Functional Medicine Approach to Vitamins and Supplements

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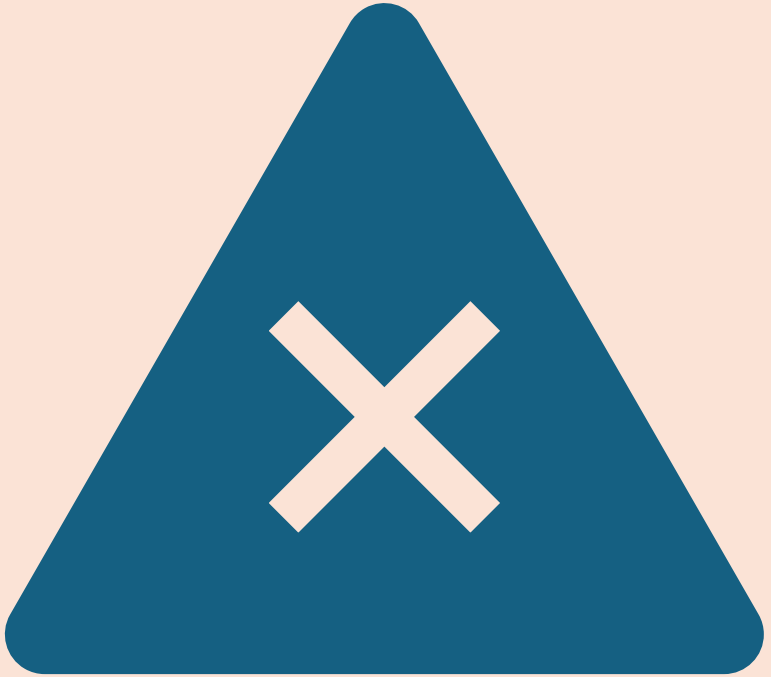
Conflicts of interest

I have none to report



OBJECTIVES

Describe the general role and the importance of vitamins and supplements in everyday life.

Differentiate between the water-soluble/fat-soluble vitamins and how those should be taken.

Identify at least one strategy for use of vitamins and supplements in your personal life and clinical practice.

Perceived Controversy

- Do I need vitamins?
- Should I take vitamins?
- Are the vitamins a waste of money?
- How do I know which vitamins should I take?

You do not need vitamins or supplements if you:

- Have no chronic stress
- Hunt and gather your own wild food
- Drink pure water (not processed or purified)
- Exercise daily and lead a very active lifestyle
- Not exposed to environmental toxins or insults
- Follow circadian rhythms and get at least 8hrs of sleep every night

Hyman (2024)

Statistics

~95% of Americans are deficient in at least 1 essential nutrient

Globally, over 2 billion people suffer simple correctable deficiencies

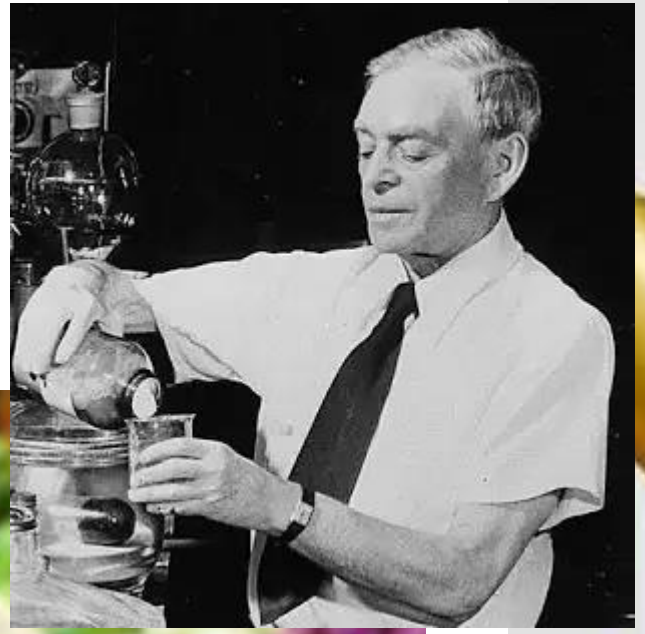
Factors that influence vitamin and nutrient deficiencies

MODERN AGRICULTURAL PRACTICES

ENVIRONMENTAL TOXINS

CERTAIN DIETS DEPLETING NUTRITIONAL QUALITY OF FOOD

What are vitamins?



Water Soluble vs Fat-Soluble Vitamins

Fat-Soluble

- A
- D
- E
- K

Water-Soluble

- B-complex (B1, B2, B3, B5, B6, B7, B9, B12)
- C

Fat-Soluble Vitamins

- **A**
- **D**
- **E**
- **K**


vitamin A

Vitamin A (retinol and beta-carotene)

- Essential in bone growth, development and maintenance of epithelial tissues, skin, eyes and hair.
- Alcohol and antihyperlipidemic drugs can decrease absorption of vitamin A, causing a deficiency.
- It has antioxidant properties, however, in excessive doses can become toxic. Pregnant females should maintain RDA (no more than 770mcg/day) as excessive amounts may cause fetal harm.
- Well absorbed from the GI tract. Because it is stored in liver, the vitamin may be available for days, weeks or months.

McCuistion et.al., 2022

Food sources of Vitamin A

Dark-colored fruits and vegetables:

- Carrots, cantaloupe, mangoes, spinach, pumpkin, and sweet potatoes.

Animal products:

- Dairy, meat, fish and fish oil.


Vitamin
D

Vitamin D

- Major role in regulating calcium and phosphorus metabolism; and it is needed for calcium absorption from the intestines.
- Dietary vitamin D is absorbed in the small intestine and requires bile salts for absorption.
- Deficiency may lead to rickets, suppressed immune system, depression, muscle aches and osteoporosis.
- Traditionally, adult RDA is 400-800 IU/day up to 4,000IU/day.

McCuistion et.al., 2022

Food Sources of Vitamin D

VITAMIN D-FORTIFIED MILK AND CEREAL

EGGS

FATTY FISH

LIVER


Vitamin
E

Vitamin E

- Antioxidant protecting cellular components and red blood cells from hemolysis.
- “Off label” for prevention of CVD and Alzheimer’s disease.
- The RDA is 22.4 IU/day or 15mg/day and should not exceed 1,500IU or 1,000 mg/day in oral intake.
- If in excess: fatigue, weakness, nausea, GI upset, headache, bleeding, and breast tenderness.
- May prolong prothrombin time, so patients on warfarin should have their PT monitored closely.
- Iron and vit E should not be taken together as iron may interfere with absorption of vitE.

McCuistion et.al., 2022

Food Sources of Vitamin E

- Whole-grain cereals
- Sunflower seeds
- Milk
- Eggs
- Meat
- Avocados
- Asparagus
- Broccoli
- Spinach
- Vegetable oils


K

Vitamin K

- Needed for synthesis of prothrombin and clotting factors.
- Used for anticoagulant overdose; most effective in preventing hemorrhage.
- Deficiency: increased bruising, bleeding from mucous membranes, and dark, tarry stools.
- Once absorbed, it is stored primarily in the liver and in other tissues. Half of vitK comes from the intestinal flora, and the remaining portion comes from the diet.
- The RDA: 90 and 120mcg/day (female-male).
- When vitK levels may lead to thrombi.

McCuistion et.al., 2022

Food Sources of Vitamin K

- Leafy-green vegetables: broccoli, Brussel sprouts, collard greens, lettuce, spinach)
- Liver
- Cheese
- Egg yolk
- Vegetable oil (soybean and canola)

Water-Soluble Vitamins

- B-complex
- C


VITAMIN
B

B-complex Vitamins

- Vitamin B1 (thiamine) deficiency can lead to the polyneuritis and cardiac pathology most commonly associated with alcohol abuse
- Vitamin B2 (riboflavin) may be given to manage dermatologic problems such as scaly dermatitis, cracked corners of the mouth, and inflammation of skin and tongue. Also used in higher doses for migraine headaches.
- Vitamin B3 (niacin) is given to alleviate pellagra (inflamed skin, diarrhea, dementia, sores in mouth) and hyperlipidemia. Large doses may cause GI irritation and vasodilation, resulting in a flushing sensation.
- Vitamin B6 (Pyridoxine) is administered to correct vitB6 deficiency caused by lack of adequate diet, inborn errors of metabolism, and drug-induced deficiencies.
- VitB6 is essential in as a building block of nucleic acids, in RBC formation, and in synthesis of hemoglobin. Patients with alcoholism and diabetes may benefit from daily supplementation.

McCuistion et.al., 2022

Food Sources of Group-B vitamins

- B1 – fortified whole-grain products, legumes, cereals, pork
- B2 – Milk, enriched flour, green vegetables, yogurt, eggs, nuts, cheese, and meats, especially organ meats (liver and kidney)
- B3 – Animal and plant protein, peanuts, mushrooms, whole wheat, enriched grains, green vegetables, unpolished rice
- B6 – Cereal grains, meat, fish, vegetables, legumes, white potatoes


VITAMIN
C

Vitamin C (Ascorbic acid)

- Needed for carbohydrate metabolism and protein, lipid and collagen synthesis necessary for wound healing.
- Aids in the absorption of iron and in the conversion of folic acid. It is not stored in the body and is readily and completely excreted in urine.
- Used in the treatment of scurvy and those who consume few fruits and vegetables, or on restricted diets, smokers or who abuse alcohol or drugs.
- The RDA is 75-90 mg/day to prevent deficiency. In doses greater than 500mg, it aids in iron absorption, but can decrease the effects of oral anticoagulants. Massive doses may cause GI upset.

McCuistion et.al., 2022


B9

Folic Acid (Vitamin B9)

- Essential for body growth, DNA synthesis, assists intestinal functioning, and prevents certain anemias.
- Chronic alcoholism, poor nutritional intake, malabsorption syndromes, pregnancy, and certain drugs are causes of folic acid deficiencies.
- Symptoms of deficiency: anorexia, nausea, stomatitis, diarrhea, fatigue, alopecia, and blood dyscrasias. These symptoms are not seen until 2-4 months after FA storage depletion.
- FA deficiency during the first trimester of pregnancy can affect the development of the CNS of the fetus and cause neural tube defects, such as spina bifida or anencephaly.

Food sources: leafy green vegetables, yellow fruits and vegetables, yeast, organ meats, black-eyed peas and lentils.

- The recommendation for pregnant women – 600mcg/day.

McCuistion et.al., 2022


VITAMIN
B12

Vitamin B12

- Essential for DNA synthesis, hematopoiesis and nervous system integrity. Aids in the conversion of folic acid into its active form. With active FA, vitB12 promotes cellular division.
- The gastric parietal cells produce an intrinsic factor that is necessary for the absorption of vitamin B12 through the intestinal wall. Without the intrinsic factor, little to no vitB12 is absorbed.
- Major cause of deficiency - Pernicious anemia (lack of the intrinsic factor), but deficiency may also develop in strict vegetarians, those with cancer, Celiac disease, gastrectomy, Crohn's disease, and liver and kidney diseases.
- VitaminB12 deficiency is commonly seen with the use of metformin and PPIs (omeprazole).
- Most vitB12 is stored in the liver and is slowly excreted, and it can take 2-3 years for stored vitamin to be depleted and for the deficit to be noticed.

McCuistion et.al., 2022

Food Sources of Vitamin B12

Liver, kidney, fish, dairy, eggs, chicken, and meat.

RDA: 2.6mcg/day for adults and up to 2.8 mcg/day for lactating women.

Those who are deficient in vitB12 may receive 1000-2000mcg daily either IM or PO (sublingually).

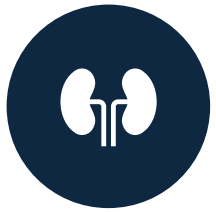
Minerals and Supplements


IRON

Iron

- Vital for hemoglobin regeneration. 60% is found in hemoglobin, and one of the causes of anemia **is** iron deficiency.
- Food and antacids slow the absorption of iron.
- Caution! Iron toxicity is a serious cause of poisoning in children.

Food Sources of Iron



LIVER

LEAN MEATS

EGG YOLKS

DRIED BEANS

GREEN VEGETABLES

FRUIT


ZINC

Zinc

- Trace element, essential for biologic functions and important in growth, appetite, testicular maturation, skin integrity, mental activity, wound healing, and immunocompetence.
- Deficiency is associated with diets high in unrefined cereal, TPN, intestinal disease, alcoholism, and pregnancy.
- May alleviate symptoms of the common cold and shorten its duration.
- Large amounts of zinc can be toxic.
- The adult RDA is 8-11mg/day.
- Foods rich in zinc: beef, lamb, eggs, and leafy and root vegetables.

McCuistion et.al., 2022


Mg

Magnesium

- Co-factor in >300 enzyme systems.
- Protein synthesis, muscle/nerve function, B/P regulation, BS control.
- Energy production, glycolysis.
- Development of bone, DNA/RNA synthesis.
- Active transport of Ca and K ions across cell membranes (nerve impulse conduction, muscle contraction, normal heart rhythm).
- RDA 300-400mg/day
- Foods sources: pumpkin seeds, almonds, spinach, cashews, etc.

NIH (2022)


SELENIUM
Rooted

Selenium

- Essential non-metallic element, play critical roles in reproduction, thyroid hormone metabolism, DNA synthesis, and protection from oxidative damage and infection.
- Symptoms of deficiency: hypothyroidism, muscle weakness, myalgia, myositis, pancreatic degeneration.
- May have an anticarcinogenic effect, and doses lower than 200mcg may reduce the risk of lung, prostate and colorectal cancer. Research is controversial.
- Excess doses of >200mcg may cause weakness, hair loss, dermatitis, nausea, diarrhea, and abdominal pain.
- The RDA for selenium is 55mcg/day.
- Foods rich in selenium: meats, liver, seafood, poultry, grains.

McCuistion et.al., 2022

- “While pharma drugs often focus on managing symptoms, supplements aim to optimize function, body’s natural processes and achieve and maintain optimal health by addressing nutritional deficiencies.” – Mark Hyman, MD (2024)

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THANK
YOU!