Chapter 10
Water Soluable Vitamins
Vit B & Vit C

- Bioavailability
  Amount of vitamin absorbed and used by the body; dependent on:
  - efficiency of digestion
  - nutrition status
  - other foods consumed at the same time
  - method of preparation (raw, cooked, processed)
  - source of nutrient (synthetic, fortified, natural)

Precursors
- Provitamins – inactive form that once inside the body is converted to active form

Organic Nature of Vitamins
Vitamins can be destroyed by cooking and storage – handle with care

- To Minimize Nutrient Loss:
  - Refrigerate Fruits/Vegetables
  - Store Cut Fruits/Vegetables in Air Tight Containers in Refrigerator
  - Use Microwave, Steam, or Simmer in Small Amts of Water

Soluability and Storage

- Water Soluable Vitamins
  - Move directly into blood; circulate freely at cellular level
  - Kidneys detect and remove small excesses
    - Vitamin B
    - Vitamin C

- Fat Soluable Vitamins
  - Enter lymph then blood; held in fatty tissues and liver
  - Tend to remain in fat-storage sites rather than being excreted
    - Vitamin A
    - Vitamin D
    - Vitamin K
    - Vitamin E

B Vitamins

- Thiamin (B1)
- Riboflavin (B2)
- Niacin (B3)
- Biotin
- Pantothenic Acid (B5)
- Pyridoxine (B6)
- Folate/folic acid
- Cobalamin (B12)

Sources of Thiamin (B1)
Whole/fortified/enriched grains, legumes, milk, nuts, oats, oranges, rice, pork, beef, seeds

- Moderate Amts Found in All Foods
- Dosage: 50mg daily
**Riboflavin (B2)**

- **Function:**
  - Necessary for normal cell function, growth, and energy production
  - Easily Destroyed by Ultraviolet Light/Irradiation; antagonized by caffeine, alcohol, estrogen, zinc
  - Increased need with stress

- **Deficiency Symptoms:**
  - Sore mouth, lips, tongue
  - Insomnia
  - Photosensitivity
  - Bloodshot, gritty eyes
  - Scaly red skin on sides of nose

- **Dosage:** 50 mg daily

**Sources of Riboflavin (B2):**
- Milk Products (Yogurt/Cheese), Enriched/Whole Grains, Leafy Green Vegetables, Eggs, Fish, Liver, Yeast

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**Niacin (B3)**

- **Function:**
  - Important in metabolism of glucose, fat and alcohol
  - Vital for normal brain function (deficiency linked to schizophrenia and depression)
  - Improves the health of skin, circulation, and the digestive system

- **Deficiency Symptoms:**
  - Diarrhea/Abdominal Pain/Vomiting
  - Swollen/Inflamed/Red Tongue
  - Fatigue/Headache/Memory Loss/Insomnia
  - Rash when Exposed to Sunlight
  - Muscle weakness
  - Irritability
  - Psychiatric disturbances
  - Pellagra Disease

- **Toxicity:**
  - Large doses from supplements or drugs
    - Niacin flush
    - Nicotinic acid taken in doses 3-4 times the RDA
    - Dilates the capillaries and causes a tingling sensation
    - Nicotinic acid used to lower blood cholesterol and prevent heart disease
    - Predisposed to toxicity:
      - Liver disease, Diabetes, Peptic Ulcers, Gout, Inflammatory bowel disease, Migraines, Alcoholism

**Sources of Niacin (B3):**
- Milk/Eggs; Meat/Poultry/Fish; Whole Grains/Enriched Breads & Cereals; Nuts; Avocados; Sunflower Seeds; Prunes

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**Biotin**

- **Functions:**
  - Part of Energy Metabolism
  - Fat Synthesis
  - Amino Acid Metabolism
  - Glycogen Synthesis
Biotin

- **Deficiency Symptoms:**
  - Depression, Lethargy, Hallucinations
  - Numb or Tingling Sensation of Arms/Legs
  - Red Scaly Rash around Eyes, Nose & Mouth
  - Hair Loss
  - Deficiencies are *Very Rare*

Sources of Biotin

- Organ Meats/Egg Yolks/Fish
- Soybeans
- Whole-Grains
- Wide Spread in Foods

Pantothenic Acid (Vitamin B5)

- **Function:**
  - Necessary for conversion of carbohydrates to energy; slight deficiency can lead to fatigue
  - Helpful during times of stress
- **Deficiency Symptoms:**
  - Fatigue/Insomnia/ Depression
  - GI distress (nausea, vomiting, stomach cramps)
  - Hypoglycemia/Increased sensitivity to insulin
  - Burning feet
  - Poor coordination/numbness/muscle cramps/inability to walk

Pantothenic Acid Food Sources

- Organ Meats
- Eggs
- Nuts
- Potatoes/Tomatoes/Broccoli/Green Veggies
- Whole Grains
- Destroyed during canning, freezing, refining

Pyridoxine (Vitamin B6)

- **Functions:**
  - Amino Acid Metabolism
  - Fatty Acid Metabolism
  - Helps Make Red Blood Cells
  - Improves Immune System

Vitamin B6

- **Deficiency/Toxicity Symptoms:**
  - Skin Rashes
  - Anemia
  - Depression/Confusion/Convulsions
  - Insomnia
  - Kidney stones
  - PMS
- Most common in those who eat diets centered around “junk” or “convenience” foods. Food processing destroys up to 90% of vitamin B6 content in food (heat)
**Sources of B6:**
- Meats/Poultry/Fish/Liver
- Legumes
- Soy
- Non-Citrus Fruits (banana and cantaloupe)
- Fortified Cereals
- Milk
- Eggs
- Seeds

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**Folate (Folic Acid)**

- **Functions:**
  - DNA Synthesis & New Cell Formation
  - There are Higher Recommendations for Pregnant Women:
    - Folic acid crucial to development of the fetus
    - Pregnant Women Should Take Folate Supplements to reduce the risk of birth defects.
  - Easily destroyed by cooking, processing, and exposure to light and air

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**Folate and Heart Disease**

- Folate Breaks Down Homocysteine
  - High Homocysteine + Low Folate = High Risk for Heart Disease
  - May Help Prevent Cancer

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**Folate Deficiency Symptoms/Toxicity**

- Megablastic Anemia
- Smooth Red Tongue
- Mental Confusion/Fatigue/Headache
- Masks Vitamin B12 Deficiency
- Anorexia
- Fatigue
- Digestive problems
- Increased risk cancer and heart disease

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**Folate Food Sources:**
- Fortified Grains
- Leafy Green Vegetables
- Avodados
- Legumes/Seeds
- Liver
- Egg Yolk
- Apricots/Melons/Fresh Oranges

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**Vitamin B12 (Cobalamin)**

- **Functions:**
  - New Cell Synthesis
  - Maintains Nerve Cells
  - Helps Break Down Amino Acids/Fatty Acids
  - Forms and regenerated RBC’s

- Easily Destroyed By Microwaving
**B12 Deficiency/Toxicity Symptoms**
- Anemia
- Fatigue
- Nerve damage
- Heart disease
- Brain damage/hallucinations
- Atrophic Gastritis
- No Known Toxicity

**Vitamin B12 Food Sources**
- Meat/Fish/Poultry/Shellfish
- Milk/Cheese/Eggs/Yogurt
- Fortified Cereals

**Vitamin C (Ascorbic Acid)**
- Serves as an Antioxidant
- Boosts the immune system
- Easily Destroyed By Heat and Oxygen
- Cure for the Common Cold
- Vitamins C Needs Increase During Times of Stress
- Co-Factor for Collagen Formation — helps with healing
  - Collagen is used for Bones/Teeth, Scar Tissue and Artery Walls
  - Necessary for the absorption of iron

**Vitamin C Deficiency**
- Symptoms:
  - Anemia
  - Fatigue
  - Atherosclerosis
  - Lowered immune system
  - Bone Fragility/Joint Pain
  - Bleeding Gums/Loose Teeth
  - Rough Skin/Blotchy Bruises
  - Scurvy

**Vitamin C Toxicity**
- Symptoms
  - Nausea/Vomiting/Diarrhea
  - Hot Flashes/Rashes
  - Creates False Positive/Negative Lab Results
  - Aggravates Gout, Urinary Tract Infections, and Kidney Stones

**Vitamin C Food Sources**
- Citrus Fruits, Canteloupe, Strawberries, Papayas, Mangoes
- Dark Green Vegetables
- Potatoes
- Green Bell Peppers
- Cabbage/brussels sprouts

**Best when eaten fresh or raw**
Chapter 11
Fat Soluable Vitamins

- Vitamin A
- Vitamin D
- Vitamin E
- Vitamin K

Vitamin A & Beta-Carotene

- Promotes Vision
- Reproduction and Growth
  - Sperm Development
  - Normal Fetal Development
  - Bone Growth called Remodeling

Vitamin A Deficiency

- Infectious Diseases- Impaired Immunity
- Night Blindness- Inability to see in Dim Light
- Blindness
- Keratinization- Rough Dry Scaly Skin

Vitamin A in Foods

- Spinach/Dk Leafy Vegetables
- Cantaloupe
- Squash, Carrots, Sweet Potatoes
- *Brightly colored fruits & vegetables

Vitamin D

- Roles in the Body
  - Bone and Teeth Growth
  - Helps Maintain Blood Levels of Calcium and Phosphorous
  - Important for absorption of Vitamin A
  - Normal kidney function
- Produced by the body in presence of sunlight

Vitamin D Deficiency

- Rickets
  - Affects Mainly Children
  - Inadequate Calcification of Bones
  - Misshapen Bones
  - Enlargement of the Ends of Bones
**Vitamin D Deficiency**
- Osteomalacia
  - Affects Adults
  - Soft, Flexible, Brittle, Deformed Bones
  - Pain in Pelvis, Lower Back, and Legs
- Osteoporosis
  - Loss of Calcium from the Bones
  - Popular in the Elderly
  - Post Menopausal r/t Loss of Estrogen

**Vitamin D Sources**
- Fortified Milk/Butter/Margarine
- Cereals
- Chocolate Mixes
- Veal, Beef, Egg Yolks, Liver, Fatty Fish
- Vitamin D from the Sun
  - Synthesized in the Body from Cholesterol
  - May Be Obtained from Tanning Beds (UV)

**Vitamin E**
- It is an Antioxidant
- Helps the development/maintenance of bones and muscles
- Improves immune activity
- Easily Destroyed by Heat and Oxygen
- Primary Deficiency is Rare
- Smokers and women who take BCP have additional vitamin E requirements

**Food Sources Vitamin E**
- Leafy Green Vegetables / Broccoli
- Wheat Germ
- Liver/Egg Yolks
- Nuts/Seeds
- Soybeans
- Whole wheat

**Vitamin K**
- **Roles in the Body:**
  - Synthesis of Blood-Clotting Proteins
  - Deficiency Causes Hemorrhagic Disease
  - Vitamin K Injections at Birth or as an Adult
  - Hemophilia is hereditary and not cured with Vitamin K
  - Healthy gut bacteria ensure adequate amounts (eat yogurt!)
Food Sources for Vitamin K

- Yogurt
- Egg yolk
- Broccoli / Leafy green vegetables
- Green tea
- Whole grains
- Tomatoes
- Liver

Questions??