

# Dietary Supplements for Optimizing Health



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*Healthy At Home*  
*Fortify Your Life*  
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## Protein Needs



- From Greek *protos*, “first.” Build **new cells, maintain tissues** (e.g., muscles, inner bone, hair, nails), create **enzymes, make hemoglobin, lipoproteins to transport cholesterol; present in membrane of every living cell.**
- Sources include meat, poultry, seafood, eggs, soy products, nuts, nut butters, beans, peas, and seeds.
  - Choose seafood 2 x weekly (low in mercury, high in omega 3s, sustainable)
  - Include beans and peas often in your diet, as a side or main dish
  - Chicken and poultry regularly, red meat 10 ounces per week. Avoid processed red meats.

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## How Much Protein Do You Need Per Day



- ~0.8 g/kg body weight for adults
    - (Multiply weight in lb x 0.36)
    - 150 pounds = 55 g/d
    - 180 pounds = 65 g/d
  - 1.0-1.2 g/kg for those over 60\*
    - 150 pounds = 69-81 grams
    - 180 pounds = 81-98 grams
  - 1.2-1.5 g/kg competitive athletes
- \*Not for those with kidney disease

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## Protein Rich Foods

Food	Portion Size	Protein (g) (approximate)
Meat, fish, or poultry	75g (2 ½ oz) / 125 mL (½ cup)	21
Firm tofu	150g / 175 mL (¾ cup)	21
Egg, chicken	2 large	13
Cheese	50 g (1 ½ oz)	12
Fortified soy beverage	250 mL (1 cup)	6-8.5
Cooked dried beans, peas, or lentils	175 mL (¾ cup)	12
Cow's milk	250 mL (1 cup)	9
Yogurt	175 mL (¾ cup)	8
Peanut butter or other nut spread	30 mL (2 Tbsp)	8
Nuts or seeds	60 mL (¼ cup)	7
Bread	1 slice (35g)	3
Cereals, cold	30 g	3
Cereals, hot	175 mL (¾ cup)	3
Pasta or rice	125 mL (½ cup)	3
Vegetables	125 mL (½ cup) or 250 mL (1 cup)	2
Fruit	1 fruit or 125 mL (½ cup)	1

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## Protein Powders

- **Whey** protein hydrolysate: digested quickly after workout)
  - **Casein:** “time-release protein” take before bed for muscle recovery
  - **Egg white:** no fat, equal to whey. Allergy.
  - **Soy:** complete protein, no carbs/fiber, highly absorbed. Allergy.
  - **Hemp:** omega 3, fiber, less protein
- All of the above are “complete proteins” and highly absorbable.
- **Brown Rice** - hypoallergenic
  - **Pea** – see next page

Per 20g serving	Soy*	Rice**	Pea*	Hemp*
Calories (kcal)	80	88	72	77
Protein (g)	17	15.3	15.5	9
Fat (g)	1	1.2	1.1	1.9
Carbs (g)	0	2.4	1.5	6.5 (5.2g fiber)
Sodium (mg)	190	0	192	0
Cost (per 100g) in USD	2.3	4.32	3.96	2.82

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## Pea Protein

	Pea protein	Whey protein
Calories	120	118
Protein	22.5 grams	27 grams
Carbs	1.5 grams	1 gram
Fat	2.25 grams	less than 1 gram
Cholesterol	0 grams	0.011 grams
Fiber	1.5 grams	0 grams
Sugar	0 grams	0 grams
Sodium	15% of the Daily Value (DV)	2% of the DV
Calcium	7% of the DV	10% of the DV
Potassium	1% of the DV	4% of the DV
Iron	42% of the DV	0% of the DV

- Good choice for those with **allergies or who are vegan/vegetarian.**
- Much higher in **iron**, making it a good choice for **menstruating or pregnant women.**
- No methionine.
- Usually made from **yellow split peas**, not if you have gout.

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## Collagen is Essential for Strength and Structure

- **Collagen** is a protein that forms a scaffold that protects tissues; it is abundant in the **skin, bones, muscles, tendons.** Collagen production **declines with age** and exposure to **smoke, UV light, high sugar diet, and lack of sleep**, leading to wrinkles, osteoarthritis, etc.
- 80-90% of collagen are types 1, 2 and 3.
  - **Type I** - Skin Elasticity
  - **Type II** - Joints and Immune System
  - **Type III** - Skin, Blood Vessels, Vital Organs
  - **Type IV** - Cell Health and Growth
  - **Type V** - Skin, Tendons and Immune System
  - **Type X** - Joints, Bones, Muscles and Hair

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## Oral Collagen: Meta-Analysis for Skin

- **19 randomized, double-blind, controlled studies were reviewed<sup>1</sup>**
  - N=1125, ages 20-70 years, 95% female
- **Conclusions:** favorable results of **hydrolyzed** collagen supplementation compared with placebo in terms of **skin hydration, elasticity, and wrinkles** when 6-10 g/d taken for at least 90 days. Good safety profile, no adverse effects.<sup>1,2</sup>
- **Note:** studies are small and mostly subsidized by collagen companies.

1. de Miranda RB, et al. Effects of hydrolyzed collagen supplementation on skin aging: a systematic review and meta-analysis. *Int J Dermatol* 2021; 60(12):1449-1461.

2. Choi FD, et al. Oral Collagen Supplementation: A Systematic Review of Dermatological Applications. *J Drugs Dermatol* 2019; 18(1):9-16.

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## Oral Collagen for Musculoskeletal Pain

- Studies in healthy adults and those with **knee OA** report that **10 g/d of hydrolyzed collagen reduces joint pain and improves function.**
- Small studies assessing consumption of **undenatured type II collagen** (most abundant protein in joints/spine) alone or with vitamin D show a reduction of **musculoskeletal pain and improvement in joint function.**
- **Undenatured type II collagen** *more effective* than glucosamine and chondroitin sulfate supplements in companion animals. Dose generally 40 mg per day.

Mohasheri A, et al. A White Paper on Collagen Hydrolyzates and Ultrahydrolyzates: Potential Supplements to Support Joint Health in Osteoarthritis? *Curr Rheumatol Rep* 2021; 23(1):78

Rodrigues Mendonca C, et al. Effects of Nutritional Interventions in the Control of Musculoskeletal Pain: An Integrative Review. *Nutrients* 2020; 12(10):3073.

Genovese H, et al. Undenatured Type II Collagen (UC-II) in Joint Health and Disease: A Review on the Current Knowledge of Companion Animals. *Animals* 2020;10:697

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10 g/ collagen and 9 grams protein per serving. Bovine cartilage. Types 1 and III. Tested free of any heavy metals.	11 g/collagen and 10 gram protein per serving. Marine. Type 1 collagen. 3 <sup>rd</sup> party tested.	10 g/collagen and 9 g/protein per serving. Types I, II, III, V, X. Fish, egg, bovine, chicken. 3 <sup>rd</sup> party tested.	Undenatured type II. 40 mg per dose. From chicken. 3 <sup>rd</sup> party tested.
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### Omega 3 Fatty Acids

N-6 PUFA		N-3 PUFA
18: 2n6: LA	← Delta-6 Desaturase →	18: 3n3: ALA
18: 3n6	← Elongation →	18: 4n3
20: 3n6	← Delta-5 Desaturase →	20: 4n3
20: 4n6, AA	← Elongation →	20: 5n3, EPA
22: 4n6	← Elongation →	22: 5n3
24: 4n6	← Delta-6 Desaturase →	24: 5n3
24: 5n6	← Elongation →	24: 6n3
22: 5n6	← Beta Oxidation →	22: 6n3, DHA

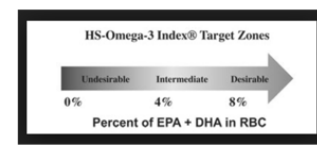
- Foods high in omega-3 include fish, nuts (walnuts), flax, grass fed meats, leafy vegetables.
- Hard to convert ALA to EPA and DHA – why most recommendations are for marine omega 3 that contain EPA/DHA.
- Most people do not need to limit their omega 6 fatty acids, they need to INCREASE their omega 3.

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### No Fish Story: The Omega 3 Index

- Omega-3 Index test is now the gold standard for omega-3 biostatus testing. It is used as a compliance marker for randomized controlled trials with fish oil supplements, and in epidemiological research.
- In 2008 Dr. Bernadine Healy, cardiologist and past President of the AHA and first woman Director of the NIH said, “Before long, your personal Omega-3 Index just could be the new cholesterol—the number you want to brag about.”



HS-Omega-3 Index® Target Zones

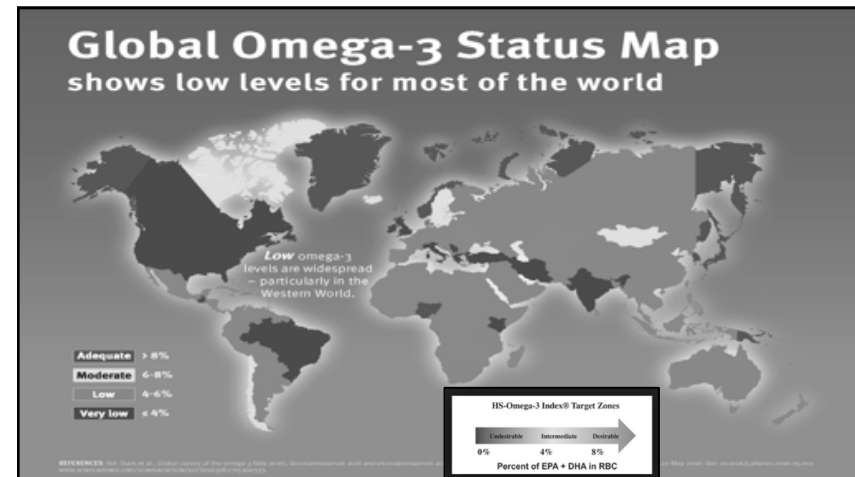
Undesirable Intermediate Desirable

0% 4% 8%

Percent of EPA + DHA in RBC


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**Greater Longevity with a Higher Omega-3 Index**



Postmenopausal women with an Omega-3 Index over 8% were 30% less likely to die than those with an Index under 4% over 15 years.

**Recovering from a Heart Attack with Omega-3s: The OMEGA-REMODEL Study**




Patients who had recently had a heart attack and were then treated with omega-3 fatty acids for 6 months had healthier hearts if their Omega-3 Index reached 11% compared to those with lower levels.

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**The Omega-3 Index and Risk for Fatal CHD**



Data from 10 prospective cohort studies including >24,000 subjects showed that an Omega-3 Index of 8% or greater was associated with the lowest risk for fatal CHD.

**Total Mortality and the Omega-3 Index: Heart and Soul**



People with the highest Omega-3 Index levels lived longer than those with the lowest levels.

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*Fish Oil: What Type is Best?*

- Supplementation is an **alternative** to eating fish; however, not all supplements are equal.
- Randomized, crossover study of 35 healthy individuals compared four popular brands/types of omega 3 fatty acids:
  - Concentrated triglyceride (rTG) – Nordic Naturals ProOmega
  - Ethyl ester (EE) – Minami MorEPA
  - Phospholipid krill oil (PL) – Source Natural Arctic Pure
  - Triglyceride salmon oil (TG) – New Chapter Whole Mega Salmon

Laidlaw M, et al. *Lipids Health Dis* 2014; 13:99

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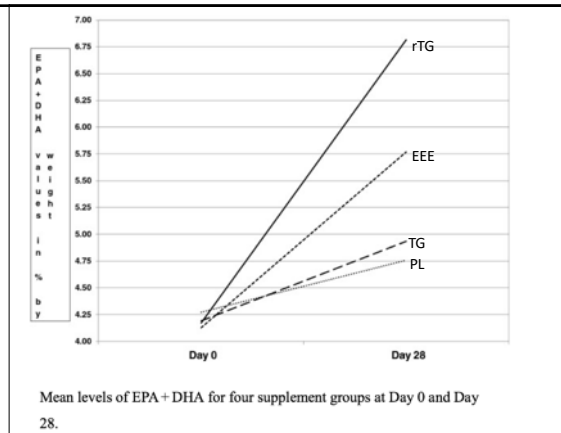
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**Dosing According to Manufacturer's Recommendations**

TRT	Product	EPA & DHA per capsule*	Tested values	Label use: caps/day	Daily dosage of EPA + DHA
rTG	Nordic Naturals ProOmega®	325 mg EPA	329.6 mg EPA	2	EPA: 650 mg
	Triglyceride	225 mg DHA	226.0 mg DHA		DHA: 450 mg
EE	Minami MorEPA®	756 mg EPA	774.2 mg EPA	1	EPA: 756 mg
	Platinum Ethyl Ester	228 mg DHA	233.7 mg DHA		DHA: 228 mg
PL	Source Naturals ArcticPure®	75 mg EPA	78.0 mg EPA	2	EPA: 150 mg
	Krill Oil Phospholipid	45 mg DHA	46.7 mg DHA		DHA: 90 mg
TG	New Chapter				
	Wholomega® Salmon	90 mg EPA	96.4 mg EPA	2	EPA: 180 mg
	Oil Triglyceride	110 mg DHA	109.5 mg DHA		DHA: 220 mg

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## *Fish, Omega-3, Pregnancy and Early Childhood*

- Critical for **neurological and visual development**, particularly in 3<sup>rd</sup> trimester and first few years.
- >dozen studies show mother's fish intake influences **atopy** risk in baby. Eating fish early in life (<9 months of age) may prevent allergic diseases like **asthma, eczema and allergic rhinitis**.<sup>1</sup>
- FDA: **2–3 servings of low mercury fatty fish per week** (avoid shark, swordfish, tilefish, king mackerel) during pregnancy/breastfeeding or take **200-300 mg/d DHA**.
- **Vegan DHA** available. **Nordic Naturals** endorsed by American Pregnancy Association
- **Children need steady supply of DHA first few years of life.** If omega 3 levels are ~8%, breastfeeding women do not need to supplement baby (up to 15 pounds 300-500 mg/d EPA/DHA, 15-40 pounds 500-800 mg/d).

1. American Academy of Pediatrics: publications.aap.org/aapnews/news/13485

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## *Omega 3 and Prostate Cancer?*

- **SELECT trial raised concerns** about potential link between omega 3s and increased prostate cancer/aggressive cancer.
- European Food Safety (EFSA) concluded, “there is **no evidence** for a role of EPA and/or DHA intake in the development of prostate cancer.”
- Also, “**supplemental intake of EPA and DHA combined at doses up to 5 g/d does not give rise to safety concerns for adults.**”
- FDA: safe supplemental level **2 g/d** and total EPA/DHA at **3 g/d**

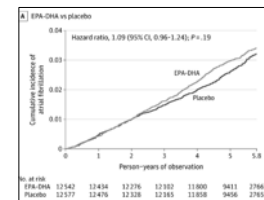
EFSA Journal 10(7): doi:10.2903/j.efsa.2012.2815

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## *Heart Arrhythmias?*



Albert CM, et al. Effect of Marine Omega-3 Fatty Acid and Vitamin D Supplementation on Incident Atrial Fibrillation: A Randomized Clinical Trial. JAMA 4 2021 Mar 16;325(11):1061-107

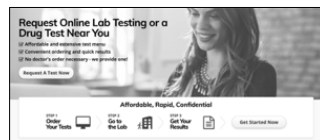
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- Omega 3's have been said to **reduce and increase** the risk of heart arrhythmias.
- Randomized clinical trial **25,119 women/men aged 50 years or older** without cardiovascular disease, cancer, or AF **failed to show any effect (positive or negative)** with **1 gram/d marine omega 3, 2000 IU vitamin D, or combo.**

## Where Can You Get Tested?

- Talk to your health care practitioner about potential concerns around micronutrient deficiencies.
- Most lab tests are readily available through LabCorp or Quest.
- If you order your own tests, [www.requestatest.com](http://www.requestatest.com), Vibrant America, **EveryWell**, and SpectraCell are commonly used.



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## Micronutrient Status of Americans

- **31% population** at risk for *at least one vitamin deficiency* or anemia.
- **Deficiency risk most common in women (37% overall): 19–50 years (41%), and pregnant or breastfeeding women (47%).**
- Those who **did NOT** take dietary supplements had *highest risk* of any deficiency (**40%**), compared to users of **full-spectrum MVI-mineral supplements (14%)**.
- Individuals consuming an **adequate diet** based on EAR had a **lower risk of any deficiency (16%)**, compared to those with **inadequate diet (57%)**.

Bird JK, et al. *Nutrients* 2017 Jun 24;9(7):655.

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## Real State of Our Nutrition

- **90 million** Americans are **vitamin D deficient** (using the Endocrine Society guidelines **<20ng/mL**)
- **30 million** are **deficient in vitamin B6**
- **18 million** people have **B12 deficiency**
- **16 million** have scurvy (by serum levels)
- 13% of Latinas and 16% of African American women (ages 12–49) are **iron deficient**
- **Women 25–39** overall have borderline **iodine insufficiency**



CDC. 2<sup>nd</sup> National Report on the Biochemical Indicators of Diet and Nutrition in the U.S. population

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## B-Vitamins Fast Facts

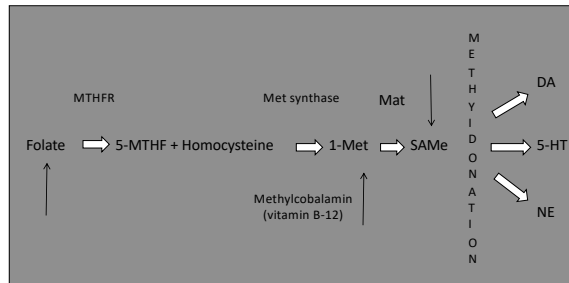
- **8 B-vitamins** partner together, which is why you almost always want to take them together.
- Vitrally important for energy, and maintenance of healthy brain, nervous and cardiovascular system.
- Low levels of vitamin B6 and B12, increase risk for *depression and impair cognition, attention, and memory*.
- Subset of women taking birth control pills are deficient in vitamin B6.
- 2/3<sup>rd</sup> of those with B12 deficiency are over age 50.
- Women may not get sufficient folate, significant if pregnancy occurs.

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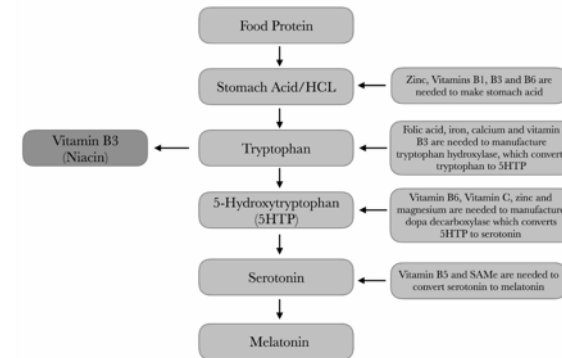
## The “Stress” B- Vitamins



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## Serotonin and Melatonin Pathways



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## Oral Contraceptives & Vitamin B6

- Majority of women on OCPs have **low serum B6** levels, even when meeting dietary RDA.<sup>1</sup>
- Oral contraceptive** use in US 2017–2019:<sup>2</sup>
  - 19.5% of women aged 15–19
  - 21.6% aged 20–29
  - 10.9% aged 30–39
  - 6.5% of women aged 40–49
- Low B6: microcytic anemia, **depression**, **poor concentration**, **fatigue**, etc.
- Women who discontinue OCs and **become pregnant** may be at **increased risk** for **preterm birth**, **early pregnancy loss**, and **difficulty conceiving**.<sup>3,4</sup>



- Morris MS, et al. *Am J Clin Nutr* 2008; 87(5):1446-54
- [www.cdc.gov/nchs/products/databriefs/db388.htm](http://www.cdc.gov/nchs/products/databriefs/db388.htm)
- Wilson SMC. *Nutr Rev* 2011 Oct; 69(10):572-83
- Ho CL, et al. *Nutrients* 2016; Sep 1;8(9).

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## Vitamin B12

- 18 million** Americans deficient
- Geriatric population** prevalence **21%**
- Risk for deficiency:
  - Inadequate intake
  - Veganism
  - Malabsorption
  - Medications (PPI, metformin)
  - Obesity
  - Aging
- 25–250 mcg** per day if at risk



Singh NN, et al. Vitamin B-12 Associated Neurological Disease; 2018; Oct 22  
<https://emedicine.medscape.com/article/1152670-overview#a6>

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## Screening for B12 Deficiency

Even **marginal B12 status** reduces cognitive function, mood, and energy.

Screening *should be considered* in those with one or more risk factors for low B12:

- Inflammatory bowel disease
- Use of **metformin** >4 months
- Use of **PPIs/H2 blockers** >12 months
- **Vegans**, possibly vegetarians
- **Bariatric surgery**
- Those over **70 years old**



Langan RC, Goodbred AJ. *Am Fam Physician* 2017 Sep 15;96(6):384-389

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## Metformin & PPI Increase Risk for Low B12

- 2015 meta-analysis: **80% increased risk B12 deficiency after 10 months of regular proton pump inhibitor use.**
- Meta analysis 29 studies: **245% increased risk B12 deficiency with metformin use. Low B12 increases progression of diabetic neuropathy.**
- B12 deficiency can lead to **difficulty walking, tingling/numbness** in hands and feet, **fatigue**, shortness of breath, **loss of appetite, joint pain, depression, loss of taste and smell, cognitive impairment, and dementia.**
- B12 should be monitored every 1–2 years if taking these medications.

Jung SB, et al. Association between vitamin B12 deficiency and long-term use of acid-lowering agents: a systematic review and meta-analysis. *Intera Med J* 2015; 45(4):409-16.

Qian M, et al. Long-term treatment with metformin in type 2 diabetes and methylmalonic acid: Post hoc analysis of a randomized controlled 4-year trial. *J Diabetes Complications* 2016; 32(2):171-178.

Niafar M, et al. *Intera Emerg Med* 2015; 10(1):93-1026.

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## Downside of PPI Acid Suppression

- **Dysbiosis and SIBO** (probiotics)
- **Rebound hypersecretion of acid** (taper)
- **Gastrointestinal infections: FDA warning** (probiotics)
- **Pneumonia** (vitamin D, immune support)
- **Fracture: FDA warning** (vitamins D3, K2, calcium, mag)
- **Food allergies** (protease, betaine HCl, probiotics)
- **Deficiencies: FDA warning magnesium.** In addition, vitamins B12 and C, and iron
- **Kidney injury** (monitor, limit salt)
- **Cognitive decline\***
- **Gastric cancer\***

\* Correlation but not strong evidence at this time



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## Vitamin B12 in Elders



- 10–30% of elders have **atrophic gastritis**, which can interfere with B12 absorption. Deficiency can cause weakness, cognitive/behavioral changes.
- National Academy of Medicine recommends **all adults over 50 get majority of vitamin B12 from supplement or fortified foods.**
- **Intakes well above RDA** may be required in older adults to maintain vitamin B12 status.

Langan RC, Goodbred AJ. *Am Fam Physician* 2017 Sep 15;96(6):384-389

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## Proton Pump Inhibitors & Fracture



- FDA: patients taking **high doses of PPIs and/or taking one year or more at highest risk**. Warning label mandated.
- Recent study of adverse event reporting at FDA showed that PPI also increases fracture of ribs and other sites.
- **American Geriatrics Society recommends *against* PPIs for longer than eight weeks in older adults, except in high-risk patients, due to the potential risk of bone loss, fractures and *C. difficile* infection**

<https://www.fda.gov/Drugs/DrugSafety/PostmarketDrugSafetyInformationforPatientsandProviders/ucm213206.htm>

Wang L, et al. Proton Pump Inhibitors and the Risk for Fracture at Specific Sites: Data Mining of the FDA Adverse Event Reporting System. *Sa Rep* 2017 Jul 17;1(1):2527.

American Geriatrics Society 2015 Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults. *J Am Geriatr Soc*; 63(11):2227-46.

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## Alpha Lipoic Acid

- **$\alpha$ -lipoic acid (ALA, thioctic acid)** naturally occurring compound produced by humans (and others), resides in mitochondria.
- Johns Hopkins review: multiple studies show **ALA can improve pain of diabetic peripheral neuropathy (moderate strength of evidence)**.<sup>1</sup>
- **200 people diabetic peripheral neuropathy: significant improvement in vibration perception threshold, neurological symptom score and disability score, and visual analog scale in group receiving add on 600 mg ALA (BID) for 6 mo., compared to placebo.**<sup>2</sup>
- May be beneficial for **burning mouth syndrome**.

1. Nesbitt SA, et al. Non-pharmacologic treatments for symptoms of diabetic peripheral neuropathy: a systematic review. *Curr Med Res Opin* 2019

2. El-Nahas MR, et al. Oral Alpha Lipoic Acid Treatment for Symptomatic Diabetic Peripheral Neuropathy: A Randomized Double-Blinded Placebo-Controlled Study *Endocr Metab Immune Disord Drug Targets*. 2020

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## Choline: Related to B-Vitamins



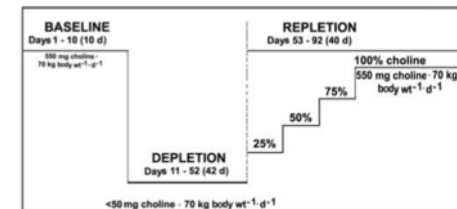
- Choline deficiency causes **abnormal deposition of fat in the liver, which results in a condition called *nonalcoholic fatty liver disease***.
- Necessary for **healthy cell membranes and cognition as we age**.
- Particularly crucial during pregnancy and first three years of a child's life, improves **cognitive function in adulthood, prevents age-related memory decline**, and protects brain from neuropathological changes associated with **Alzheimer's disease**, and **neurological damage** associated with epilepsy, fetal alcohol syndrome, and Down's.
- New **daily value** set in 2016: **550 mg per day**

Jiang X, et al. *Trends Endocrinol Metab* 2014; 25(5):263-73. Wozniak JR, et al. *Nutr Res* 2013; 33(11):897-904

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- **57 healthy adults were fed choline-deficient diets under controlled conditions.**
- Results showed that **77% of men, 80% of postmenopausal women, and 44% of premenopausal women developed fatty liver, liver damage, and/or muscle damage.**
- **Dysfunction corrected when choline was reintroduced into diet.**

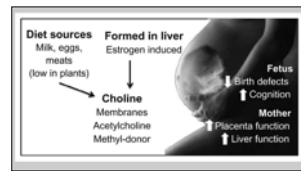
Fischer LM, et al. *Am J Clin Nutr*. 2007;85(5):1275-1285.

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## Choline in Pregnancy



- ACOG, AMA, AAP, EFSA, WHO: all conclude that choline is **crucially important** during pregnancy.<sup>1</sup>
- ~90–95% pregnant women **consume less than recommended** amounts of choline.
- Review found supplementing **mother/child's diet** with choline over first 1,000 days of life:
  - **Supports normal brain development.**
  - Protects against **neural/metabolic insults**, particularly when **fetus exposed to alcohol**.<sup>2</sup>
  - Improves **neural and cognitive functioning**.<sup>3</sup>

1. Schwarzenberg SJ. *Pediatrics*. 2018;141. doi: 10.1542/peds.2017-3716. 2. Derbyshire F, et al. *Nutrients* 2020 Jun 10;12(6):1731. 3. Brunst KJ, et al. *BMJ* 2010 May 20;340:c2181.

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Food	Choline Content Per Serving	Milligrams (mg) per serving	Percent DV*
Beef liver, pan fried, 3 ounces		356	65
Egg, hard boiled, 1 large egg		147	27
Beef top round, separable lean only, braised, 3 ounces		117	21
Soybeans, roasted, ½ cup		107	19
Chicken breast, roasted, 3 ounces		72	13
Beef, ground, 93% lean meat, broiled, 3 ounces		72	13
Fish, cod, Atlantic, cooked, dry heat, 3 ounces		71	13
Potatoes, red, baked, flesh and skin, 1 large potato		57	10
Wheat germ, toasted, 1 ounce		51	9
Beans, kidney, canned, ½ cup		45	8
Quinoa, cooked, 1 cup		43	8
Milk, 1% fat, 1 cup		43	8
Yogurt, vanilla, nonfat, 1 cup		38	7
Brussels sprouts, boiled, ½ cup		32	6
Broccoli, chopped, boiled, drained, ½ cup		31	6
Mushrooms, shiitake, cooked, ½ cup pieces		27	5
Cottage cheese, nonfat, 1 cup		26	5

<https://ods.od.nih.gov/factsheets/Choline-HealthProfessional/#en16>, Accessed July 17, 2021

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## Iodine Crucial Brain Health

- **Crucial nutrient**, especially during **pregnancy, infancy, and childhood** when thyroid hormones regulate growth in developing brain.
- **Mild deficiency** associated with **autistic spectrum disorder, ADHD, learning disabilities, and dyslexia**.<sup>1</sup>
- **American Thyroid Association:** women planning on becoming pregnant, are pregnant or lactating **take supplement containing 150 mcg/d potassium iodide**.<sup>2</sup>



1. Hay I, et al. *Nutrients* 2019 Aug 22;11(9):1974  
2. Stagnaro-Green A, et al. *Thyroid*. 2011;21(10):1081-1125

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### Iodine Intake Pregnancy and Breastfeeding

- Data from National Health and Nutrition Examination Survey found **use of iodine containing dietary supplements among pregnant and lactating women remains low** in contrast with current recommendations.
  - Among **pregnant** women, 72.2% used any dietary supplement; however, **only 17.8% used a dietary supplement with iodine**.
  - Among **lactating** women, 75.0% used a dietary supplement; however, **only 19.0% used a dietary supplement with iodine**.

Gupta PM, et al. Use of Iodine-Containing Dietary Supplements Remains Low among Women of Reproductive Age in the United States: NHANES 2011-2014. *Nutrients* 2018 Mar 29;10(4): pii: E422

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### Iron

- Low iron *most common cause of anemia* in young women; detrimental to *mood, cognition; physical well-being*.
- Prenatal and early childhood iron deficiency** associated with **long-term neurobehavioral damage**, may not be reversible, even with treatment.
- RDA for females:**
  - 14–18 yrs.: 15 mg/d
  - 19–50 yrs.: 18 mg/d
  - Pregnant: 27 mg/d
  - Breastfeeding: 9 mg/d
  - 51 and older (*and men*): 8 mg/d

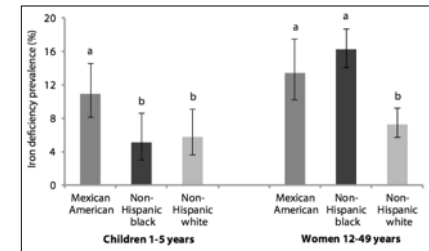


Image: <https://www.cdc.gov/nutritionreport/pdf/Trace.pdf> Accessed May 7, 2021

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Journal of the American College of Nutrition  
ISSN: 0731-5724 (Print) 1541-1087 (Online) Journal homepage: <http://www.tandfonline.com/loi/jacn20>

Product Used was Mega Food Blood Builder

#### A Food-Derived Dietary Supplement Containing a Low Dose of Iron Improved Markers of Iron Status Among Nonanemic Iron-Deficient Women

Christopher R. D'Adamo, James S. Novick, Termeh M. Feinberg, Valerie J. Dawson & Larry E. Miller

To cite this article: Christopher R. D'Adamo, James S. Novick, Termeh M. Feinberg, Valerie J. Dawson & Larry E. Miller (2018) A Food-Derived Dietary Supplement Containing a Low Dose of Iron Improved Markers of Iron Status Among Nonanemic Iron-Deficient Women, *Journal of the American College of Nutrition*, 37:4, 342-349, DOI: 10.1080/07315724.2018.1427158

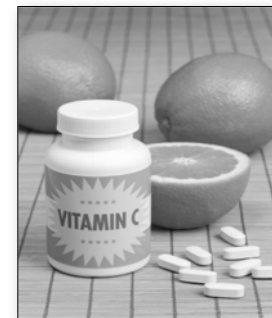
To link to this article: <https://doi.org/10.1080/07315724.2018.1427158>

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### Vitamin C

- Plays crucial role in **innate and adaptive immune responses**.
- Maintains **epithelial barrier** function, increases alveolar fluid clearance, and attenuates pro-inflammatory response.
- Deficiency leads to **impaired immunity and greater risk of infection**.<sup>1</sup>
- Only 1 in 10 Americans** get recommended daily intake for **fruits and vegetables**.<sup>2</sup>
- ~15.7 million Americans** have serious vitamin C deficiency; **~60 million** have marginal status.



1. Vothton P, et al. *Eur J Clin Pharmacol* 2019; 75(3):303-311.  
2. [https://www.cdc.gov/reports/odians/66/ser/marg6451.htm?\\_csl=mr6645a](https://www.cdc.gov/reports/odians/66/ser/marg6451.htm?_csl=mr6645a)  
Accessed November 24, 2020  
3. [https://www.cdc.gov/nutritionreport/pdf/Nutrition\\_Book\\_complex508\\_final.pdf](https://www.cdc.gov/nutritionreport/pdf/Nutrition_Book_complex508_final.pdf)

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## Prevalence of Vitamin C Deficiency and Low Vitamin C Concentration in US Population

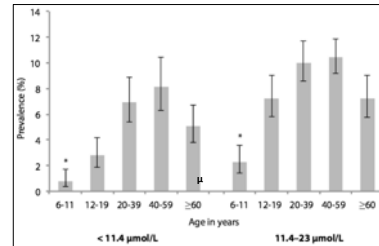


Figure H.1.1. Prevalence estimates of vitamin C deficiency (serum concentrations less than 11.4 µmol/L) and low vitamin C concentrations (11.4-23 µmol/L) in the U.S. population aged 6 years and older by age group, National Health & Nutrition Examination Survey, 2003-2006.

Error bars represent 95% of confidence intervals. \*Prevalence in children is significantly lower than prevalence in persons 20 years and older ( $p < 0.05$ ).

**Scurvy induced** when dietary vitamin C intake < 10 mg/d and/or plasma vitamin C levels **below 11 µmol/L**

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## Vitamin C: Acute Infection



- **Infection depletes levels** due to increased inflammation and metabolism.
  - 35% Scottish elders hospitalized for respiratory inf: levels < 11 µmol/L.<sup>1</sup>
  - Canadian hospital: 19% patients had levels < 11 µmol/L<sup>1</sup>
  - Paris hospital: 44% patients had levels < 6 µmol/L.<sup>1</sup>

- **Maintain adequate vitamin C levels**, especially during periods of stress.

1. Hemila H, et al. Vitamin C Can Shorten the Length of Stay in the ICU: A Meta-Analysis. *Nutrients* 2019 Apr; 11(4): 708.

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## ‘Picky’ Eater?

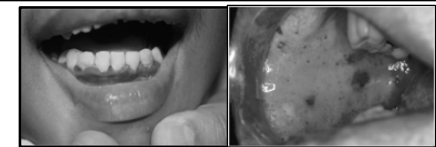
- **Healthy 4-year-old boy** seen by ortho/rheumatology with **right-leg pain and progressively worse limping**, became **unable to weight bear**.
- Intermittent **non-blanching rash arms and legs** past 2 years, topical emollients not effective. **Bleeding when brushing teeth, gingivitis**.
- Diet primarily waffles, yogurt, pasta with butter, goldfish crackers, peanut butter, chicken nuggets, and water.
- Workup negative except for **iron, vitamins C and D deficiencies**.
- **100 mg ascorbic acid q 8 hours x 7 days**, then 1 x daily with **iron and vitamin D**.
- **Limp and rash completely disappeared within weeks**.

Nastro A, et al. Scurvy Due to Selective Diet in a Seemingly Healthy 4-Year-Old Boy. *Pediatrics* September 2019; 144 (3) e20182824.

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## Vitamin C



- Skin changes, **easy bruising**, **slow healing wounds**, **dry mouth**, **dry eyes**. Emotionally **labile**. **Weakened capillaries**. Hemorrhage is hallmark of scurvy and hair follicles are common site of cutaneous bleeding.
- **Inflammation of gingiva** followed by **bleeding, ulceration, and bad breath**.
- **Swelling of periodontal membranes** occur, followed by **loss of bone**, and **loosening of the teeth**.
- Low ascorbic acid levels found in **healthy subjects with gingivitis** and in **diabetics with periodontitis**. 250 mg BID improved symptoms.<sup>1</sup>

1. Gokhale NH et al. *J Diet Suppl*. 2013;10:93-104.

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MAIN FUNCTIONS	GOOD SOURCES	
<ul style="list-style-type: none"> <li>Antioxidant defense</li> <li>Enhances immune function</li> <li>Needed to make collagen, carnitine, and the neurotransmitters serotonin and norepinephrine</li> </ul>	<b>Fruit</b> <ul style="list-style-type: none"> <li>Kiwifruit, 1 medium-sized, 90 mg</li> <li>Strawberries (whole), 1 cup, 85 mg</li> </ul>	<b>Vegetables</b> broccoli • kale • tomatoes <ul style="list-style-type: none"> <li>Sweet Red Pepper, ½ cup chopped, 95 mg</li> </ul>
<b>DAILY RECOMMENDATION</b> <div style="text-align: center;"> <div style="background-color: black; color: white; border-radius: 50%; width: 60px; height: 60px; display: flex; align-items: center; justify-content: center; margin: 0 auto;"> <div style="text-align: center;"> <b>400</b> mg </div> </div> <p>All Adults</p> </div>	<b>SPECIAL NOTES</b> <ul style="list-style-type: none"> <li>Heat destroys vitamin C. Try to eat fresh foods and cook by steaming, microwaving, or stir-frying.</li> <li>Vitamin C in food is identical to vitamin C in supplements.</li> <li>The Daily Recommendation listed is specific to the LPI based on extensive review of the scientific evidence. The Institute of Medicine's Recommended Dietary Allowance (RDA) is 90 mg/day for men and 75 mg/day for women.</li> </ul>	

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## Vitamin D

- Deficiency common globally, more **severe in elders** due to environmental/biological factors.
- 75% elders** in nursing homes **severely** vitamin D deficient (25(OH)D < 10 ng/mL).
- Obesity, dark skin, living northern latitudes, use of sunscreen**, all increase deficiency risk.
- Vitamin D increases **innate immunity** via secretion of **antiviral peptides**, strengthening **mucosal defenses** and **reducing risk of respiratory infections**.

Lips P, et al. *Eur J Endocrinol*. 2019;180:23–54.  
Ali N. *J Infect Public Health* 2020; Oct; 13(10): 1373–1380.

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## Vitamin D & Respiratory Infection

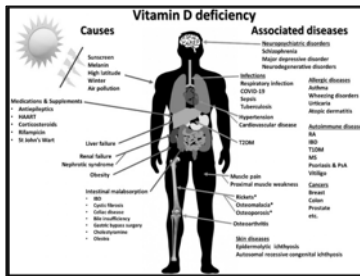
Martineau AR, et al. Vitamin D supplementation to prevent acute respiratory tract infections: systematic review and meta-analysis of individual participant data. *BMJ* 2017; 356: i6583.

- Acute respiratory infection kills **~2.65 million people/year**.
- Vitamin D releases antimicrobial peptides in the lungs, helps to mount immune response.
- 25 eligible randomized controlled trials** (n=10,933, aged 0–95 years).
- Supplementation **reduced risk of acute respiratory infection** among all participants (NNT=33) and those who were vitamin D deficient experienced the most benefit (NNT=4).

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## Vitamin D & Microbiome



- Vitamin D ensures appropriate level of antimicrobial peptides in mucus; maintains intestinal barrier function.

- If bacteria penetrate epithelial layer and enter interstitium, immune cells trigger adaptive immune response by activating Th1/Th17 cells. **Vitamin D/VDR signaling in these cells ensures clearance of the bacteria.**

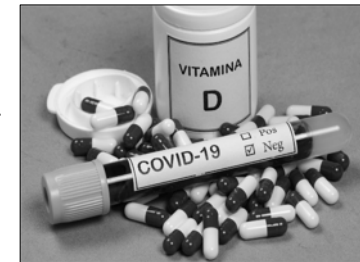
Fakhoury HMA, et al. *J Steroid Biochem Mol Biol* 2020

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## Vitamin D & COVID

- 212 cases COVID-19: **vitamin D deficient patients had 19.6-fold higher risk of critical outcome** compared to those with sufficient levels ( $p < 0.001$ ).<sup>1</sup>
- Retrospective study: **780 confirmed cases SARS-CoV-2 infection** found those vitamin D deficient **~13 times more likely to die**.<sup>2</sup>
- Israeli data: **26% of COVID patients died** if vitamin D deficient soon before hospitalization, compared to **3% who had normal levels of vitamin D**.
- Hospitalized patients **who were vitamin D deficient 14 times more likely to end up in severe or critical condition than others**.<sup>3</sup>



1. Alirol, M. Vitamin D Supplementation Could Possibly Improve Clinical Outcomes of Patients Infected with Coronavirus-2019 (COVID-2019). *SSRN/Editions*, J. 2020, doi:10.2139/ssrn.3571484.  
2. Rahmawan P., et al. Patterns of COVID-19 Mortality and Vitamin D: An Indonesian Study. *SSRN* 2020 doi: 10.2139/ssrn.3585561  
3. <https://www.timesofisrael.com/1-in-4-hospitalized-covid-patients-who-lack-vitamin-d-die-in-study/>

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## Vitamin D Deficiency

- Serum 25(OH)D level** is used to determine vitamin D status. According to the American Endocrine Society:
  - Preferable level **40–60 ng/mL** (100–150 nmol/L)
  - Sufficiency is 30 ng/mL** (75 nmol/L) and above
  - Insufficiency defined as 20–29 ng/mL**
  - Deficiency defined as <20 ng/mL** (<50 nmol/L)
  - Severe deficiency <12 ng/mL** (<30 nmol/L)
- 66.8 million Americans** 1 year and older levels between **12–20 ng/ml**
- 23 million Americans** 1 year and older: levels **less than 12 ng/ml**
  - Most at risk were *women and non-Hispanic blacks*.
- 2000–4000 IU per day** appears necessary to maintain sufficient levels.

CDC 2<sup>nd</sup> National Report on Biochemical Indicators of Diet and Nutrition in the U.S. Population  
Holick MF, et al. *J Clin Endocrinol Metab* 2011; 96(7):1911-30

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Table 2. IOM and Endocrine Society Recommendations for Vitamin D Intake<sup>6,11</sup>

Life-stage Group <sup>a</sup>	IOM Recommendations, IU/d		Endocrine Society Recommendations, IU/d <sup>b</sup>	
	Intake	Upper Limit <sup>c</sup>	Intake	Upper Limit <sup>c</sup>
0-6 months	400 <sup>d</sup>	1,000	400-1,000	2,000
6-12 months	400 <sup>d</sup>	1,500	400-1,000	2,000
1-3 years	600	2,500	600-1,000	4,000
4-8 years	600	3,000	600-1,000	4,000
9-18 years	600	4,000	600-1,000	4,000
19-30 years	600	4,000	1,500-2,000	10,000
31-50 years	600	4,000	1,500-2,000	10,000
51-70 years	600	4,000	1,500-2,000	10,000
71+ years	800	4,000	1,500-2,000	10,000
Pregnant or lactating women (14-18 years)	600	4,000	600-1,000	4,000
Pregnant or lactating women (19-50 years)	600	4,000	1,500-2,000	10,000

<sup>a</sup> Includes normal healthy individuals of both genders unless otherwise specified.

<sup>b</sup> Estimated intake needed to maintain blood 25(OH)D levels above 30 ng/mL.

<sup>c</sup> Maximum level that is expected to have no risk of adverse effects to healthy individuals. 1 µg of vitamin D is equivalent to 400 IU.

<sup>d</sup> Refers to adequate intake (intake estimated to maintain protective 25(OH)D levels in a group of healthy individuals with limited sun exposure and vitamin D stores) instead of recommended intake, which could not be established because of insufficient evidence.

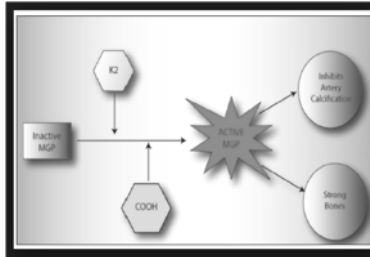
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## Don't Forget the Vitamin K

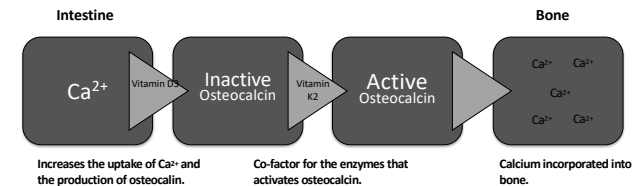
- Calcium, vitamins D and K, and magnesium contribute independently and collectively to bones.
- Beneficial role of vitamin K, particularly **vitamin K2**, in bone and cardiovascular health reasonably well supported scientifically, with several preclinical, epidemiological, and clinical studies published over the last decade.
- Vitamin K2 (MK-7) 100–200 mcg per day.



Karpinski M, et al. Roles of Vitamins D and K, Nutrition, and Lifestyle in Low-Energy Bone Fractures in Children and Young Adults. *J Am Coll Nutr* 2017 Jul;36(5):399-412.

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## Magnesium

- Low magnesium** intakes and serum levels associated with **type 2 diabetes, metabolic syndrome, inflammation, high blood pressure, atherosclerotic vascular disease, sudden cardiac death, chronic pain, osteoporosis, migraine, asthma, and colon cancer.**
- 50% of U.S. population** consumes less than the required amount of daily magnesium.
- Deficiency associated with negative effects on **calcium and vitamin D homeostasis.**



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## Magnesium and Inflammation

- Adults consuming < RDA of magnesium **1.48–1.75 times more likely to have elevated hs-CRP** than those with adequate intake.
- Oral magnesium** supplementation **decreases CRP** levels in seniors, those who are obese and/or with prediabetes.
- Hypomagnesemia** may accentuate pain by unblocking the **NMDA receptor (involved in central sensitization). Magnesium creates a blockade of the NMDA receptor in the spinal cord.**
- Meta-analysis 20 studies:** magnesium alleviates **acute postoperative pain** and *enhances effect of opioids* without increase in side effects.

Shiragel A, et al. Low magnesium intake is associated with increased knee pain in subjects with radiographic knee osteoarthritis: data from the Osteoarthritis Initiative. *Osteoarthritis Cartilage* 2018 May;26(5):651-658; de Oliveira GS, et al. Perioperative systemic magnesium to minimize postoperative pain: a meta-analysis of randomized controlled trials. *Anesthesiology* 2013 Jul;119(1):178-90.

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## *Magnesium Deficiency*

- Magnesium deficiency: *menstrual cramps, leg cramps, increased pain, migraines, fatigue, anxiety, insulin resistance, heart arrhythmia, etc.*
- Severe cases of deficiency, **seizures, tingling and numbness in arms and legs, bizarre muscle movements (especially of eyes and face), personality changes, and coronary spasms** can occur.
- Magnesium **citrate, malate, glycinate** are much better tolerated than **magnesium oxide**.
- **Supplementing 300–600 mg/d** very safe. Larger doses should not be used in those with impaired kidney function.

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## *Resources*

- *Fortify Your Life* and *Guide to Medicinal Herbs* with National Geographic
- Dietary Supplement Label Database: [dssl.nlm.nih.gov](https://dssl.nlm.nih.gov)
- NIH National Center for Complementary and Integrative Health (NCCIH): [nccih.nih.gov](https://nccih.nih.gov)
- Office of Dietary Supplements: [ods.od.nih.gov](https://ods.od.nih.gov)
- Linus Pauling Institute: [lpi.oregonstate.edu](https://lpi.oregonstate.edu)
- Consumer Labs: [www.ConsumerLabs.com](https://www.ConsumerLabs.com)
- Natural Medicines Research Collaboration  
<https://naturalmedicines.therapeuticresearch.com>

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