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# VITAMINS

# VITAMINS

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- group of organic nutrients
  - required in small quantities
  - needed for a variety of biochemical functions
  - cannot be synthesized by the body
  - supplied in the diet
  - they are not a source of calories (energy)
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# VITAMINS (cont.,)

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- Physiological role (specific metabolic function)
- Prevents disease, unlike “supplements”  
(ex. Omega 3s, fibers)
- *supplements may promote “something” or have general metabolic effect*
- Natural vitamins = Synthetic vitamins  
(**except Vitamin E**)



# VITAMINS (cont.,)

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- Nutritional Value lost by:
    - Bacteria
    - Light
    - Oxidation
    - and Heat
  
  - Age, Gender, Pregnancy, and Lactation
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# Vitamin Requirements (cont.,)

- **Recommended Dietary Allowances (RDA)** is a norm for how much of various nutrients people should take in every day to stay healthy

Vitamin Content Per Ounce

Vitamin	Daily Value	Manganese Plant <sup>1</sup>	Thal <sup>2</sup> Co <sup>3</sup>	BenCo <sup>4</sup>	Naturely Thal <sup>5</sup> Manganese	Manganese <sup>6</sup>
Vitamin A as beta carotene IU/oz	3000 IU	3,741	Less Than 3	3.4	300	Less Than 3
Vitamin C mg/oz	60 mg	618	Less Than 0.1	5.2	0.10	67.4
Vitamin D3 IU/oz	400 IU	1187	43.5	24.2	2	Less Than 5
Vitamin E as d alpha tocopherol IU/oz	30 IU	55.95	2.43	Less Than 0.1	0.37	2.44
Vitamin B1 mg/oz	1.2 mg	1.48	Less Than 0.2	Less Than 0.2	Less Than 0.1	Less Than 0.2
Vitamin B2 mg/oz	1.7 mg	9.19	Less Than 0.5	Less Than 0.5	Less Than 0.5	Less Than 0.5
Vitamin B6 mg/oz	2 mg	4.45	Less Than 0.5	Less Than 0.5	Less Than 0.5	Less Than 0.5
Vitamin B12 mg/oz	20 mcg	55.95	Less Than 0.5	Less Than 0.5	Less Than 0.5	Less Than 0.5
Folic Acid mg/oz	400 mcg	879	Less Than 35	Less Than 10	10.00	Less Than 0.2
Vitamin B12 mg/oz	4 mcg	13.98	Less Than 5	Less Than 0.5	Less Than 0.5	Inferior!!!
Biotin mg/oz	200 mcg	213	34	Less Than 20	20.00	Less Than 20
Pantothenic Acid mg/oz	10 mg	13.26	Less Than 1	Less Than 1	1.64	Inferior!!!

Comparisons based on independent lab tests conducted in July 2003 for #B284; February 2004 for #AC9; June 2004 for #D435304; November 2004 for #B401; April 2006 for #B402 and May 2006 for #B433203A; as influenced by the name of the product.

# The RDA

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## Vitamins:

- Vitamin A -- 5000 IU
- Vitamin C -- 60 mg
- Vitamin D -- 10 mcg (400 IU)
- Vitamin E -- 10 mg (15 IU)
- Vitamin K -- 80 mcg
- Thiamin -- 1.5 mg
- Riboflavin -- 1.8 mg
- Niacin -- 20 mg
- Vitamin B-6 -- 2 mg
- Folate -- 400 mcg
- Vitamin B-12 -- 2 mcg
- Biotin -- 30 to 100 mcg
- Panthothenic acid -- 4 to 7 mg

## Minerals:

- Calcium -- 1200 mg
  - Phosphorous -- 1200 mg
  - Iron -- 15 mg
  - Iodine -- 150 mcg
  - Magnesium -- 400 mg
  - Zinc 15 mg
  - Selenium -- 70 mcg
  - Copper -- 1.5 to 3 mg
  - Manganese -- 2 to 5 mg
  - Chromium -- 50 to 200 mcg
  - Molybdenum -- 75 to 250 mcg
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# Classification of Vitamins

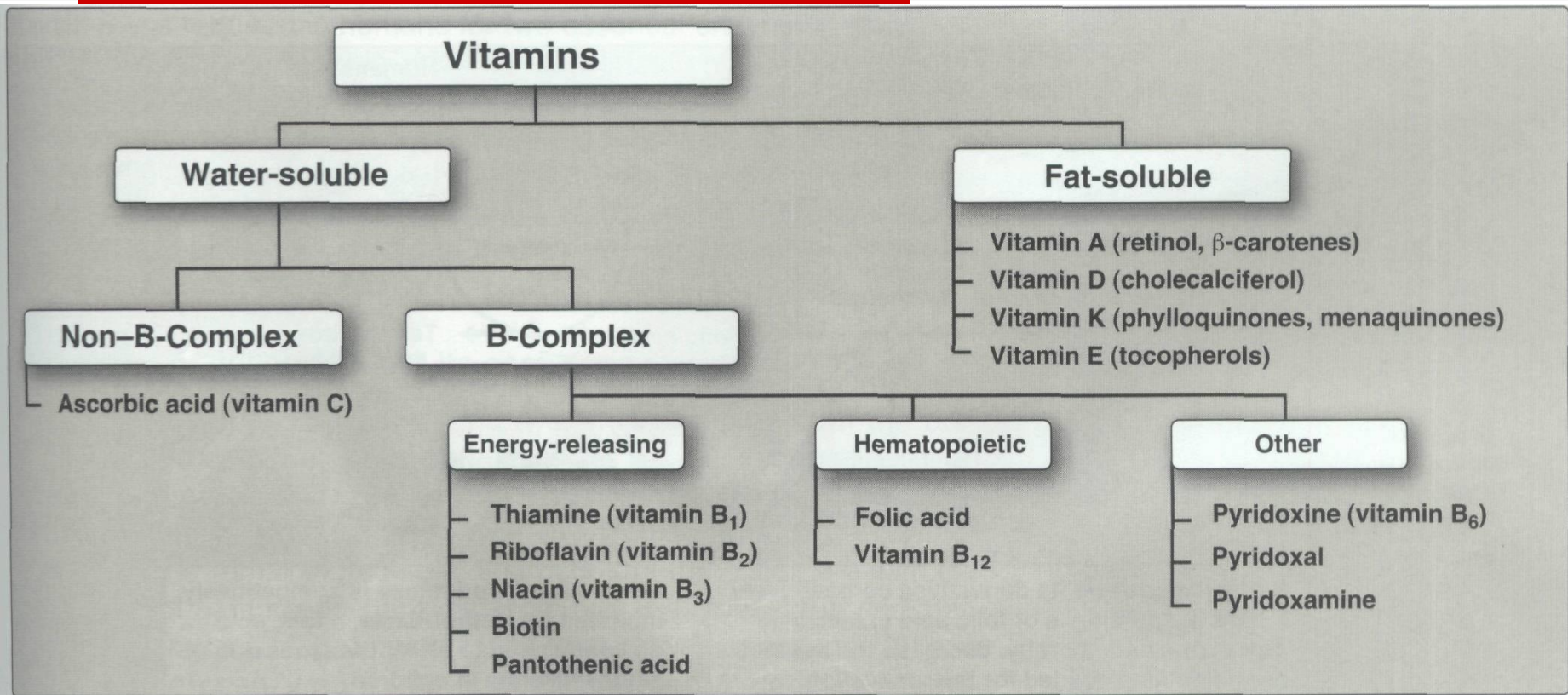


Figure 28.1  
Classification of the vitamins.



# Differences between fat soluble and water soluble vitamins

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- Fat soluble are stored in the liver and fatty tissues. These are not readily excreted from the body.
  - Water soluble vitamins travel in the blood and are stored in limited amounts. These are readily excreted from the body through urine.
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# Fat Soluble Vitamins

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- found in **fats and oils**
  - **require bile** for absorption
  - enter the lymph, then the blood
  - stored in fatty tissues
  - may reach toxic levels
  - not readily excreted
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# Fat Soluble Vitamins

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- **A** – orange, carotenoids, vision, antioxidant- used as color and antioxidant
  - **D** – *WE* make it with sunlight, found in milk (*added*), deficiency causes rickets, regulates Ca : P ratios
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# Fat Soluble Vitamins

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- **E** – tocopherols, antioxidants, role in preventing stroke, cancer, heart disease-  
used as antioxidant
  - **K** – contributes to blood clotting factor
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# Vitamin A

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- 3 forms in the body
    - **retinol**
    - **retinal**
    - **retinoic acid**
  - collectively known as retinoids
    - found in food derived from animals
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# Vitamin A (cont.,)

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- promote vision
  - small losses of retinal
  - requires continual replenishment
- maintain epithelial tissue and healthy skin
  - mucous membranes
- support reproduction and growth
  - sperm development
  - fetal development
- Regulate Immune System

# Vitamin A sources:

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## Animal Sources

- Eggs
- Meat
- Cheese
- Milk
- Liver
- Kidney
- Cod
- Halibut fish oil

## Plant Source

- Carrots
- Sweet Potatoes
- Cantaloupe
- Pink Grapefruit
- Apricots
- Broccoli
- Spinach
- Pumpkin

# Signs of Deficiency

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- NIGHT BLINDNESS
- Decreased resistance to infections
- pneumonia, measles, diarrhea
- Extremely dry skin, hair or nails

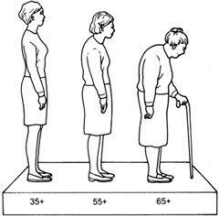




# Vitamin A Is Toxic

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- Hypervitaminosis and unbound vitamin A causes tissue damage
  - Symptoms:
    - Dry, itchy skin
    - Headaches and fatigue
    - Hair loss
    - Liver damage
    - Blurred vision
    - Loss of appetite
    - Skin coloration
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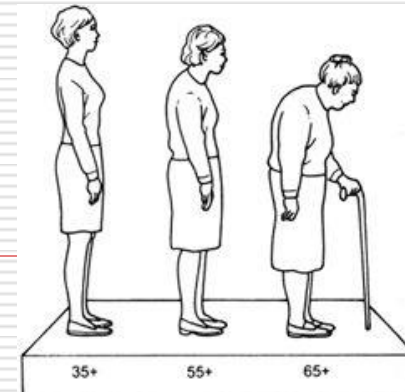
# Vitamin D

- Also known as calciferol due to its role in calcium absorption
- Main role is to MAINTAIN CALCIUM AND POTASSIUM LEVELS
- It is the only fat soluble vitamin that body can make in the presence of sunlight and cholesterol as precursor

# Vitamin D (cont.,)

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- **NOT ESSENTIAL**
- production occurs in liver and kidney
- stored in fat tissues
- Elderly are at risk (not enough sunlight exposure)



# Vitamin D (cont.,)

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- Toxicity is very dangerous
    - Occurs only from excess supplementation
    - Can lead to calcium deposits in kidneys, heart and blood vessels
    - **excess vitamin D = increase blood calcium = stones or hardening of blood vessels**
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# Distribution and requirement of vitamin D

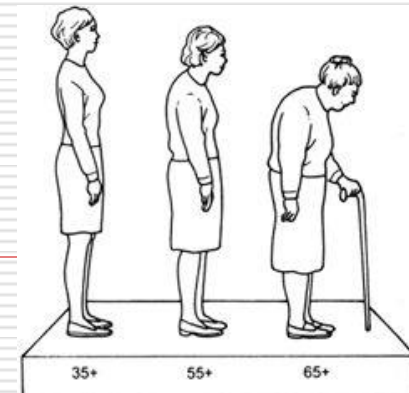
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- Vitamin D occurs naturally in fatty fish, liver, and egg yolk.
  - Milk, unless it is artificially fortified, IS NOT a good source of the vitamin
  - The RDA for adults is 5 mg cholecalciferol, or 200 international units (IU) of vitamin D
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# Vitamin D Deficiency in Children & Adults

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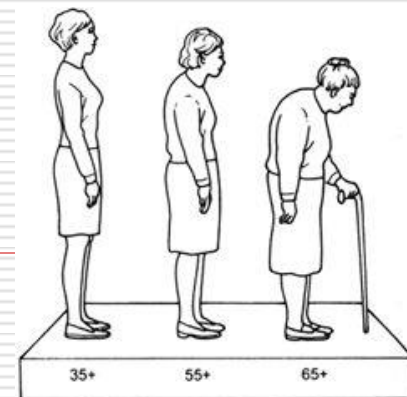
- Demineralization of bone, resulting in :
  - *rickets* in children
  - *osteomalacia* in adults
- problem in northern latitudes, where sunlight exposure is poor



# Deficiencies

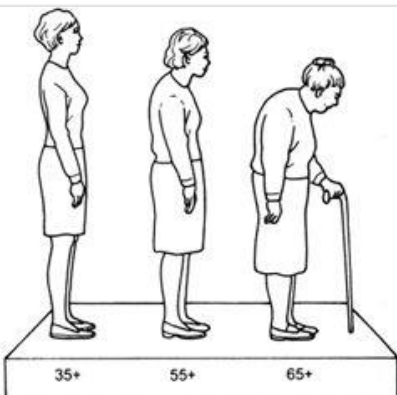


- Rickets can be caused by lack of sunlight, but also from insufficient calcium
- *Vitamin D linked to calcium absorption*



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# Osteomalacia





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# Water Soluble Vitamins

# FOLIC ACID (folate)

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- Plays a key role in one-carbon metabolism, essential for the biosynthesis of several compounds
  - Folic acid deficiencies probably the most common vitamin deficiency in the United States, particularly among pregnant women and alcoholics
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# Function of folic acid

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- *Tetrahydrofolate receives one-carbon fragments from donors such as serine, glycine, and histidine and transfers them to intermediates in *the synthesis of amino acids, purines, and thymine, (a pyrimidine found in DNA)**
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# Folate and anemia

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- Pregnancy and lactation, poor absorption from small intestine, alcoholism, or treatment with *dihydrofolate reductase* inhibitors for example, methotrexate, lead to low levels of folate
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# Folate and anemia (cont.,)

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- A primary result of folic acid deficiency is megaloblastic anemia, caused by diminished synthesis of *purines and thymidine*, which leads to an inability of cells to make DNA and, therefore, they CAN NOT DIVIDE
  - *MEGALOBLASTIC ANEMIA any of a group of disorders characterized by an abnormality of red cell development in the bone marrow.*
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# Cobalamins (Vitamin B12)

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- B12 is found **only** in foods of **animal origin**
  - **NO** plant sources
  - **Strict vegetarians (vegans) are at risk** of developing B12 deficiency
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# Cobalamins (Vitamin B12) (cont.,)

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- The small amounts of B12 formed by bacteria on the surface of fruits may be adequate to meet requirements
  - Preparations of vitamin B12 made by bacterial fermentation are available
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# **Vitamin B12 Deficiency Causes Pernicious Anemia**

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# B12 Deficiency Causes Pernicious Anemia

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- *Pernicious anemia* arises when B12 deficiency blocks the metabolism of folic acid, leading to *functional folate deficiency*
  - *PERNICIOUS ANAEMIA* a form of anemia characterized by defective production of erythrocytes and the presence of megaloblasts in the bone marrow, and sometimes accompanied by neurological changes.
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# B12 Deficiency Causes Pernicious Anemia

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- This impairs erythropoiesis (*formation of RBCs*), causing immature precursors of erythrocytes to be released into the circulation (megaloblastic anemia)
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# B12 Deficiency Causes Pernicious Anemia

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- The main cause of pernicious anemia is failure of the absorption of vitamin B12 rather than dietary deficiency
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# Vitamin B3 deficiency.

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- Dermatitis (**pellagra**) of areas exposed to light due to niacin (vitamin B3) deficiency.
- A century ago, pellagra was a common human disease; in the southern United States, where maize was a dietary staple, about 100,000 people were afflicted and about 10,000 died between 1912 and 1916.
- In a few places, including the Deccan Plateau in India, pellagra still occurs, especially among the poor.



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# Vitamin C

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# Vitamin C

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- **Ascorbic acid**  
(Toxic to viruses, bacteria, and some malignant tumor cells)
- **Antioxidant**

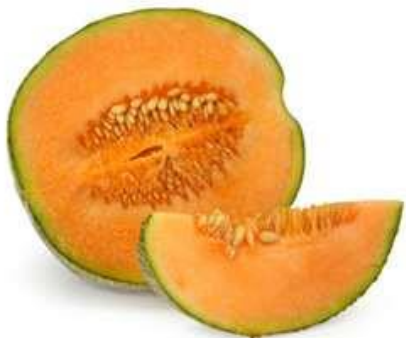


# Vitamin C sources:

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- **Fruits and vegetables**
- **Guava, Broccoli, Cantaloupe, Red Bell Pepper, Orange Juice, Strawberries, Tomato Juice, Raw Tomato, Sweet Potato, Tangerine, Spinach, Leafy Greens, Berries, Citrus Fruits**



# Vitamin C's functions:

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- Protects the body from **free radicals** (antioxidant)
- helps **form connective tissue** that hold bones, muscles, and tissues together
- aids in the **healing of wounds**
- aids the body in **absorbing iron** from plant sources





# Vitamin C's functions:

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- helps to maintain **healthy gums**
- helps the body to **fight infections**
- aids in the **prevention of heart disease**
- **prevents some forms of cancer**



# Recommended Dietary Intake (RDI)

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- **Men:**
  - 60mg/day
- **Women:**
  - 60mg/day
- **Pregnant women:**
  - 95mg/day
- **Children:**
  - 45mg/day





- Since Vitamin C is **water-soluble**
  - **excess** amounts will be **excreted**
  - but **larger doses** can cause some **problems**
  - large doses (**over 1000 mg/dose**) will have harmful effects
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# Toxicity

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- Diarrhea
  - gastrointestinal discomfort
  - Avoid chewable tablets (may cause damage to teeth)
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# Vitamin C deficiency causes:

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- Weight loss
- fatigue and joint pain
- **SCURVY** (bruising easily, bleeding gums, and tendency for bones to fracture)
- **reduced resistance to colds and infections**
- **slow healing of wounds and fractured bones**



# Scurvy

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- Scurvy characterized by **sore, spongy gums, loose teeth, fragile blood vessels, swollen joints, and anemia**
- *Many of the deficiency symptoms can be explained by a **deficiency in the hydroxylation of collagen**, resulting in **defective connective tissue***



# Scurvy

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