: 50 – 200mg/day
 - Who may need more?
 - People who take psyllium, alcohol, antacids, theophylline, caffeine, saccharin, Vit B3, Vit C, tryptophan
 - People who have high levels of copper or zinc
 - People with low thyroid function, low adrenal function...
 - Who may need less?
 - unknown
 - Toxicity: ??? Very rare

Water Soluble Vitamins

- Vitamin B3 (Niacin)
 - Produced from tryptophan with B6, B2, iron
 - Functions:
 - Production of energy, moves calcium
 - Production of fatty acids and steroids
 - Assists in DNA repair and cell differentiation
 - Assists insulin to manage blood sugar
 - Deficiency (Pellagra — dermatitis, dementia, diarrhea, death):
 - Scaly dark skin where trauma, sunlight or heat exposed (elsewhere pale)
 - Loss of appetite, nausea, indigestion, mouth sores
 - Confusion, depression, fatigue, headache, insomnia, muscle weakness, irritability

Water Soluble Vitamins

- Vitamin B3 Niacin

- Sources:

- Brewer's yeast, rice bran, wheat bran, peanuts
 - Tryptophan from milk, soy, peanuts, eggs, pork, lamb, beef

- Supplement Doses: 50 – 200mg/day

- Who may need more?

- People taking isoniazid (competes with B6)
 - People with high LDL cholesterol, Lp(a), triglycerides, fibrinogen and low HDL cholesterol
 - People with rheumatoid arthritis, osteoarthritis, diabetes, poor memory, depression

Water Soluble Vitamins

- Vitamin B3 Niacin
 - Who may need less?
 - unknown
 - Toxicity
 - Uncomfortable skin flushing
 - Can occur with doses as low as 2.5mg
 - Time release form – decreased flushing but may cause liver problems; check liver enzymes in blood test
 - Use non flushing form? inositol hexaniacinate
 - » Not as effective
 - If high doses are necessary (for high cholesterol) can take with aspirin initially to decrease flushing

Water Soluble Vitamins

- Vitamin B5 (Pantothenic Acid)
 - Functions:
 - “Pantos” = everywhere
 - Production of vitamins, proteins, fats, steroids...
 - Breakdown of proteins and carbohydrates for energy
 - Deficiency: very rare
 - Fatigue, low red blood cells, low steroid hormones
 - Sources:
 - Beef, pork, chicken, fish, organ meats, brewer’s yeast, oatmeal, hazelnuts

Water Soluble Vitamins

- Vitamin B5 Pantothenic Acid
 - Supplement Doses: 50 – 250mg/day
 - Who may need more?
 - People with rheumatoid arthritis, ulcerative colitis, fatigue, infection, adrenal dysfunction, allergies, high triglycerides, poor detoxification
 - Who may need less?
 - unknown
 - Toxicity ??
 - unknown

Water Soluble Vitamins

- Vitamin B6 (Pyridoxine) active form: pyridoxal 5' phosphate
 - Functions:
 - Assists over 100 chemical reactions in body
 - Methylation – for DNA protection (with B12, folic acid...)
 - Conversion of tryptophan to serotonin or niacin
 - Assists in production of glucose when needed
 - Modulates steroid hormone activity
 - Deficiency:
 - People with mouth sores, inflamed tongue, fatigue, sleepy
 - People low in B2 and magnesium
 - Mood disorders, nervous system problems, pregnancy, use of birth control pills or amphetamines, cigarette smokers
 - People who have amino acid abnormalities

Water Soluble Vitamins

- B6 Pyridoxine

- Sources:

- Bananas, walnuts, navy beans, sunflower seeds, wheat germ
 - P5P - Beef, salmon, chicken

- Supplement Doses: 30 – 500mg/day

- 250 – 500 mg/day for prolonged periods may be excessive; check liver

- Who may need more?

- People with autism, asthma, carpal tunnel, eczema, PMS, depression, post partum depression, atherosclerosis (esp high homocysteine) diabetes, osteoporosis, nausea of pregnancy, epilepsy, immune suppression, kidney stones

Water Soluble Vitamins

- B6 Pyridoxine
 - Who may need less?
 - unknown
 - Toxicity
 - More than 2000mg/day can produce neuropathy
 - More than 150mg P5P may suppress lactation
 - Excess may suppress detoxification

Water Soluble Vitamins

- Vitamin B12 (Cobalamin)
 - Functions:
 - Assists in production of DNA (Methyl group donor)
 - Assists in production of some neurotransmitters, other brain functions
 - Deficiency:
 - Megaloblastic anemia
 - Pernicious anemia if due to Intrinsic Factor deficiency
 - Neurotoxicity from homocysteine buildup in brain glial cells
 - Sources:
 - All animal foods (beef, beef liver, poultry, fish, eggs); synthesized by bacteria
 - Need Intrinsic Factor (from the stomach) and calcium to absorb B12 in the ileum (small intestine)

Water Soluble Vitamins

- B12 Cobalamin

- Supplement Doses: 1000 – 5000mcg/day

- Commonest form available: cyanocobalamin
 - Active form most available: methylcobalamin
 - May need to supplement with IF to absorb B12
 - Best absorption: B12 as injection
 - Lozenge form or drops absorbed in mucous membranes of the mouth (bypasses the stomach where IF needed) is the second best way to get B12 absorbed; pill form is least effective

- Who may need more?

- People with anemia, asthma, fatigue, hepatitis, dementia, epilepsy, depression, psychosis, irritability, poor coordination, numbness, tingling, neuropathy, AIDS, MS, tinnitus, infertility
 - Vegetarians, Elderly, Atherosclerosis, Stress and fatigue

Water Soluble Vitamins

- B12 Cobalamin
 - Who may need less?
 - unknown
 - Storage:
 - Stored in liver; may take 5 years to see shortage
 - Toxicity:
 - none ever reported

Water Soluble Vitamins

- Folic Acid
 - (“folium” = foliage; widespread in green leafy plants)
 - Functions:
 - Assists in production of DNA (methyl donor)
 - Assists in production of brain myelin (covering of nerves)
 - Deficiency:
 - Spina bifida, anencephaly (take folic acid preconception, needed in first few weeks of pregnancy)
 - Macrocytic anemia (always give with B12)
 - High homocysteine
 - Mood disorders (esp in elderly),
 - Sources:
 - Green leafy plants, brewer’s yeast, legumes, rice germ
 - Easily destroyed by cooking

Water Soluble Vitamins

- Folic Acid
 - Supplement Doses: 400 – 1000mcg/day (up to 10mg used)
 - If more than 400mcg given and no B12 can get neurologic damage
 - Who may need more?
 - People with anemia, diarrhea, decreased appetite, cervical dysplasia, high homocysteine, pregnancy, mood disorders
 - Who may need less?
 - unknown
 - Toxicity
 - Over 15mg/day – insomnia, irritability, GI upset
 - Should not take over 12mg/day if taking dilantin

Water Soluble Vitamins

- Biotin
 - **Functions:**
 - Accumulation of fatty acids in certain cells
 - Accumulation of lactic acid in Central nervous system
 - Assists in the production of folacin (folic acid)
 - **Deficiency:** rare
 - Seizures, poor coordination, depression, hallucinations
 - Poor hair and nail health (loss of hair)
 - Scaly dermatitis (cradle cap in infants)
 - Nausea
 - Localized numbness, muscle pain or weakness, fatigue
 - **Sources:**
 - Brewer's yeast, liver, soybean, egg yolk, peanuts, walnuts
 - Normal gut flora needed to produce biotin from food

Water Soluble Vitamins

- Biotin
 - Supplement Doses: 300 – 600mcg/day
 - Who may need more?
 - People who eat raw egg white (decreases absorption), alcoholics
 - People who eat few fruits and vegetables (decreased gut flora)
 - Scaly skin, brittle nails, hair loss
 - Nausea, decreased appetite, depression
 - Fatigue, muscle weakness, insulin resistance
 - Who may need less?
 - unknown
 - Toxicity: none

Water Soluble Vitamins

- Vitamin C (Ascorbic acid)
 - **Functions:**
 - Antioxidant and regenerates Vitamin E; protects LDL
 - Supports collagen synthesis (strong connective tissue, repair of wounds, gum health, decreased bruising)
 - Increases white blood cell activity
 - **Deficiency:** Scurvy
 - Fatigue, bleeding gums, impaired wound healing, joint pain, loose teeth, easy bruising, frequent infections cardiovascular disease
 - **Sources:**
 - Acerola cherries, red chili peppers, green peppers, guavas, papaya, oranges, cantaloupe, broccoli, cauliflower, brussels sprouts, grapefruit, strawberries
 - Vit C content declines rapidly after food picked or sliced

Water Soluble Vitamins

- Vitamin C (ascorbic acid)
 - Supplement Doses: 500 – 20,000mg/day
 - Who may need more?
 - Fatigue, easy bruising, gingivitis, poor wound healing, recurrent infections, follicular hyperkeratosis (lower extremities and buttocks)
 - Who may need less?
 - People with G6PD deficiency should not get IV Vit C (slices up red blood cells)
 - People with hemochromatosis increase iron storage with Vitamin C
 - Toxicity???
 - Unknown; diarrhea can occur with very high doses

Minerals

- Inorganic (nonliving) substances
- 18 considered “essential” – must get from diet
- Functions:
 - Coenzymes needed to initiate or facilitate biochemical reactions
 - Alter electrical currents to generate nerve impulses
 - Initiate muscle contractions
 - Open channels in cells, passageways for substances
 - Help to hold molecules and their carriers together

Minerals

- Major Minerals
 - Calcium
 - Phosphorous
 - Magnesium
 - Potassium
 - Sodium
 - Chloride
 - Body needs in quantities of 100 mg or more per day
 - Present in the body in amounts greater than 5 grams

Minerals

- Trace or Minor Minerals
 - Arsenic, Boron, Chromium, Cobalt, Copper, Fluoride, Iodine, Iron, Manganese, Molybdenum, Nickel, Selenium, Silicon, Tin, Vanadium, Zinc
 - Body needs only microgram (mcg) amounts
 - Exist in the body in amounts less than 5 grams

Minerals

- Levels of minerals in the body depend on:
 - Individual dietary habits
 - Mineral content of the soil
 - eg, selenium in west vs east soils
 - Gastrointestinal absorption
 - Poor absorption may produce deficiency
 - Influence of other substances/minerals
 - Imbalanced intake of antagonist mineral?
 - eg, calcium and phosphorous

Major Minerals

- Calcium:
 - Most abundant mineral in the body
 - 95 - 99% in bone
 - 1 – 5% used in muscle contractions, blood clotting, and nervous system function
 - Absorption of dietary calcium from intestines
 - Uses $1,25(\text{OH})_2$ Vit D
 - Regulation of calcium in the body
 - Body uses bone as the calcium “bank”
 - Body keeps steady level of calcium in the blood
 - » Parathyroid Hormone takes calcium out of the bone
 - » Calcitonin puts calcium back into the bone
 - » Kidney reabsorbs calcium using $1,25(\text{OH})_2$ Vit D

Major Minerals

- Calcium (con't)
 - Deficiency:
 - Can be caused by: excess dietary fat, fiber, caffeine, alcohol, glucose, aspartame, protein
 - Can cause symptoms like: muscle twitching, cramps, headache, hypertension, osteoporosis
 - Sources:
 - Dairy, kale, collards
 - Requirements:
 - » 1000mg/day – adults, lactation >18years old
 - » 1200mg/day – pregnant, >50years old
 - » 1300mg/day – pregnancy < 18 years old, children 9 – 18
 - Toxicity
 - None known

Major Minerals

- Phosphorous
 - Second most abundant mineral in the body
 - Body concentration is 50% that of calcium
 - Found in bone, teeth, ATP, DNA, many tissues
 - Sources:
 - Animal tissue
 - Soft drinks, fast foods (excess reduces calcium absorption)
 - Deficiency:
 - Can occur from excess calcium intake or Vit D deficiency
 - Loss of appetite, weakness, fragile bones, joint stiffness
 - Can occur with over consumption of antacids
 - Toxicity:
 - Excess phosphorous to calcium ratio

Major Minerals

- Magnesium
 - Found in bones (60%) and muscle (27%)
 - Participates in many chemical reactions
 - Deficiency:
 - Vasoconstriction, heartbeat irregularities, muscle cramps or twitches, insomnia, confusion, fatigue, decreased appetite, irritability, muscle weakness, depression
 - Seen in pregnancy and elderly more often
 - Seen with excess alcohol and caffeine
 - Low levels in people with diabetes, lupus
 - Also in people with allergies, immune or inflammatory disorders

Major Minerals

- Magnesium (con't)
 - Sources:
 - Whole grains, nuts, legumes seafood, green vegetables
 - Most absorbable: Mg citrate, Mg glycinate
 - Best to take small amounts throughout the day
 - Toxicity
 - Diarrhea (more than 600mg/day)
 - Drowsy, lethargy, weakness
 - Elderly because of consumption of many magnesium containing antacids and laxatives

Major Minerals

- **Electrolytes: Sodium, Chloride, Potassium**
 - Location of electrolytes
 - Potassium is diluted in water inside cells (2/3 of total water)
 - Sodium & chloride are diluted in water found outside of cells
 - Sources
 - Sodium/chloride: table salt; Potassium: potatoes, bananas, fruits
 - Excess
 - Sodium and chloride: too much pulls water out of cells
 - Common with Standard American Diet (SAD)
 - Can exacerbate congestive heart failure
 - Potassium: occurs when potassium not excreted sufficiently
 - People with kidney disease must restrict potassium
 - Excess can interfere with heart function

Major Minerals

- **Electrolytes**
 - Deficiency
 - **Potassium**
 - Dehydration increases potassium loss (diarrhea, vomiting, aging, some diuretics, starvation, burns)
 - Magnesium deficiency, diabetes
 - Can cause: muscle weakness, slow heart rate, fragile bones, changes in central nervous system, death
 - **Sodium** (deficiency is rare)
 - Starvation, vomiting, diarrhea can lower sodium in the ECF; water flows into cells causing water toxicity:
 - » Loss of appetite, muscle twitching, apathy
 - Water *and* sodium loss causes low blood volume
 - » muscle cramping, veins collapse

Major Minerals

- Electrolytes
 - Deficiency
 - Chloride
 - Vomiting or diarrhea
 - Can cause acid/base imbalances in the body

Trace Minerals

Boron

- Functions:
 - Maintains healthy bone
- Sources:
 - Fruits and vegetables (grown where the soil contains adequate boron)
- Deficiency:
 - Reduces calcium levels; bone mineral loss and central nervous system dysfunction
- Toxicity
 - Doses typically 1.5 – 3.0 mg per day
 - Doses exceeding 300mg per day: nausea, vomiting, diarrhea, dermatitis, lethargy

Trace Minerals

- Chromium
 - Functions:
 - Enhances insulin; blood sugar control
 - May increase HDL, decrease cortisol, improve immune function
 - Sources:
 - Brewer's yeast, meats, whole grains
 - Chromium deficiency
 - May increase blood sugar, insulin, increased body fat
 - Chromium excess
 - Chromium is safe at recommended doses

Trace Minerals

- Copper
 - Functions:
 - Enzyme reactions, red blood cells, collagen integrity, energy production
 - Sources:
 - Shellfish, legumes
 - Absorption:
 - Decreased with too much zinc, calcium, iron; molybdenum causes excretion
 - Estrogen can increase copper levels

Trace Minerals

- Copper (con't)
 - Deficiency
 - Can occur with high intake of zinc, antacids, vegetarian diet (high in legumes and vegetables), poor digestion, molybdenum supplementation
 - Iron deficiency anemia, broken blood vessels, bone and joint problems, lipid problems
 - Reduced skin pigment, central nervous system impairment, osteoporosis
 - Toxicity
 - Stomach pain, headache, diarrhea, hemolytic anemia
 - Excess copper levels found in Wilson's Disease and hemochromatosis; can cause severe liver, kidney and brain damage
 - Doses of 60mg can be emetic; doses of 3.5 grams can be fatal

Trace Minerals

- Iodine
 - Functions:
 - Used to make thyroid hormones (T4 and T3)
 - Sources
 - Sea vegetables, seafood (not much in sea salt)
 - Deficiency
 - Causes goiters (enlarged thyroid gland) and hypothyroidism
 - In infancy, severe iodine deficiency can cause growth retardation, cretinism, and death
 - Toxicity
 - Acne-like skin lesions?

Trace Minerals

- Iron

- Functions:

- Part of hemoglobin in red blood cells: carries oxygen to tissues
 - Immune functions, builds collagen

- Sources:

- Animal tissue (much better absorbed than non-heme iron found in plant tissue)

- Absorption:

- Decreased by: phytic acid, polyphenol compounds, calcium, partially digested proteins
 - Increased by: ascorbic acid, cysteine

Trace Minerals

- Iron (con't)
 - Deficiency:
 - Severe anemia, decreased energy levels, decreased immune function, learning disabilities, increased blood sugar
 - Can be caused by low stomach acid (common in elderly), chronic low grade blood loss (menstruation)
 - If not anemic, blood tests like ferritin and TIBC can show early iron deficiency
 - Toxicity
 - Excess iron not easily excreted; builds up
 - Hemosiderosis – iron is deposited in soft tissue
 - Hemochromatosis – iron is stored in liver (alcoholics at risk)
 - Excess iron may cause excess free radical production and increased risk of cancer, heart disease, joint inflammation

Trace Minerals

- Manganese
 - Functions:
 - Carbohydrate metabolism, bone and collagen formation, blood clotting, protein digestion, energy production, antioxidant activity
 - Sources:
 - Whole grains, legumes
 - Deficiency
 - Skin rash, loss of hair color, decreased hair and nail growth, decreased HDL cholesterol
 - Toxicity
 - Generally safe; iron deficiency (if iron intake low)
 - Increased levels in ALS(?); Parkinson-like symptoms

Trace Minerals

- Molybdenum

- Functions:

- Coenzyme for detoxification (alcohol, sulfite) and uric acid formation

- Sources:

- Lentils, beef liver, split peas, cauliflower, green peas, brewer's yeast, wheat germ, spinach

- Deficiency:

- Sulfite toxicity (rapid heart rate, headache, disorientation)
 - May be helpful in cancer (esophageal) prevention, decreasing dental caries; excess alcohol consumption

- Toxicity

- Generally safe; very large doses may produce gout symptoms

Trace Minerals

- Selenium
 - Function:
 - Mainly an antioxidant and supports DNA repair; prevents cancer and heart disease, reduces heavy metal toxicity; decreases symptoms of asthma and rheumatoid arthritis; enhances immune function
 - Sources:
 - Meats and seafood
 - Soil content determines selenium content of vegetables and grains
 - Deficiency
 - Susceptibility to infection, poor wound healing, fatigue...
 - Cardiomyopathy, cancer, decreased immune function seen when local diet consists of food grown where soil deficient in selenium
 - Toxicity:
 - Recommended not to exceed 200mcg/day

Trace Minerals

- Vanadium
 - Functions:
 - Assists in blood sugar metabolism
 - Other possibilities include: metabolism of lipids, red blood cell formation, thyroid gland function
 - Sources:
 - Buckwheat, Parsley, Soybeans, Safflower oil, eggs
 - Deficiency:
 - None noted in humans
 - Animal studies show; increased abortion, decreased milk production, cholesterol changes, impaired growth, thyroid changes
 - Toxicity:
 - May occur at 10 – 20 mg per day
 - Elevated blood pressure, decreased coQ10 and Coenzyme A, decreased cell energy (bipolar disorder ?)

Trace Minerals

- Zinc

- Functions

- Enzyme reactions, hormone and immune activity
 - Used in wound healing, bone structure, skin oil gland function, prostate tissue

- Absorption

- Decreased by too much iron, calcium, alcohol, and with infection, surgery

- Sources

- Oysters, red meat, shellfish
 - Whole grains, legumes, nuts but zinc bound to phytic acid and unavailable

Trace Minerals

- Zinc (con't)
 - Deficiency
 - Skin changes, hair loss, recurrent infections, diarrhea
 - Sleep disturbances, slow wound healing, dandruff, rheumatoid arthritis, reduced appetite, inflammatory bowel disease, acne, psoriasis, diabetes, AIDS patients, smokers
 - Doses
 - Routine daily dose: 15mg or less (overdosing is easy and common – if you take many supplements and eat meat often)
 - Short term (eg, infection): less than 80mg/day
 - Too much zinc can decrease immune function, cause poor wound healing, problems with taste and smell, hair loss and skin problems
 - Too much zinc causes copper deficiency (they compete for absorption)
 - Toxicity
 - Dizziness, vomiting, lethargy, anemia

Other Supplements

- Some authorities recommend daily combination of supplements
- The Foundation of Supplements
 - Multivitamin
 - Antioxidant mixture (Vit C, Vit E, beta carotene, selenium, manganese, glutathione, CoQ10, lipoic acid, flavinoids, phenols, polyphenols...)
 - Probiotic (lactobacillus, bifidobacter...)
 - Fish oil (EPA, DHA)
- Many manufacturers making “packets”

Other Supplements

- Phytochemicals
 - Important messages to your cells
 - Come from plants (“phyto”)
 - Examples:
 - Antioxidant mixtures for macular degeneration
 - Cruciferous mixtures for healthy estrogen metabolism
 - Often contained in multivitamins now
 - ECGC (from green tea)
 - Lycopene (from tomato)

Other Supplements

- Phytochemicals (con't)
 - Example: Carotenoids (~ 500 known)
 - Plant pigments
 - Beta-carotene: carrots sweet potatoes
 - Lycopene: tomatoes, watermelon
 - Lutein: from green leafy vegetables
 - Zeaxanthin: for retina of eye
 - Uses:
 - Turn into Vitamin A (but as carotenoids, they are safe at higher doses)
 - Adaptable antioxidants
 - Protection from cancer? Cardiovascular disease?

Other Supplements

- Probiotics
 - Normal flora for GI tract
 - Lactobacillus, bifidobacterium...
 - Produce vitamins, fatty acids, assist immunity
 - Restores balance after antibiotics
 - Must have: expiration date, colony count
 - Should be refrigerated (alive)
 - High concentration of organisms
 - Mixtures of organisms

Other Supplements

- Fish Oil (EPA-DHA)
 - EPA – antioxidant
 - 1000 – 1500mg/day
 - DHA – brain function, cell membrane
 - 500 – 1000 mg/day
 - Source is important
 - Third party assayed: free of PCBs, dioxin, mercury
 - Reduces clotting (stop before surgery)
 - Assists immune system, cardiovascular function, mood and brain function, and supports healthy bone/joint, skin and eye health, relieves minor pain

Other Supplements

- Nutriceuticals or Medical Foods
 - Combinations of vitamins, minerals, phytochemicals designed for prevention of a specific condition
 - Examples:
 - Protein shakes for body composition
 - Green Drinks for antioxidant/antiinflammatory effects
 - Cholesterol lowering spreads (Earth Balance)
 - Yogurt for Irritable Bowel Syndrome (probiotics)

Summary

- BEST way to get vitamins and minerals is from a healthy diet:
 - Plenty of fruits and vegetables
 - Whole grains
 - Low fat animal protein (grass fed even better)
 - Organic is best – contains the most nutrients
 - What you don't get enough of in your diet:
 - Folic acid, Vitamin B6, Vitamin B12, Vitamin D, Vitamin E

Summary

- Multivitamin/mineral formula
 - Complex interactions between vitamins and minerals
 - Need a broad spectrum of ingredients
 - Fat soluble vitamins
 - Water soluble vitamins
 - Antioxidants
 - Phytochemicals
 - Minerals

Summary

- Natural forms of nutrients best
 - eg: the “d” form of Vitamin E
 - Families best, eg; mixed tocopherols and mixed carotenoids
- Best taken with a balanced diet (carbohydrates, proteins, fats)
- DRIs or DVs not applicable to individual risks/benefits
- Don't underdose nutrients you are depending on
 - Check the serving size on the label
 - Serving size of calcium products can be high (calcium is a very bulky molecule); often 6/day; if you are taking 2/day you are only getting 1/3 of what the label says you are getting

Summary

- Not enough in multivitamin: Calcium, Magnesium, Vitamin D, Vitamin K, Chromium, Selenium and Zinc (need to individualize)
 - Vitamin K – manufacturers don't include because it can interfere with the action of blood thinning medications
 - Vitamin D – individuals will vary in their needs so best to check your blood level
 - Chromium, selenium and zinc – taking too much of these can be harmful
 - Calcium – it's a big molecule – see prior slide

Summary

– Don't overdose

- Many vitamin and mineral interactions
 - Too much of one may decrease effect of another
- Don't exceed label recommendations
- Calculate your dosages
 - Add amounts from all your bottles
 - » eg: Vit D may be in multi and in calcium product
- Be sure to take B vitamins as a mixture
 - Remember B6 without B12 may mask a B12 deficiency
- Generally a reputable manufacturer will make a balanced multivitamin – take as directed

Summary

- Watch out for too much of these:
 - Vitamin A (acetate or palmitate) retinol – the tolerable Upper Intake Level is 10,000 IU/day. Take less than this. (does not include the water soluble form beta carotene)
 - Vitamin E – used mixed tocopherols at a reasonable dose (400 – 800 IU/day) unless you have a special need)
 - Iron – you get it from red meat too. It should not be in your multi unless you have a special need (anemia, heavy periods...)
 - Zinc – it interferes with copper. Don't use more than 15mg/day unless you have special needs

Summary

- What's not in your multivitamin
 - Probiotics
 - Fish oil
 - Vitamin E (may be a small amount only)
 - Enough calcium
 - it is a bulky molecule
 - Dose often 6/day
 - Enough vitamin D
 - Some women have very low levels and need to take a large amount to build up their reserves

Summary

- Read your Multivitamin/mineral Label
 - The DV (Daily Value)
 - listed for each ingredient. This is the FDA's recommendation on how much of each nutrient you need per day from food and supplements. It is outdated (not updated since 1970s). May be listed as %DV
 - IOM Recommendation
 - Listed for each ingredient. These recommendations come from the Academy of Sciences Institute of Medicine and are more current
 - Amount per serving
 - Listed for each ingredient. This is based on serving size
 - Serving Size
 - The amount of capsules/tablets that will contain the amount of each ingredient listed. Be sure to find this. Multis can be dosed at 6/day

Summary

- Check for potency and safety
 - USP (United States Pharmacopeia) verifies:
 - The ingredients and amounts on the label are in the bottle
 - There are no harmful levels of contaminants
 - It will break down and release the ingredients in your body
 - It has been made with Good Manufacturing Practices
 - This is a voluntary program that manufacturers pay for. Not all manufacturers participate

Summary

- Check for Potency and Safety (con't)
 - Some manufacturers chose not to be evaluated by USP. There are other evaluating agencies:
 - Consumerlabs.com – randomly evaluates over the counter supplements
 - GMP – Good manufacturing processes verification may come from a variety of organizations
 - National Nutritional Foods Association
 - NSF International
 - Therapeutic Goods Administration of Australia

Summary

- Check for Other Ingredients
 - Inert ingredients
 - Preservatives, artificial colorings, flavorings, sweeteners
 - Ingredients that some are sensitive to
 - Yeast, soy protein, egg, corn protein, wheat, gluten, fish, shellfish
 - These do not have to be in the supplement. Some people will notice if the supplement was made in a facility that merely processes these types of ingredients

Summary

- What else do you take because
 - Your individual risk factors for deficiency are higher?
 - Your need for extra protection is higher?

Summary

- Your individual risk factors for deficiency are higher?
 - Vegetarians and people taking stomach acid blockers, cochlincine or dilantin need B12
 - People with skin problems often are deficient in B vitamins
 - Menstruating women may need iron in their multivitamin
 - People who take diuretics (water pills) need magnesium, potassium, zinc
 - People who drink alcohol regularly are at risk of many vitamin deficiencies – B vitamins, magnesium, zinc
 - People who drink a lot of coffee tend to lose potassium in their urine
 - People with Crohn's Disease or ulcerative colitis need more zinc
 - People in Nursing homes will need extra Vitamin D

Summary

- Your need for extra protection is higher?
 - People with heart disease need antioxidants
 - People taking statin drugs (lipitor) need CoQ10
 - People with macular degeneration need phytochemicals/antioxidants
 - You're sick and need more Vitamin C and Zinc
 - People with cancer may want to increase their intake of antioxidants, Vitamin D, melatonin, whey protein, cruciferous phytochemicals...

From Mark Twain

- The main distinguishing characteristic between man and the lower animals is the desire to take pills