

BPK 110

Chapter 7

Vitamins in our Foods

- most foods contain vitamins
- found in both animal and plant foods
- grains tend to high in the water soluble B vitamins
- animal products tend to be high in most vitamins and are the only source of vitamin B12

GRAIN PRODUCTS	VEGETABLES & FRUIT	OILS	MILK & ALTERNATIVES	MEAT & ALTERNATIVES
Thiamin	Riboflavin	Vitamin E	Riboflavin	Thiamin
Riboflavin	Niacin		Vitamin A	Riboflavin
Niacin	Vitamin B ₆		Vitamin D	Niacin
Pantothenic acid	Folate		Vitamin B ₁₂	Biotin
Vitamin B ₆	Vitamin C			Pantothenic acid
Folate	Vitamin A			Folate
	Vitamin E			Vitamin B ₁₂
	Vitamin K			Vitamin A
				Vitamin D
				Vitamin K
				Vitamin B ₆

Minimizing Vitamin Losses

- vitamins are organic → susceptible to destruction by: **Heat/Oxidation**
- prevent losses through: refrigeration, storing cut foods in airtight containers to reduce oxidation
- wash before cutting
- steam veggies in small amounts of water to avoid overcooking

Fat vs Water Soluble Vitamins

	Water Soluble	Fat Soluble
Vitamins	B Vitamins, vitamin C	A, D, E, & K
Absorption	directly into blood	with lipids into lymph
Transport	none required	require protein carriers
Storage	free in aqueous compartments	in cells associated with fat
Excretion	readily via kidneys	not readily
Toxicity	only from supplements	more likely
Requirement	frequently (every 1- 3 days)	periodically (weeks to months)

-fat soluble vitamins are transported in the body within fat transporters and are stored within fat tissue- therefore, tend to build up more and are required less often from the diet

-water soluble vitamins are stored briefly within watery environments and are excreted quickly within urine = consumed more often!

Water Soluble Vitamins (B and C)

The B Vitamins Function Primarily as Coenzymes

- bind to enzymes to promote their activity
- carry electrons, atoms, chemical groups

coenzymes are organic compounds that are required in order for an enzyme to function properly therefore, are important for catalyzing many body

- B vitamins are so important b/c one of their functions is to catalyze the steps within cellular respiration

Thiamin (B1)

- Found in enriched grains, pork, seeds, nuts
- As with all of the B vitamins, deficiency in North America is rare, except in certain conditions
- In alcoholics, deficiency promotes Wernicke/Kosakoff Syndrome, as alcohol blocks thiamin absorption
- Loss of muscle coordination, confusions, decreased sense of consciousness, insomnia, impairments in memory and learning
- In developing world, nutritional deficiency results in Beriberi
- Weakness, fatigue, enlarged heart, cardiac failure, apathy, poor short term memory, confusion, irritability, muscle paralysis.
- thiamin is important as a coenzyme for the metabolism of sugars and amino acids

Riboflavin (B2)

Found in dairy products, enriched grains, dark green vegetable

- Helps form FAD (**Flavin** adenine dinucleotide)
- important electron transporter in energy metabolism
- Deficiency** occurs typically with alcoholism, malnutrition in accordance with other deficiencies
- These symptoms of deficiency are collectively known as **ariboflavinosis**

Niacin (B3)

- Found in beef, chicken, peanuts, legumes, enriched grains
- Helps form NAD (**Nicotinamide** adenine dinucleotide)
- important electron transporter in energy metabolism
- High doses may lower LDL, raise HDL
- BUT doses above UL can promote toxicity =**niacin flush**
- Headaches, nausea, blurred vision
- Niacin Deficiency can lead to **Pellegra**
- 4 Ds of Pellegra: dermatitis, dementia, diarrhea, death**

if alcohol intake was combined w/ dietary deficiency, it further blocked niacin absorption and exacerbated the condition

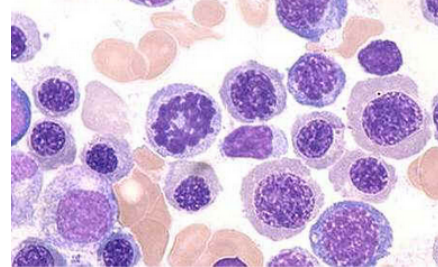
Folate/ Folic Acid (B9)

- Found in leafy greens, enriched grains, legumes
- Folate is needed for synthesis of DNA, amino acid metabolism. It is therefore particularly important for rapidly dividing cells
- Ex. Intestines, skin, embryonic and fetal tissues, bone marrow

- Low intake associated with neural tube defects
 - Neural tube becomes brain and spinal cord
 - May lead to miscarriage, or spina bifida
- Mandatory fortification of folate into enriched grains and cereals since 1998 in Canada, US
 - 50% decrease in NT defects since then (Canada)
 - results in sustained nerve damage

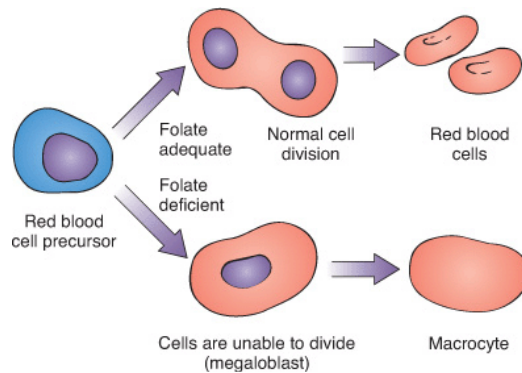
Macrocytic/Megaloblastic Anemia

- most obvious sign of folate deficiency in adults
- Since folate deficiency negatively affects DNA synthesis, red blood cells don't divide, and thus don't mature properly.
- Macrocytic, megaloblastic anemia = large, immature, non-functional red blood cells



Vitamin B12

- B12 is required to activate folate
 - prevents microcytic anemia
 - B12 deficiency leads to pernicious absorption
 - released by cells found in the stomach
- deficiency of concern for older adults with **atrophic gastritis** = leads to low HCL
 - HCL required to activate enzymes which release B12 from proteins



Vitamin C

- critical for the synthesis/maintenance of collagen
 - base of all connective tissue
 - promotes integrity of the skin
 - glue that holds the body together
- deficiency can lead to scurvy
- works as an antioxidant
 - antioxidant properties help maintain the immune system, thus deficiency associated with decreased immune function
 - doesn't prevent colds but may decrease severity/length

Antioxidants

- protect against oxidative damage by free radicals
 - FR's steal electrons, damage structure and function
- oxidative damage associated with cancer, diabetes, heart disease, etc
- agents of oxidation steal electron from DNA, cell membranes causing damage
- vit. a and c prevent this oxidation b/c they have an extra electron to give

Fat- Soluble Vitamins

Vitamin A (2 forms)

- preformed vit A= **retinoids**; from animals
- provitamin A = **carotenoids**; from plants
 - can be converted into retinoids in the body
 - **beta-carotene** = most common provitamin A

Functions:

- cell differentiation (thru gene expression)
- reproduction and growth (retinol important for normal fetal growth, bone remodelling, etc)
- antioxidant: **carotenoids only**
- vision(retinal is part of **rhodopsin**, a visual pigment in the **retina** of the eye, which helps interpret visual stimuli)

Vitamin A Deficiency

- **xerophthalmia** — collective term for eye conditions caused by vit A deficiency; can lead to blindness!
- **night blindness** — early stage of xerophthalmia (inability to replenish rhodopsin stores)

Vitamin D and Calcium Regulation

- active vitamin D critical for maintaining **calcium** and phosphorus levels in the body
- when calcium levels drop, **parathyroid hormone (PTH)** is released, which activates vit D at kidney
- activated vitamin D, through its role in gene expression;
 - promotes Ca absorption at SI
 - reduces Ca excretion at kidneys
 - mobilizes Ca from bone

Vitamin D activation

- it is inactive **until** modified by **liver and kidneys**
- you do not absorb vit D from the sun! when light energy from the sun hits the skin, it triggers the rxn that helps synthesize an inactive form of vit D from precursors

Vitamin D sources

- primary source = sunlight but found in liver, egg yolks, oily fish, fortified foods, etc

Vitamin D Deficiency

- lowers [blood Ca] which leads to bone breakdown to release Ca

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- leads to **rickets** in children (bones don't calcify properly = bad under pressure of body growth)
- in adults, leads to **osteomalacia (weakened bones) = increased risk of osteoporosis**

Vitamin E

- antioxidant and anti-inflammatory may promote reduced risk of chronic disease
 - individuals w. highest [vit E blood] have lowest risk of death
 - deficiency leads to break down of cell membranes
 - RBC, nerve tissue at high risk
 - RBC membranes may rupture = **hemolytic anemia**

Vitamin K

- can be synthesized by bacteria
- needed for the production of several clotting factors, that allow blood to clump, so wounds can heal
- deficiency can lead to **hemorrhage**

Dietary Supplementation

- vegans or those that eliminated dairy = (B12, vit D, Ca)
- older adults (B12, vit D)
- alcohol users (B vitamins)