Optimal Aging Closing the Lifespan-Healthspan Gap

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National Geographic's
Life Is Your Best Medicine
Healthy At Home
Fortify Your Life
Guide to Medicinal Herbs

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Reflection

- What if someone could predict with **90% accuracy how long you will live**?
- **Would you want to know**?
- How would it affect the **way you live**?
- What if **you planned to live to 100**?
- Would it **change** the way you…
  - work and play?
  - manage your money?
  - spend time with your family?

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People aged 60 and older

Source: UNDESA Population division, World population prospects: the 2015 revision, DVD Edition, 2015.

Maps created by TRUE

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The Oldest of the Old

- In 1997, oldest person to have lived **died at age 122 years and 164 days**. Jeanne Louise Calment lived in France, took up fencing at age 85, and still rode a bicycle at 100.
- From family of **long-lived** persons: father died at age 93, mother at 86, and brother at age 97.
- She **quit smoking at 117;** she was nearly blind and felt embarrassed asking for a light.
- Jeanne Calment: example of "*optimal aging*."

www.managedhealthcareconnect.com/article/7994

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What is "Optimal" Aging?

"The capacity to function across many domains—**physical, cognitive, emotional, social and spiritual**—to *one's satisfaction* and in *spite of one's medical conditions*."

To live a life that is *meaningful, fulfilling, and relatively independent.*

Brummel-Smith K, Optimal Aging, Part I: Demographics and Definitions, *Annals of Long-Term Care*, 2007; 15: 26 – 28

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Life Span and Expectancy

- **Life Span:** maximum number years ***an individual*** can live; has remained ~125 years
- **Life Expectancy:** number of years ***average*** *person born in a* ***particular year*** will **probably** live:
  - **2019:** average American life expectancy **78.8 years**
  - **2020:** life expectancy declined to **77 years**
  - **2021:** life expectancy declined to **76.4 years**

Source: U.S. Centers for Disease Control and Prevention, news release, Dec. 22, 2022; NCHS Data Brief, Dec. 2022

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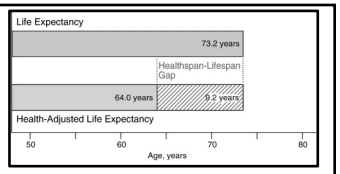
Lifespan versus Health Span



- Human **lifespan** steadily increasing, though slowing, leading to **rise in age-associated diseases.**
- **Health span** (time without significant age-related disease burden), is ***not*** **increasing at same rate**; **more life years suffering** from one/more diseases.
- **Goal:** delay onset of age-associated frailty and disease; ***compression of morbidity.***
- **Cardiovascular diseases, cancer, diabetes, and chronic respiratory diseases** account **for 80% of chronic disease related deaths**

World Health Organization (2019) *World health statistics 2019: monitoring health for the SDGs: sustainable development goals.* Geneva, Switzerland. GRAPH: Garmany A, et al. Longevity leap: mind the healthspan gap. *npj Regenerative Medicine* 2021; 6, 57

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The Good News

- **Five habits** may increase **life expectancy by 14 years in women and 12 years in men:**
  - Good diet
  - Regular exercise
  - Healthy weight
  - Do not smoke
  - Don't drink too much alcohol

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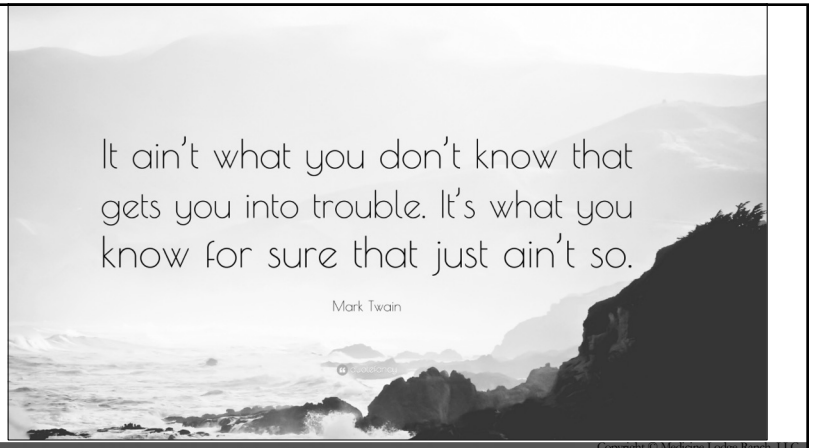

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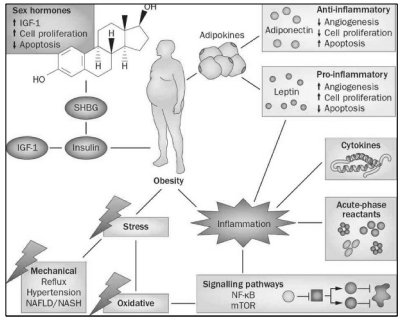
Inflammageing



- Inflammageing, **age-related increase in levels of pro-inflammatory markers in blood and tissues**, is a **strong risk factor** for multiple disease such as **cardiovascular** and chronic **kidney** disease, **type 2 diabetes**, **cancer, depression, dementia, and sarcopenia**.

Ferrucci L, et al, *Nat Rev Cardiol* 2018 Sep; 15(9): 505–522.

Image: Frasca D, et a;. Aging, Obesity and Inflammatory Age-Related Diseases. *Front Immunol* 2017 Dec 7;8:1745.

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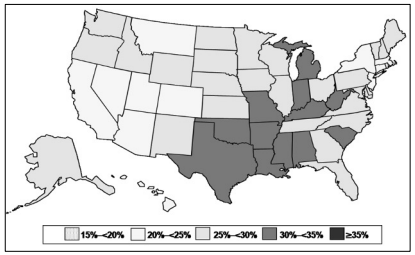
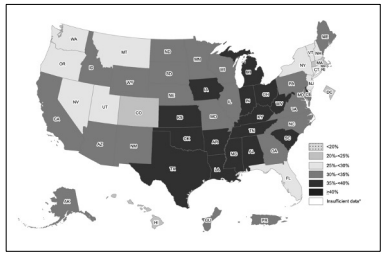
The Changing Landscape of Adult Weight

CDC 2011 Adult Obesity Prevalence Map



CDC 2020 Adult Obesity Prevalence Map



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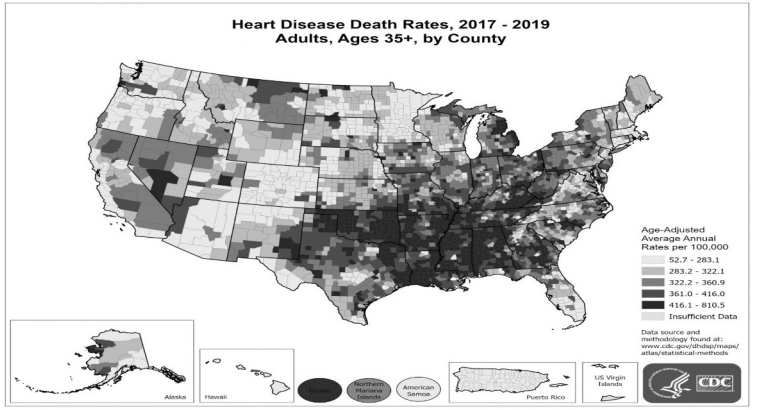
Heart Disease Death Rates, Total Population Ages 35+



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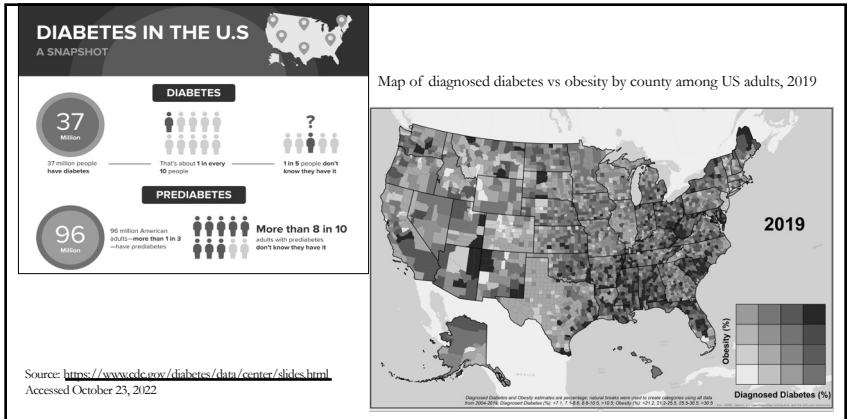

Map of diagnosed diabetes vs obesity by county among US adults, 2019

Source: https://www.cdc.gov/diabetes/data/center/slides.html
Accessed October 23, 2022

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AGING, ENVIRONMENTAL HEALTH, FOOD POLICY AND OBESITY **Sep. 22 2022**

How Does What We Eat Affect Our Healthspan and Longevity? It's a Complex Dynamic System

STUDY FINDINGS EMPHASIZE IMPORTANCE OF TAKING A HOLISTIC APPROACH TO THINKING ABOUT NUTRIENTS

RELATED STORIES

Aging Experts Agree: Seniors Must Get Screened for Frailty

Efforts to Delay Aging are Solid Investment

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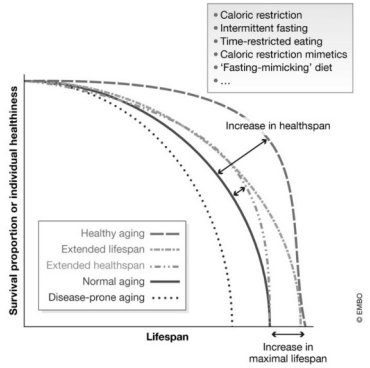
Figure 1



Theoretical concepts underlying dietary healthy aging intervention

Sustained reduction in caloric intake *without malnutrition* is probably the *most robust and best studied "anti-aging" dietary intervention* in model organisms.

Source: Hofer SJ, et al. *EMSO Mol Med* 2022 Jan 11; 14(1): e14418.

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SCIENTIFIC AMERICAN.

PUBLIC HEALTH

The Hunger Gains: Extreme Calorie-Restriction Diet Shows Anti-Aging Results

A new study shows five days of hunger a month may reduce risk factors for aging and age-related diseases

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Caloric Restriction?

(L) Canto 27 year old monkey on CR diet
(R) Owen is 29 year old on unrestricted diet.

- 25 year study University of Wisconsin Madison: 76 rhesus monkeys who between ages 7-14 years, began eating a diet **reduced in calories by 30%.**
- Disease was **3-fold greater** in control group. **No evidence of diabetes in any caloric-restricted animal.**
- National Institutes of Aging reported one monkey on 30% CR diet at age16 years lived to be **43 years old**, a longevity record for the species; equivalent of human living to 130.

news.wisc.edu/monkey-caloric-restriction-study-shows-big-benefit-contradicts-earlier-study/

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CALERIE (Comprehensive Assessment of the Long-term Effects of Reducing Intake of Energy)

- National Institute of Aging controlled study: 218 non-obese individuals, **randomized** to **current diet or 25% caloric restriction for 2 years. (11.7% caloric restriction maintained on average).**
- Study found **statistically significant reduction in cardiometabolic risk factors, inflammatory** markers; **weight** loss, improved **mood**, **sleep** duration.
- Reduced **bone mineral density** noted in **CR group**. Exercise was recommended to offset loss of BMD.

Ravussin E, et al. : A 2-Year Randomized Controlled Trial of Human Caloric Restriction: Feasibility and Effects on Predictors of Health Span and Longevity. *J Gerontol A Biol Sci Med Sci.* 2015;70(9):1097–104.

Martin CK, et al. Effect of Calorie Restriction on Mood, Quality of Life, Sleep, and Sexual Function in Healthy Nonobese Adults: The CALERIE 2 Randomized Clinical Trial. *JAMA Intern Med* 2016 Jun 1;176(6):743-52.

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Fasting-Mimicking Diets (FMD)?

Wei M, et al. Fasting-mimicking diet and markers/risk factors for aging, diabetes, cancer, and cardiovascular disease. *Sci Transl Med* 2017; 9(377).

- USC study of 100 healthy participants randomized into 2 study arms and tested the effects of FMD done **5 consecutive days each month for 3 months.**
  - **1100 calorie** first day, **700 calories for 4 days** (plant based, multivitamin). Ate whatever they wanted rest of the month.
- Three FMD cycles **reduced body weight and total body fat; lowered blood pressure, cholesterol, triglycerides and IGF-1**. Lean muscle mass remained unchanged. **Note: 25% drop-out rate**
- Effects still noted **3 months AFTER** study ended.

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Promising and…..

- Research in rhesus monkeys impressive.
- CALERIE study showed **even 11% reduction in calori**es can improve weight loss and certain biomarkers associated with aging. Most people could not sustain 25% reduction in calories.
- **The data suggest they have a favorable impact on many metabolic parameters associated with better health.**
- Do these diets **extend *longevity* in humans**?

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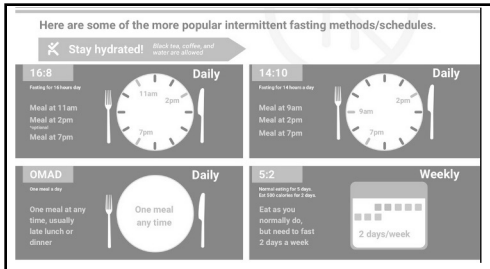


Intermittent Fasting

There are **many variations.** Three of the most popular are:

- **18/6 method**: restrict time you eat to 6 hrs./day and fast for 18 hours
- **16/8 method**: restrict time you eat to 8 hrs./day and fast for 16 hours
- **5:2 diet**: eat only 500–600 calories on two non-consecutive days, and eat normally the other five days
- **MAFD:** restrict to 500 calories every-other day.

Intermittent Fasting and Weight Loss

- MADF and 5:2 diet only fasting types associated with **statistically significant weight loss** in overweight/obese adults.
- MADF associated with improvement of **cardiovascular risk factors** in first 2-12 months including **LDL-C, total cholesterol, triglycerides, and blood pressure.**
- ***Earlier* eating window may** offer wider health benefits.
- 3-month study **late time restricted eating** (eating window 12-8 PM) found **no significant improvements** in weight loss, fasting insulin levels, fat mass, or blood lipid levels.

Patikorn C, et al. Intermittent Fasting and Obesity-Related Health Outcomes: An Umbrella Review of Meta-analyses of Randomized Clinical Trials. *JAMA Netw Open.* 2021;4(12):e2139558.

Lowe DA, et al. Effects of time-restricted eating on weight loss and other metabolic parameters in women and men with overweight and obesity: the treat randomized clinical trial. *JAMA Intern Med* 2020; 180: 1491–1499

Diet and Health

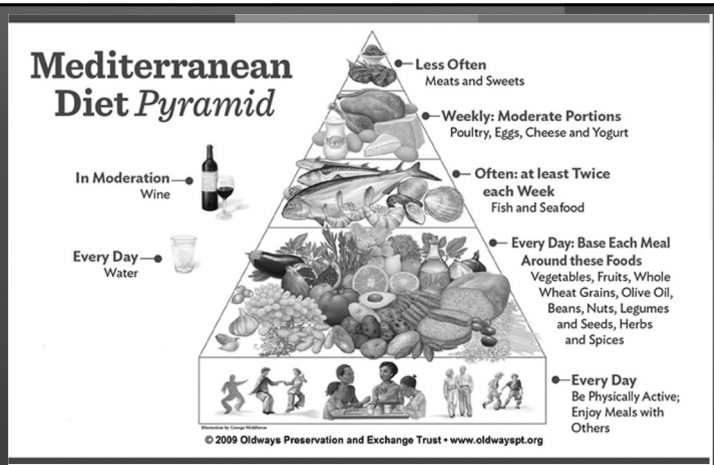
The relationship between diet and health is undisputed: **our bodies reflect what we eat and—just as importantly—what we *do not* or *cannot* eat.**

Dietary risks are complex: those associated with **'overnutrition'** and **atherogenic diets** and those related to **underconsumption of key micronutrients and macronutrients**. ***Nutrition impacts almost all health conditions.***

Much of our food policy and public attention is oriented around the effects of ***excess* sugar, salt, and saturated fats.**

However, the **leading dietary risk factors for *mortality* are DIETS LOW in whole grains, fruit, nuts and seeds, vegetables, and omega-3 fatty acids.**

Afshin A, *et al.* Health effects of dietary risks in 195 countries, 1990-2017: a systematic analysis for the global burden of disease study 2017. Lancet 2019;**393**(10184):1958–72. doi:10.1016/S0140-6736(19)30041-8pmidhttp://www.ncbi.nlm.nih.gov/pubmed/30954305



Mediterranean Dietary Pattern

- **13 *meta-analyses*** observational studies and **16 *meta-analyses*** of **randomized controlled trials** investigating association between adherence to Mediterranean diet and 37 different health outcomes, for a total population of over than **12,800,000 subjects**, were reviewed.
- Robust evidence (p-value<0.001) showed that greater adherence to the Mediterranean diet was associated with *reduced risk* of **overall mortality, cardiovascular diseases**, **myocardial infarction**, **overall cancer incidence**, **diabetes, and neuro-degenerative diseases.**

Dinu M, et al. Mediterranean diet and multiple health outcomes: an umbrella review of meta-analyses of observational studies and randomized trials. *Eur J Clin Nutr* 2017; May 10. doi: 10.1038/ejcn.2017.58.

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Mediterranean Dietary Pattern and Memory

- **Mediterranean and DASH diets have both been associated with lower dementia risk**. Researchers evaluated the inflammatory potential of these diets in relation to mild cognitive impairment or dementia risk using the Dietary Inflammatory Index (DII) during an average follow up of 9.7 years during Women's Health Initiative Memory Study.
- Higher DII scores (inflammatory diets) were significantly associated with ***greater cognitive decline and earlier onset of cognitive impairment***.

Hayden KM, et al. The association between an inflammatory diet and global cognitive function and incident dementia in older women: The Women's Health Initiative Memory Study. *Alzheimers Dement* 2017 May 19. pii: S1552-5260(17)30185-1.

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Inflammatory Food Ratings

200 or higher	Strongly anti-inflammatory
101 to 200	Moderately anti-inflammatory
0 to 100	Mildly anti-inflammatory
-1 to -100	Mildly inflammatory
-101 to 200	Moderately inflammatory
-201 or lower	Strongly inflammatory

FOOD	SERVING SIZE	SERVING SIZE (GRAMS)	IF RATING
AGAVE NECTAR	1 TBSP	21	-74
ALMOND BUTTER	¼ CUP	64	100
CHEESE, CHEDDAR	1 OUNCE	28.35	-20
CHICKEN BREAST, RSTD	3 OUNCES	85	-19
MILK, WHOLE	1 CUP	246	-46
OLIVE OIL	1 TBSP	14	74
ONIONS, COOKED	½ CUP	105	240
RICE, WHITE	1 CUP	158	-153
SPINACH	1 CUP	30	75
SALMON, SOHO BAKED	3 OUNCES	85	**450**
TURMERIC	½ TSP	1.5	338

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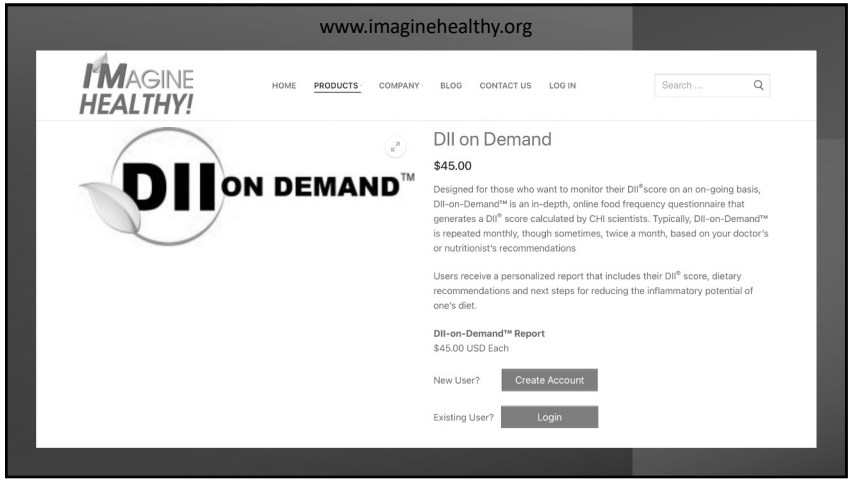
www.imaginehealthy.org



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AMERICAN COLLEGE of CARDIOLOGY ASCVD Risk Estimator Plus

Estimate Risk | Therapy Impact | Advi

2.0% Low Current 10-Year ASCVD Risk**

Lifetime ASCVD Risk: 39% Optimal ASCVD Risk: 2.1%

Current Age * 59 (Age must be between 20-79)

Sex * Male | ✔ Female

Race * ✔ White | African American | Other

Systolic Blood Pressure (mm Hg) * 117 (Value must be between 90-200)

Diastolic Blood Pressure (mm Hg) 68 (Value must be between 60-130)

Total Cholesterol (mg/dL) * 220 (Value must be between 130 - 320)

HDL Cholesterol (mg/dL) * 86 (Value must be between 20 - 100)

LDL Cholesterol (mg/dL) 110 (Value must be between 30-300)

History of Diabetes? * Yes | ✔ No

Smoker? * Current | Former | ✔ Never

On Hypertension Treatment? * Yes | ✔ No

On a Statin? Yes | ✔ No

On Aspirin Therapy? Yes | ✔ No

http://tools.acc.org/ASCVD-Risk-Estimator-Plus/#!/calculate/estimate/

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View Advice Summary for this Patient

Projected 10-Year ASCVD Risk

~% with no treatments selected yet

Quit Smoking | Start/Intensify Statin | Start/Add Blood Pressure Medication(s) | Start/continue aspirin therapy

*Guidelines do not recommend statin therapy for patients with 10-year risk < 5%
*Guidelines do not typically recommend aspirin therapy for patients with 10-year risk < 10%
*ACC/AHA Guidelines do not specify antihypertensive drug therapy for SBP<120 mmHg (<130 mmHg w/diabetes)

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Mediterranean Diet for 5 Years for Heart Disease Prevention (Without Known Heart Disease)

61 for prevented stroke, heart attack, or death

Benefits in NNT	Harms in NNT
• 1 in 61 were helped (avoiding a stroke, heart attack, or death)	• None were harmed (diet effects)

7447 subjects followed for an average of roughly five years, and demonstrated a clear reduction in their combined endpoint of strokes, heart attacks, and death.

Estruch R, Ros E, Salas-Salvadó J, et al; PREDIMED Study Investigators. Primary prevention of cardiovascular disease with a Mediterranean diet. *N Engl J Med.* 2013 Apr 4;368(14):1279-90. doi: 10.1056/NEJMoa1200303.

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Mediterranean Diet for Secondary Prevention After Heart Attack

30 for mortality

Benefits in NNT	Harms in NNT
• 1 in 18 were helped (preventing repeat heart attack) • 1 in 30 were helped (preventing death) • 1 in 30 were helped (preventing cancer)	• None were harmed

Benefits in Percentage	Harms in Percentage
• 94% saw no benefit • 6% were helped by preventing a repeat heart attack • 3% were helped by preventing death • 3% were helped by preventing cancer	• 0% were harmed

To compare saving a life post-heart attack with this diet (NNT= 30) and with statins (NNT=83) suggests that diet is nearly three times more powerful as a life-saving tool. Cancers were also reduced,

https://www.thennt.com/nnt/mediterranean-diet-for-post-heart-attack-care/

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Statin Drugs Given for 5 Years for Heart Disease Prevention (Without Known Heart Disease)

104 for non-fatal heart attack

Benefits in NNT	Harms in NNT
• None were helped (life saved) • 1 in 104 were helped (preventing heart attack) • 1 in 154 were helped (preventing stroke)	• 1 in 50 were harmed (develop diabetes*) • 1 in 10 were harmed (muscle damage)

Effect of statins for people who have never had a heart attack or stroke (most of the people who currently take statins). They do lower cholesterol in most people who took them. But it takes 5 years of daily statin therapy to achieve a 1.6% chance of avoiding a heart attack, and a 0.37% chance of avoiding a stroke. There continues to be a debate over the true benefit/risk of statins. Almost all studies have been industry sponsored.

https://www.thennt.com/nnt/statins-for-heart-disease-prevention-without-prior-heart-disease-2/

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Statins, CoQ10 and Myopathy

- Statin-induced myopathy, a main adverse effect of statins, is one of the primary reasons for statin discontinuation that contributes to adverse cardiovascular outcomes.
- In a review of 12 randomized controlled trials, CoQ10 supplementation ameliorated statin-associated muscle symptoms (e.g., muscle pain, weakness, tiredness and cramp.
- CoQ10 supplementation may be a complementary approach to manage statin-induced myopathy. Dose in studies 100-600 mg/d.

Qu, H, et al. *Journal of the American Heart Association* 2018; 7(19):e009835.

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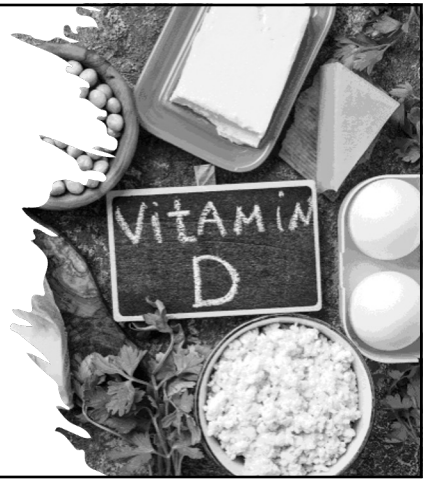
Statins, Vitamin D, and Myopathy

- Meta-analysis: nine cohort studies (n=2906 patients) revealed that the 25OHD level of patients with statin-related myopathy was significantly lower than that of patients without myopathy and subset of studies found that statin tolerance improved to 89% ($p < 0.001$) after vitamin D supplementation.
- Patients should have levels corrected to sufficient levels (>30 ng/mL).



Hou G, et al *Am J Cardiovasc Drugs* 2022 Mar;22(2):183-193.

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C-Reactive Protein and Cardiovascular Risk

- Coronary artery disease once considered primarily **lipid accumulation mediated disease**, now shown to involve ongoing **inflammatory response.**
- **C-reactive protein (CRP)** is a sign of inflammation in the body. There should be no detectable (hs)CRP in healthy individual.
- hs-CRP improves risk prediction at all levels of LDL cholesterol.

hs-CRP Value	Cardiovascular Disease Risk Level*
< 1 mg/L	**low** risk
1-3 mg/L	**average** risk
> 3 mg/L	**high** risk

* Risk levels published in 2003. American Heart Association / Centers for Disease Control and Prevention Scientific Statement

Christodoulidis G, et al. Cardiol Rev 2014 Jan 15

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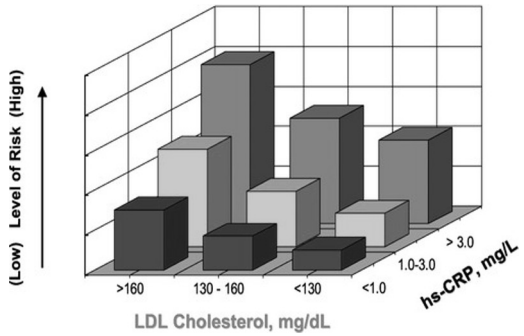

Paul M Ridker. Circulation. C-Reactive Protein. Volume: 108, Issue: 12, Page: 1501-1505, DOI: (10.1161/01.CIR.0000093381.57779.67)

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Sugar & Cardiovascular Risk

- **Diets high in sugar increase total-, LDL-cholesterol, and triglycerides.** To match **cholesterol increases** seen with *typical* sugar consumption, you'd need to **consume saturated fat at a level ~40% of daily calories** (typical intake is ~10 %).
- Human/animal data show high sugar diets **impair glucose tolerance, cause insulin resistance, elevate uric acid, and alter platelet function.**
- *Added* **sucrose and fructose** increases **leptin resistance** (satiety hormone), increasing weight gain; causes **NAFLD**, most common cause of liver disease in US, and is a **strong risk factor for coronary heart disease.**
- American Heart Association recommends **women limit added sugar intake to 6 tsp/d** (25 g); **men limit to 9 tsp/d** (37.5 g). Americans consume roughly triple this amount.

Chhabra R, et al. *Mayo Clin Proc.* 2013;88:1259–65; Vasselli JR, et al. *Advances in Nutrition (Bethesda, Md)* 2013;4:164–75.

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Magnesium and CRP

- Patients with low Mg intake **have *increased* likelihood of serum hs-CRP** ≥3.0 mg/L.
- **Elevated serum hs-CRP** is ***decreased*** by **Mg supplementation** in patients with chronic disease.[1]
- **Meta-analysis** 8 RCTs: Mg supplementation (320-500 mg/d) significantly decreased level of **serum hs-CRP by an average of –1.33 mg/L**.[2]
- Supplements: magnesium oxide likely to cause diarrhea; **citrate, malate, and glycinate** gentler on GI. **L-threonate** may have superior brain penetration.
- **Caution** using supplements in those with severe kidney dysfunction.

1. Nielsen FH. Dietary magnesium and chronic disease. *Adv Chronic Kidney Dis* 2018 May;25(3):230-235.
2. Mazidi M, et al. Effect of magnesium supplements on serum C-reactive protein: a systematic review and meta-analysis. *Arch Med Sci* 2018 Jun; 14(4): 707–716.

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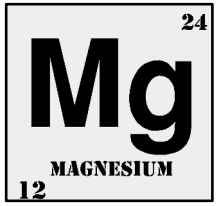
Magnesium and Diabetes

- **Insulin resistance** repeatedly shown to **decrease magnesium** levels and **diabetics** with low magnesium show a **more rapid disease progression** and an increased risk for **diabetes-related complications.**
- A vicious forward feeding cycle is created.
- **Magnesium supplementation** shown to **improve glucose metabolism and insulin sensitivity** in those with type-2 diabetes.



Gommers LM, et al Hypomagnesemia in Type 2 Diabetes: A Vicious Circle? *Diabetes 2016;* 65(1):3-1

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Magnesium and Heart Disease

- 2013 **meta-analysis** of 16 studies with more than **313,000 participants** found:
  - Higher blood levels associated with a **30% lower risk of cardiovascular disease**.
  - Dietary magnesium (per 200-mg/d increment) associated with a **22% lower risk of fatal ischemic heart disease.**
- Magnesium important in maintaining blood pressure and **supplementation (365 to 450 mg/d)** shown to **significantly lower blood pressure** in those with **insulin resistance, prediabetes, and other chronic diseases.**
- Mg involved in heart's electrical conduction and hypomagnesemia, hypokalemia and other electrolyte disturbances may trigger **cardiac arrhythmias.**

Del Gobbo LC, et al. *Am J Clin Nutr* 2013; 98(1):160-73. Dibaba DT, et al. *Am J Clin Nutr 2017;* 106(3):921-929.
Barbagallo M et al. *Nutrients* 2021 Feb; 13(2): 463.

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Magnesium Deficiency

- People with magnesium deficiency can present with **insulin resistance, menstrual cramps, leg cramps, migraines, fatigue, anxiety and mild elevations in blood pressure**.
- In **more severe cases** of deficiency, **seizures, tingling and numbness in the arms and legs, bizarre muscle movements (especially of the eyes and face), personality changes, and coronary spasms can occur.**
- Many medications can deplete magnesium (e.g., **diuretics, PPIs, OCPs, gout medication, B2-agonists, steroids,** etc.).
- Mg is necessary for **vitamin D synthesis, transport, and activation**; hence, **Mg deficits** impair production of **active form of vitamin D.**

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Magnesium Content in Foods

Nuts and Seeds

Almonds, dry	¼ cup	105
Brazil nuts, dry	¼ cup	80
Cashews, dry roasted	¼ cup	89
Peanuts, dry or oil roasted	¼ cup	67
Peanut Butter	2 Tbsp	50
Pecans, dry	¼ cup	38
Sesame Seeds, roasted whole	1 oz.	101
Soybeans, roasted	¼ cup	63
Sunflower Seeds, dry	¼ cup	128
Walnuts, chopped	¼ cup	63

Magnesium Content in Foods

Fruits

Apricots, canned	3 halves	8.0
Banana	1 medium	33.0
Cherries, canned, pitted	½ cup	16.0
Grapefruit, fresh	½ cup	9.5
Orange, fresh	1 medium	13.0
Peach, fresh, pared	1 medium	6.0
Peach, canned in syrup	½ cup	6.0
Pear, fresh	1 medium	9.0
Pear, canned in syrup	½ cup	5.5
Pineapple, canned	½ cup	17.5
Strawberries, raw	½ cup	8.0

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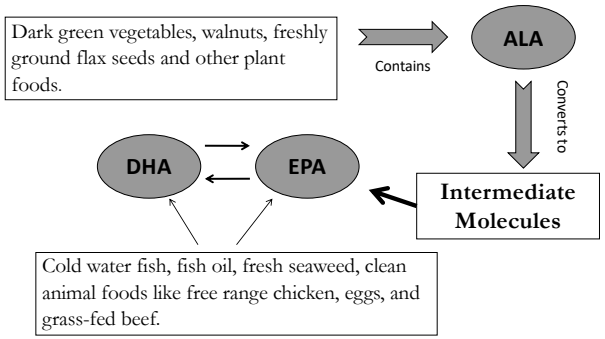
Omega 3 Fatty Acids from Plants and Animals



45

American Heart Association

- "Omega-3 fish oil supplements prescribed by a healthcare provider may help ***prevent death*** from heart disease in patients **who recently had a heart attack** and may ***prevent death and hospitalizations*** in patients with **heart failure**."

Siscovick DS, et al. *Circulation* 2017; Mar 13.

46

Omega 3 Fatty Acids – Healthy Muscles

- Chronic low-grade inflammation also contributes to the **loss of muscle mass, strength and functionality,** referred to as sarcopenia, as it affects both muscle protein breakdown and synthesis through several signaling pathways.
- Omega-3 fatty acids stimulate muscle protein synthesis in older adults and may be useful for the **prevention and treatment of sarcopenia.**

Dalle S, et al. Front Physiol 2017; Dec 12;8:1045
Ticinesi A, et al. Nutrients 2016; Mar 29;8(4):186

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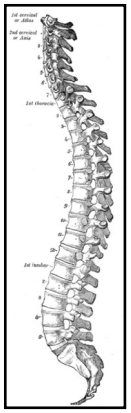
Choose Your Seafood Wisely

https://www.seafoodwatch.org/seafood-recommendations/our-app

48



Risk Factors for Osteoporosis

- Personal history of fracture after age 50
- Low bone density
- Female
- Thin and/or having a small frame
- Advanced age
- Family history of osteoporosis
- Estrogen deficiency, especially early or surgical menopause, amenorrhea
- Low lifetime calcium intake
- Use of certain medications
- Low testosterone levels in men
- Inactive lifestyle

Who Should Get a DXA?

Indications for BMD testing
Consider BMD testing in the following individuals:
• Women age 65 and older and men age 70 and older, regardless of clinical risk factors
• Younger postmenopausal women, women in the menopausal transition, and men age 50 to 69 with clinical risk factors for fracture
• Adults who have a fracture at or after age 50
• Adults with a condition (e.g., rheumatoid arthritis) or taking a medication (e.g., glucocorticoids in a daily dose ≥5 mg prednisone or equivalent for ≥3 months) associated with low bone mass or bone loss

National Osteoporosis Foundation, Clinician's Guide to Prevention and Treatment of Osteoporosis 2014

DXA Scan

Table 1. World Health Organization Classification of T Score

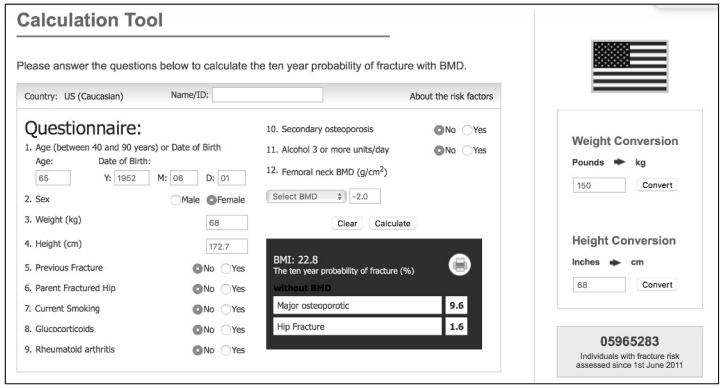
Normal	BMD ≥ -1.0
Low bone mass (osteopenia)	BMD > -2.5 and < -1.0
Osteoporosis	BMD ≤ - 2.5
Severe (established) osteoporosis	BMD ≤ - 2.5 with history of fragility fracture

T-scores are based on the NHANES reference values for women aged 20-29 years. The same absolute values are used in men.

Guidance in US

Consider FDA-approved medical therapies in postmenopausal women and men aged 50 years and older, based on the following:

- A **hip or vertebral** (clinical or morphometric) fracture
- **T-score ≤ -2.5** at the femoral neck or spine after appropriate evaluation to exclude secondary causes
- **Low bone mass** (T-score -1.0 to -2.5 at the femoral neck or spine) and **10-year probability of hip fracture ≥ 3% or 10-year probability of major osteoporosis-related fracture ≥ 20%** based on the US-adapted WHO FRAX algorithm



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Bisphosphonates for Fracture Prevention in **Post-Menopausal Women With Prior Fractures or With Very Low Bone Density** (NNT = 100)

In Summary, for those who took the bisphosphonates:

Benefits in NNT	Harms in NNT
• 1 in 20 were helped (vertebral fracture prevented) • 1 in 100 were helped (hip fracture prevented)	• A small number were harmed

Benefits in Percentage	Harms in Percentage
• 94% saw no benefit after 3 years of treatment • 5% avoided a vertebral fracture • 1% avoided a hip fracture	• A small percentage were harmed

www.thennt.com/nnt/bisphosphonates-for-fracture-prevention-in-post-menopausal-women-with-prior-fractures-or-very-low-bone-density/

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Bisphosphonates for Fracture Prevention in **Post-Menopausal Women Without Prior Fractures**

In Summary, for those who took the bisphosphonates:

Benefits in NNT	Harms in NNT
• None were helped (fracture prevented after 3 years of medicine)	• A small number were harmed

Benefits in Percentage	Harms in Percentage
• 100% saw no benefit after 3 years of treatment	• A small percentage were harmed

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Fragility Fractures

- **Fragility fractures** associated with **decreased quality of life**, increased disability, more frequent hospital admission and **increased risk of mortality.**
- While a multimodal approach is important, **vitamin D supplementation alone, or in combination with calcium**, has been shown to **significantly reduce the risk of falling in elders.**

WHO. Nutrition for Older Persons. http://www.who.int/nutrition/topics/ageing/en/index1.html Accessed January 3, 2018

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Vitamin D

- Vitamin D deficiency can cause **osteomalacia** (lower bone mineralization), leading to **musculoskeletal pain**, usually in the pelvis, shoulders, low back, and proximal muscles.
- Deficiency is common worldwide but often **more severe in elders** due to environmental and biological factors.
- Impaired mobility can limit time spent outdoors and **decreased synthesis of vitamin D in skin** makes it difficult to maintain adequate levels even with sun exposure.
- As aging advances, intestinal resistance to 1,25(OH)2D **impairs the uptake of calcium** and a **decline in renal function reduces activation of vitamin D.**

Wintermeyer E, et al. Crucial Role of Vitamin D in the Musculoskeletal System. *Nutrients* 2016; Jun 1;8(6). pii: E319.

57

Vitamin D: Bones, Balance, and Infection

- Low vitamin D increases risk of **falls** and **gait instability**. Exercise, calcium and vitamin D supplementation all been shown to decrease falling in elders.
- Meta-analysis by National Osteoporosis Foundation: eight studies (n= 30,970 participants): **calcium plus vitamin D supplementation** produced significant **15 % reduced risk total fractures and 30% reduced risk hip fracture**.
- Vitamin D supplementation also protects against **acute respiratory tract infection**, especially in those who were most deficient.

Tricco AC, et al. Comparisons of Interventions for Preventing Falls in Older Adults: A Systematic Review and Meta-analysis. *JAMA* 2017; Nov 7;318(17):1687-1699.

Weaver CM. Calcium plus vitamin D supplementation and risk of fractures: an updated meta-analysis from the National Osteoporosis Foundation. *Osteoporosis Int* 2016 Jan;27(1):367-76

Martineau AR, et al. Vitamin D supplementation to prevent acute respiratory tract infections: systematic review and meta-analysis of individual participant data. *BMJ* 2017; Feb 15;356:i6583.

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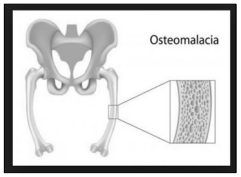
Osteomalacia



- Vitamin D **positively affects muscle strength, muscle size and neuromuscular performance.**
- In adults, **deficiency can cause osteomalacia (lower bone mineralization): musculoskeletal pain, usually in the pelvis, shoulders and proximal muscles.**
- **Pain increased by mild pressure on the sternum or anterior tibial bone are typical symptoms**.

Wintermeyer E, et al. Crucial Role of Vitamin D in the Musculoskeletal System. *Nutrients* 2016; Jun 1;8(6). pii: E319.

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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:
  - **Sufficiency is 30 ng/mL** (75 nmol/L) and above (range 30-100 ng/mL
  - **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 black*.
- **1000-2000 IU per day appears necessary to maintain sufficient levels**.

CDC 2nd *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

60

Calcium: Deficiency and Risk

- One of first signs of calcium deficiency is **muscle aches of thighs and arms, with minimal exertion.** Long term deficiency leads to **poor bone development/loss of bone mineral density,** numbness and **tingling in the fingers**, lethargy, poor appetite, **abnormal heart rhythms** and convulsions.
  - Sodium: **high sodium** intake **increases urinary calcium excretion**. 1,000 mg/d of calcium required per 2,000 mg/d sodium to maintain balance.
  - **High protein** intake increases calcium excretion BUT also increases absorption, overall, a **neutral effect**.
  - **Caffeine** very modestly increases urinary excretion (**1 cup brewed coffee ~3 mg loss of calcium**)
  - Alcohol can reduce calcium absorption and also reduce hepatic activation of vitamin D, by how much is unknown.

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A Note on Protein

- Framingham Osteoporosis Study found **higher protein** intakes (60-83g/d versus 46g/d) in elder men and women (mean 75 years) associated with **a 37% decreased risk of hip fracture**.
- Women's Health Initiative: **20% increase in protein intake** (15-18% of energy intake) improved BMD maintenance and marginally lowered forearm fracture risk.
- European guidelines recommend **20-25 grams high quality protein with each meal for women over age 50 with regular physical activity/exercise 3-5 times/week.**

Misra D, et al. *Osteoporosis Int* 2011; 22(1):345-349.
Beasley JM, et al. Am *J Clin Nutr* 2014; 99(4):934-940.
Rizzoli R, et. al. *Maturitas* 2014 Sep;79(1):122-32.

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More Protein as We Age

- **~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 age 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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Table 2. Prevalence of Micronutrient Inadequacies Among Older Adults in the US when Accounting for Intake from Food Only (n=4,905), NHANES 2009-2012 (42)

Micronutrient	Ages 51-70 Years, % < EAR	Ages ≥71 Years, % < EAR
Folate	10.6	17.0
Niacin	1.3	4.0
Riboflavin	2.6	3.4
Thiamin	6.0	8.9
Vitamin A	39.2	37.2
Vitamin B_6	15.6	22.4
Vitamin B_{12}	5.2	4.9
Vitamin C	42.1	44.2
Vitamin D	94.6	95.5
Vitamin E	85.0	91.7
Vitamin K*	48.7	62.9
Calcium	51.4	72.9
Copper	4.1	9.6
Iron	<1	<1
Magnesium	51.3	68.6
Phosphorus	<1	2.1
Selenium	<1	2.4
Zinc	17.9	26.1
*% ≤ AI		

Table from: https://lpi.oregonstate.edu/mic/micronutrient-inadequacies/subpopulations-at-risk. Accessed Sept 1, 2021

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Prescription Meds and Nutrients: Just a Glimpse

- Widespread use of **prescription drugs** for management of chronic health conditions can make it difficult to **maintain adequate levels of specific nutrients.**
- **PPI drugs** are one of the most commonly prescribed medications and are also available over-the-counter in the United States. Long-term use can **increase the risk of fracture, cause magnesium levels to plummet, and interfere with B12 absorption, as well as increasing the risk of *C. difficile* infection.**
- With increasing prevalence of type-2 diabetes, we will continue to see increase in **metformin use, a drug known to deplete vitamin B12.**

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Metformin With Proton Pump Inhibitors: A Polypharmacy Recipe for Neuropathy via Vitamin B12 Depletion

Zdilla MJ. *Clin Diabetes* 2015; 33(2):90-5.

66

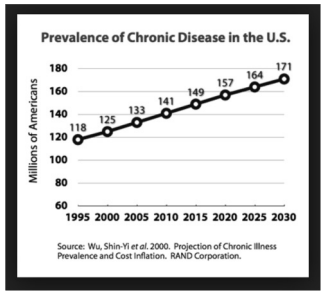
Vitamin B12

- **Atrophic gastritis affects 10%-30% of people over 60** years of age causing malabsorption of food bound vitamin B12.
- Low vitamin B_{12} concentrations can cause serious problem; **peripheral neuropathy, balance disturbances, cognitive disturbances, physical disability, and greater loss of bone density.**
- Risk: inadequate intake, veganism, malabsorption, medications (PPI, metformin), obesity, aging
- ***18 million Americans are*** deficient in vitamin B12.
- Supplement with 20-100 mcg per day.

Niafar M, et al. Intern Emerg Med 2015; 10(1):93-102.

67

Consequence of Inactivity



- Higher risk for heart disease, type 2 diabetes, certain cancers, Alzheimer's disease and increase lower back pain, depression and anxiety.
- Half of baby boomers in the US report having NO exercise.
- 80 million Americans over the age of 6 years of age are entirely inactive

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Pain, Mood, and Sleep

- 50-80% of people with chronic pain have sleep disturbances. Pain can interfere with sleep and sleep disturbance can exacerbate pain. Vicious cycle.
- Depression and anxiety higher in people with chronic pain and strongly correlated with self-reporting of insufficient sleep.
- Lack of exposure to sunlight and the use of bright lights at night increases the likelihood of disordered circadian clock.
- As we age, we have more disturbed and lighter sleep. Melatonin secretion declines with age, which may also impact sleep in older adults.

Cheatle MD, et al. Assessing and Managing Sleep Disturbance in Patients with Chronic Pain. *Sleep Medicine Clinics*, 2016;11(4): 531-541

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Some Tips

- Start morning with ***exposure to sunlight*** or consider using a dawn simulating device that slowly increases intensity of light for 30 minutes before awakening. (Philips Wake-Up Light with Colored Sunrise Simulation is highly rated)
- Turn down thermostat to 65-68 F. Wear socks to bed if feet get cold.
- Use black out blinds or curtains to eliminate external light. **Use blue light blocking glasses if using technology at night.**
- Replace mattress every 10 years, pillows every 2 years, use nice bed linens, make it peaceful, no blue light of any kind in room, consider wearing amber blue blocking glasses at night for computer.

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Cognitive Behavioral Therapy

- **CBT has emerged as a recommended *first-line therapy for insomnia.*** Digital CBT has been shown to be effective for improving sleep, as well as mental health and well-being.
- CBT-I typically consists of:
  - Psychoeducation about sleep and insomnia
  - Stimulus control
  - Sleep restriction
  - Sleep hygiene
  - Relaxation training
  - Cognitive therapy

Luik AI, et al. Digital cognitive behavioral therapy for insomnia: a state of the science review. *Curr Sleep Med Rep* 2017; 3(2): 48–56

72

Current Recommendations

- **Controlled-release melatonin** and doxepin are recommended as first-line agents in older adults; the so-called z-drugs (zolpidem, eszopiclone, and zaleplon) should be reserved for use if the first-line agents are ineffective.
- Dose generally 2-3 mg melatonin.

Matheson E, et al. Insomnia: Pharmacologic Therapy. *Am Fam Physician* 2017; Jul 1;96(1):29-35.

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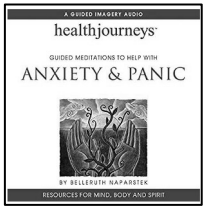
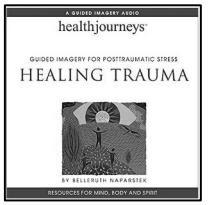
Belleruth Naparstek

- Love, love, love her. Something for everyone.
- She has Guided Imagery Meditations for:
  - Anxiety and Panic
  - Anger and Forgiveness
  - Depression
  - Healing Trauma
  - Ease Grief
  - Relieving Stress
  - Undergoing Surgery
  - Chemotherapy and Radiation





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Sleep Evaluation

- There are numerous medications that can impair sleep (e.g., beta blockers antidepressants, steroids, ADHD meds, possibly statins, etc.) Do some online research and/or talk to your pharmacist. If you are taking medication that disrupts sleep, talk to your health care provider.
- Restless leg syndrome impacts many people. Talk to you provider, it could be due to low iron, vitamin D or meds you are taking – though the cause is really not known.
- Sleep apnea is a condition where breathing is interrupted during the night. A sleep study can be ordered and treatments are available (e.g., CPAP, dental appliances which reposition lower jaw and tongue)

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Letting Go…..

"Healing may not so much be about getting better, but about letting go, of all the expectations, all of the beliefs, and becoming who you are."

— Rachel Naomi Remen, M.D.

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Be patient with yourself. Self-growth is tender; it's holy ground.
There's no greater investment.
Stephen Covey
Vieraona Low Dog, M.D.
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