Vitamin D

By Kristen Perrella
Vitamin D₂ (Ergocalciferol)

Vitamin D₃ (Cholecalciferol)

Source: https://online.epocrates.com/data_dx/reg/641/img/641-1-hlight.jpg
Biochemical Significance

• Vitamin D3: formed from cholesterol skeleton by ultraviolet radiation
  o Regulation of calcium and phosphorus metabolism
  o Cholesterol $\rightarrow$ 7-dehydrocholesterol
    • Rearranged by UV radiation from the sun $\rightarrow$ cholecalciferol is hydroxylated by liver enzymes to the most active form of vitamin D, 1,25-dihydroxycholecalciferol

• Active form of vitamin D, 1-25 dihydroxyvitamin D
  o Involved in cell death and survival pathways
  o Depending on tissue, used in the protection of cells or in killing tumor cells in conjunction with chemotherapy
Why Vitamin D is Important

Phosphorus Homeostasis
- Calcitriol acts on the same target organs as when maintaining calcium homeostasis to maintain phosphorus homeostasis
- Intestine
- Bone
- Kidneys
- Excess phosphorus is excreted in the urine in response to PTH

Cell differentiation, proliferation, and growth
- Within non-calcium regulating tissues, maintains normal cell growth, differentiation, and proliferation
- In some tissues, prevents malignancy by down-regulating cancer cell growth and inducing apoptosis as needed
- Treatment of psoriasis

Calcitriol and muscle
- Vitamin D deficiency
- Atrophy of type 2 (fast-twitch) muscle fibers
Vitamin D3 Deficiency: Rickets

- Nutritional disease
  - Bone malformation from improper calcium and phosphorus metabolism
  - Deficient adults develop osteomalacia, a weakening of bone
  - Childhood form of osteomalacia

- At risk:
  - People in areas with little sunshine (here!)
  - People with darker skin color
    - Melanin blocks some of the UVB rays

- Bowing of the legs

Sources of Vitamin D

- Natural sunlight
- Fortified milk
- Cheese
- Butter/margarine
- Cereal
- Fish

Source: http://tasterie.com/blog/2012/03/vitamin-d-and-food-allergies/
Recommended Daily Allowance

• Assuming minimal sun exposure...
  o Children, adolescents, adults, including women who are pregnant or lactating: 600 IU (15 micrograms)
  o Age 70+: 800 IU (20 micrograms)

• During spring, summer, fall:
  o Try to get 5 to 15 minutes of sunlight between 10am and 3pm
Fair-skinned individuals generate 10,000 to 20,000 IU vitamin D in 15 to 30 minutes.
Current Research

• DRI for calcium and Vitamin D from the IOM
  o Prevalence of Vitamin D inadequacy has been overestimated
  o 25-hydroxy vitamin D level—20 ng/mL / 600 IU vitamin D
    • Need to reassess lab ranges to avoid problems of under-treatment and over-treatment

• Annual high-dose vitamin D and falls/fractures in older women
  o 500,000 IU cholecalciferol
    • Prevent decreases in 25-hydroxycholecalciferol
  o Autumn or winter
  o Reduce risk of fractures and falls
  o 2256 women, age 70+
  o Resulted in an increased risk of falls
    • 15% more falls
    • 26% more fractures
References