

# “Nutrition, Dietary Supplements and Oral Health”



**Tieraona Low Dog, MD**

Chair: US Pharmacopeia  
Dietary Supplements Admissions  
Joint Standard Setting Sub-  
Committee

Author of National Geographic's  
“*Fortify Your Life*” “*Healthy At Home*”  
and “*Life Is Your Best Medicine*”

[www.DrLowDog.com](http://www.DrLowDog.com)

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[www.DrLowDog.com/Resources](http://www.DrLowDog.com/Resources)

Helpful Health Resources

**Medicine Lodge Ranch**

Dr. Low Dog has created a new **online classroom** called **Medicine Lodge Ranch** to expand the reach of her natural medicine school located at her ranch in the heart of New Mexico's Santa Fe National Forest.

Through our **online courses**, **digital educational tools**, and **hands-on intensive classes** at our ranch, you will have access to the resources to make yourself & your family both healthier and more whole. [Learn more.](#)

**Conference Handouts**

- Sierra Society for Dental Excellence** - Presentation handouts  
[Dietary Supplements](#)  
[The Nutrition Prescription](#)
- Delaware State Dental Society** - Presentation handout  
[Life Is Your Best Medicine](#)
- American Dental Association** - Presentation handouts  
[Emotional Well Being](#)  
[Integrative Medicine](#)

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"THE FOOD YOU EAT  
CAN BE EITHER  
THE SAFEST  
&  
MOST POWERFUL  
FORM OF MEDICINE  
*or*  
THE SLOWEST  
FORM OF POISON."

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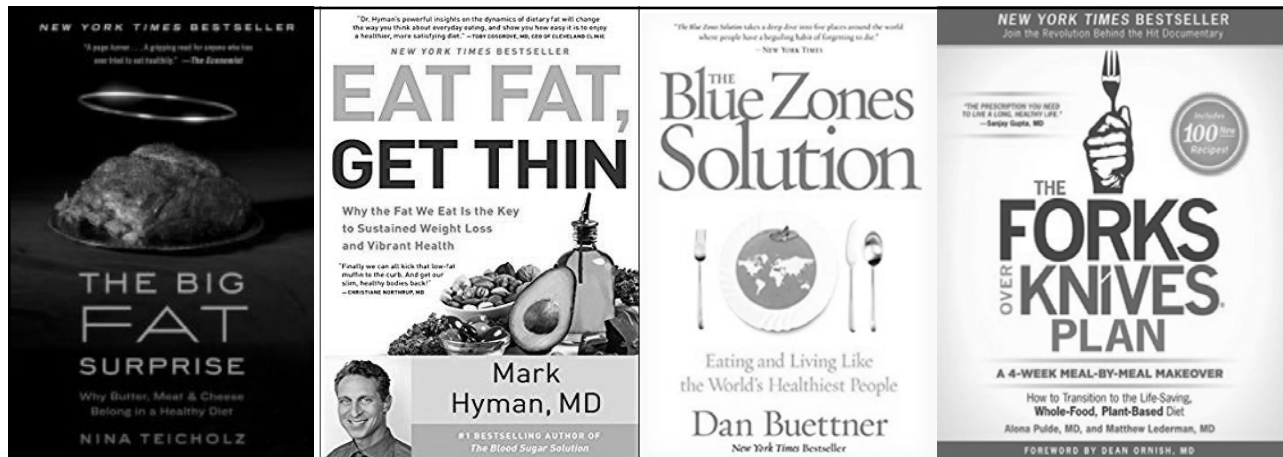
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## Nutrition in the 21<sup>st</sup> Century



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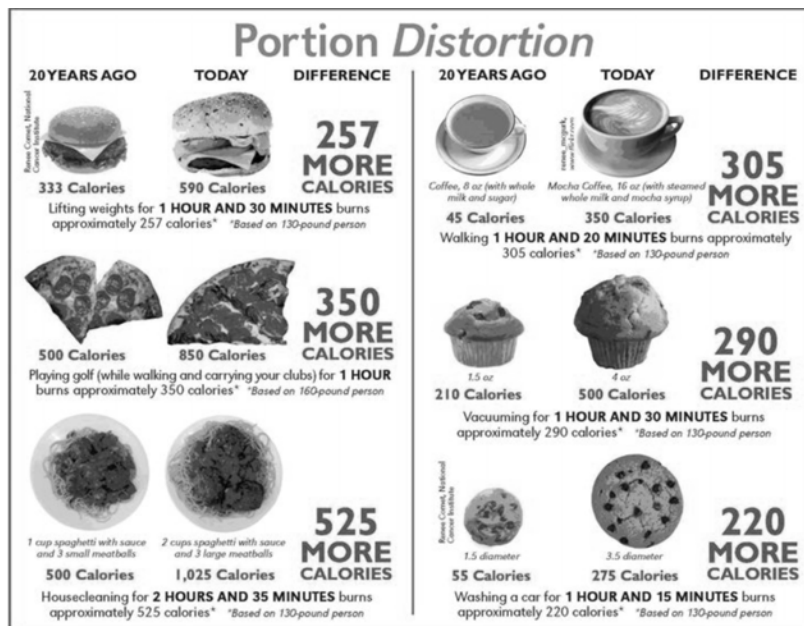
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Is it any wonder that people are confused?

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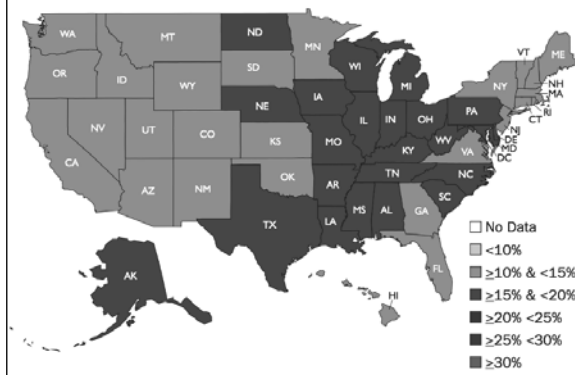


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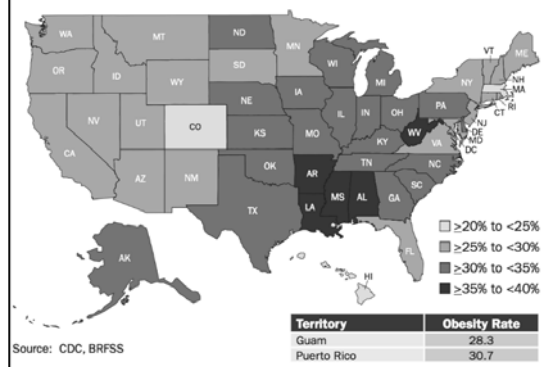
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# The Changing Landscape of Adult Weight

1993-1995 Combined Data



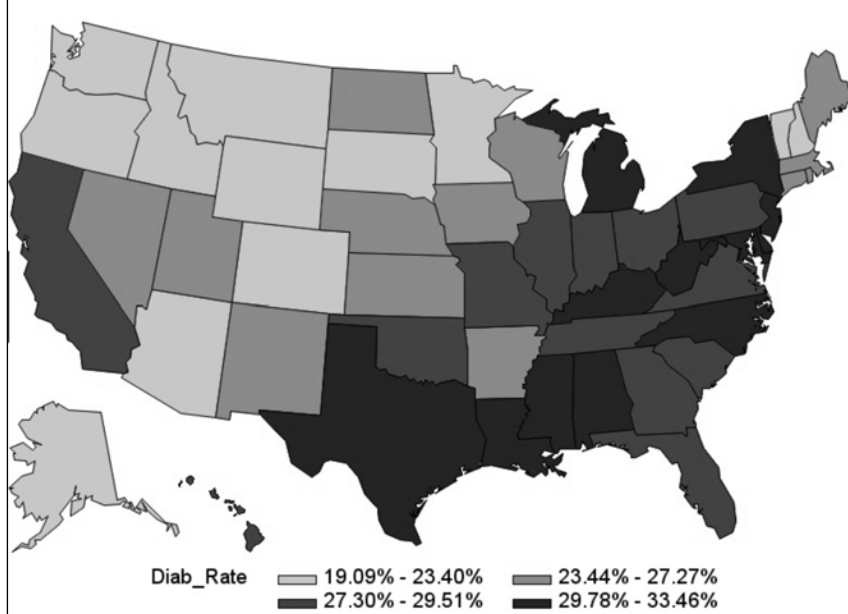
2016 Adult Obesity Rates



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Diabetes Period Prevalence, 2015



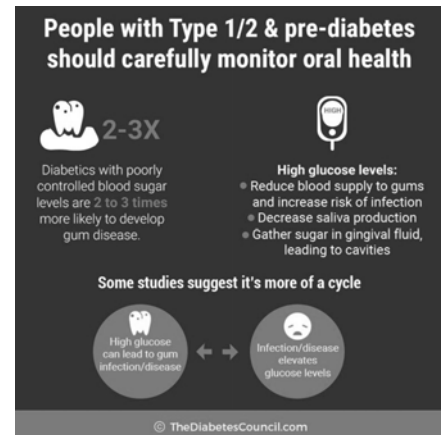
<https://www.ccwdata.org/web/guest/medicare-charts/medicare-chronic-condition-charts>

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## Diabetes Matters to Us All

- “There is strong evidence that **people with periodontitis have elevated risk for dysglycemia and insulin resistance.**”
- **Periodontitis** is also associated with an **increased risk** of type 2 diabetes.”
- “The European Federation of Periodontology and the International Diabetes Federation report consensus guidelines for **physicians, oral healthcare professionals and patients to improve early diagnosis, prevention and co-management of diabetes and periodontitis.**”



Sanz M, et al. Scientific evidence on the links between periodontal diseases and diabetes: Consensus report and guidelines of the joint workshop on periodontal diseases and diabetes by the International Diabetes Federation and the European Federation of Periodontology. *J Clin Periodontol* 2017 Aug 24. doi: 10.1111/jcpe.12808.

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## Periodontal Disease and Dental Caries



Chapple IL, et al. Interaction of lifestyle, behaviour or systemic diseases with dental caries and periodontal diseases: consensus report of group 2 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *J Clin Periodontol* 2017 Mar;44 Suppl 18:S39-S51.

- Fermentable carbohydrates/sugars/ starches **most relevant common dietary risk factor for periodontal diseases and dental caries.**
- In caries, fermentation process leads to acid production and the generation of biofilm components (e.g., glucans).
- In periodontitis, glycemia drives oxidative stress and advanced glycation end-products trigger hyper inflammatory state.
- Micronutrient deficiencies, such as vitamins C, D and B12, may be related to the onset and progression of both periodontal diseases and caries.

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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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## Fasting-Mimicking Diets (FMD)?

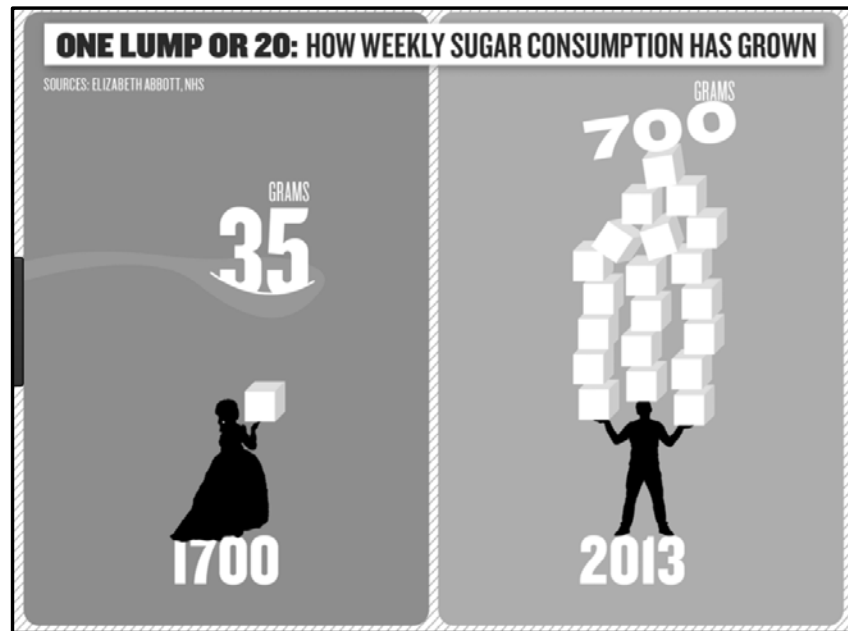


Wei M, et al. Fasting-mimicking diet and markers/risk factors for aging, diabetes, cancer, and cardiovascular disease. *Sci Transl Med* 2017; 9(377).

- 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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November 2016

## Sugar Industry and Coronary Heart Disease Research

### A Historical Analysis of Internal Industry Documents

Cristin E. Kearns, DDS, MBA<sup>1,2</sup>; Laura A. Schmidt, PhD, MSW, MPH<sup>1,3,4</sup>; Stanton A. Glantz, PhD<sup>1,5,6,7,8</sup>

► Author Affiliations

*JAMA Intern Med.* 2016;176(11):1680-1685. doi:10.1001/jamainternmed.2016.5394

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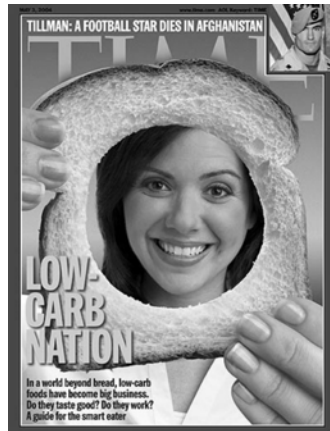
#### Abstract

Early warning signals of the coronary heart disease (CHD) risk of sugar (sucrose) emerged in the 1950s. We examined Sugar Research Foundation (SRF) internal documents, historical reports, and statements relevant to early debates about the dietary causes of CHD and assembled findings chronologically into a narrative case study. The SRF sponsored its first CHD research project in 1965, a literature review published in the *New England Journal of Medicine*, which singled out fat and cholesterol as the dietary causes of CHD and downplayed evidence that sucrose consumption was also a risk factor. The SRF set the review's objective, contributed articles for inclusion, and received drafts. The SRF's funding and role was not disclosed. Together with other recent analyses of sugar industry documents, our findings suggest the industry sponsored a research program in the 1960s and 1970s that successfully cast doubt about the hazards of sucrose while promoting fat as the dietary culprit in CHD. Policy-

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- One of the most popular dietary trends in US is the “low carb” diet.
- Perhaps instead of focusing on LOW CARB, we could emphasize **LOW GLYCEMIC LOAD CARBS**.



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## Glycemic Index/Load

- International consensus conference concluded that diets low in GI and GL were relevant to the **prevention and management of diabetes and coronary heart disease**, and are **particularly important in individuals with insulin resistance**.
- “Given the high prevalence of diabetes and pre-diabetes worldwide and **the consistency of the scientific evidence reviewed**, the expert panel confirmed an urgent need to communicate information on GI and GL to the general public and health professionals, through channels such as national dietary guidelines, food composition tables and food labels.”

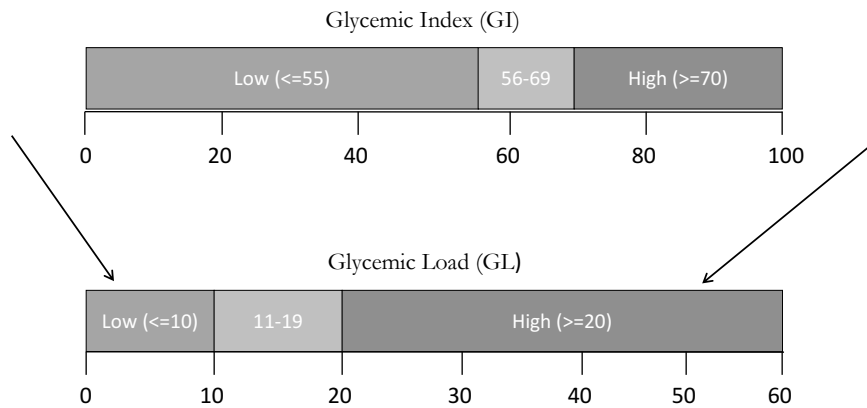
Augustin LS, et al. Glycemic index, glycemic load and glycemic response: An International Scientific Consensus Summit from the International Carbohydrate Quality Consortium (ICQC). *Nutr Metab Cardiovasc Dis* 2015 Sep;25(9):795-815.

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## Glycemic Index & Glycemic Load Rating Chart



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## Which One Would You Choose?

### Banana

Glycemic Index = 52

Available Carbs = 24 grams

Glycemic Load = 14

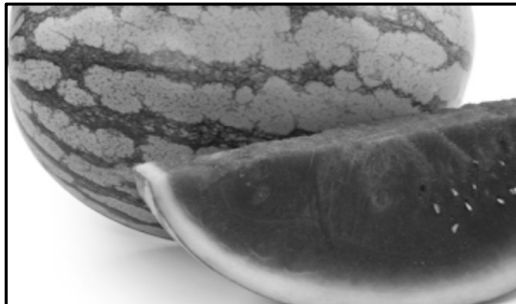


### Watermelon

Glycemic Index = 72

Available Carbs = 10 grams

Glycemic Load = 8

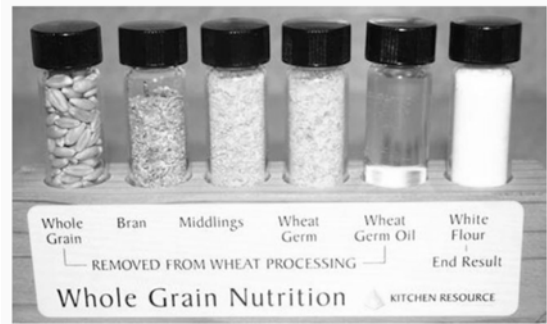


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## What Impacts Glycemic Load of Foods

- Amount of **processing** (increases surface area, increases GL)
- **Fiber** content (decreases GL)
- **Fat** content and **protein** slow stomach emptying (decreases GL)
- Many “**fat-free**” foods are **high GL** and contribute to obesity



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## Tips on Whole Grains

- **100% Whole Wheat** (first ingredient!)
- **Oats** (skip the instant)
- **Brown Rice** (white has bran/germ removed, LOW in nutrients)
- **Whole Rye** (four times the fiber of whole wheat, most nutritious)
- **Whole Grain Barley** (not pearled: bran and germ have been removed)
- **Buckwheat** (loaded in magnesium, gluten-free)
- **Quinoa** (not a grain, it's a seed loaded in protein and omega 3)
- **Whole Wheat Couscous** (delicious and high in fiber)
- **Corn** (organic, non-GMO – increases healthy gut flora)

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## Health Benefits of Low Glycemic Load Diet

- Numerous studies in both adults and teens have found that low glycemic load diets are associated with:
  - Better **weight control**
  - **Improvement** in **blood sugar**
  - **Reduction** in **triglycerides**
  - Improved ovulation in **obese women with infertility**
  - **Lower risk of heart disease**, particularly in women

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## Glycemic Load and Mood

- 82 healthy weight and healthy overweight or obese, adults enrolled in randomized, crossover controlled feeding study.
- Compared to a low GL diet, consumption of **high GL diet** resulted in:
  - 38% higher score for **depressive symptoms** ( $P = 0.002$ )
  - 55% higher score for **total mood disorder** ( $P = 0.05$ )
  - 26% higher score for **fatigue/inertia** ( $P = 0.04$ ), compared to low GL diet.



Breymeyer KL, et al. *Appetite* 2016; Dec 1;107:253-259.

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Food	Serving Size	Glycemic Load
Grapefruit	½ large	3
Apple	1 medium	6
Banana	1 large	14
Raisins	1 small box	20
Watermelon	1 cup	8
Carrots	1 large	5
Orange	1 medium	6
Sweet potato	1 cup	17
Baked potato	1 medium	28
French fries	1 medium serving	26
Snickers	1 bar	35
Reese's cup	1 miniature	2
White table wine	5 ounces	1
Red table wine	5 ounces	1
Grape juice	6 ounces	12

Food	Serving Size	Glycemic Load
Asparagus	½ cup	2
Broccoli	1 cup	4
Green beans	1 cup	3
Tomato	1 medium	2
Subway sandwich Turkey breast	6 inch	17
Butter pecan ice cream	5.5 ounces (small)	22
Vanilla ice cream cone	4.5 ounces (small)	19
Potato chips, fat free	1 bag (8 ounces)	49
Tortilla chips, white corn	3.5 ounces	38
Eggo oat waffles	1 serving	13
Maple syrup	4 Tbsp	39
Egg, hard boiled	1	2
Apple juice	8 ounce	6

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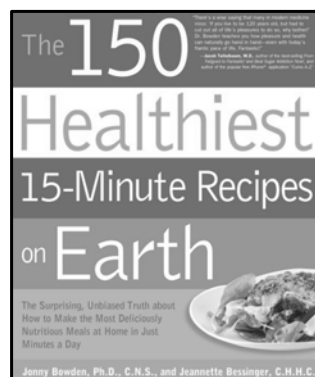
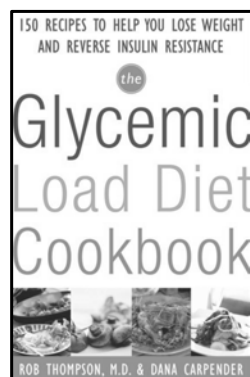
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Food	Serving Size	Glycemic Load
Spaghetti	1 cup	38
Brown rice	1 cup	23
White rice	1 cup	33
White bread	1 slice	10
Whole grain bread	1 slice	5
Bagel, cinnamon raisin	1 3.5 inch	24
Pumpernickel bread	1 slice	6
Macaroni and cheese	1 cup prepared	31
Chocolate doughnut	1 doughnut (80 g)	25
Glazed doughnut	1 doughnut (80 g)	12
Kellogg's Frosted Flakes	$\frac{3}{4}$ cup	20
Kellogg's Special K	1 cup	14
Post Bran Flakes	$\frac{3}{4}$ cup	12
Post Raisin Bran	1 cup	25

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## Some Resources



App \$3.99



Low GI Diet Tracker



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## Gluten

- Autoimmune condition **celiac disease**, where immune system interacts negatively with **gluten**, a storage protein in cereal grains. **ONLY** treatment is complete avoidance of gluten. Note: *In children, celiac disease is associated with both enamel defects and aphthous stomatitis.\**
  - Celiac symptom checklist: ([celiac.org/celiac-disease/resources/checklist/](http://celiac.org/celiac-disease/resources/checklist/))
- Other individuals may be **allergic to wheat**, not all grains. Symptoms can include GI (indigestion, cramps, diarrhea, nausea), respiratory (stuffy/runny nose) and/or skin (hives or rash). Necessary to **AVOID** wheat.
- And still others appear to have a **gluten sensitivity**, where “symptoms” improve when they eliminate gluten from their diet. This is less clear.....

\*Nieri M, et al. Enamel defects and aphthous stomatitis in celiac and healthy subjects: Systematic review and meta-analysis of controlled studies. *J Dent* 2017; Oct;65:1-10.

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[www.celiac.org](http://www.celiac.org)

Lots of info. Recipes provided for 7 day meal plan.

Get an app!

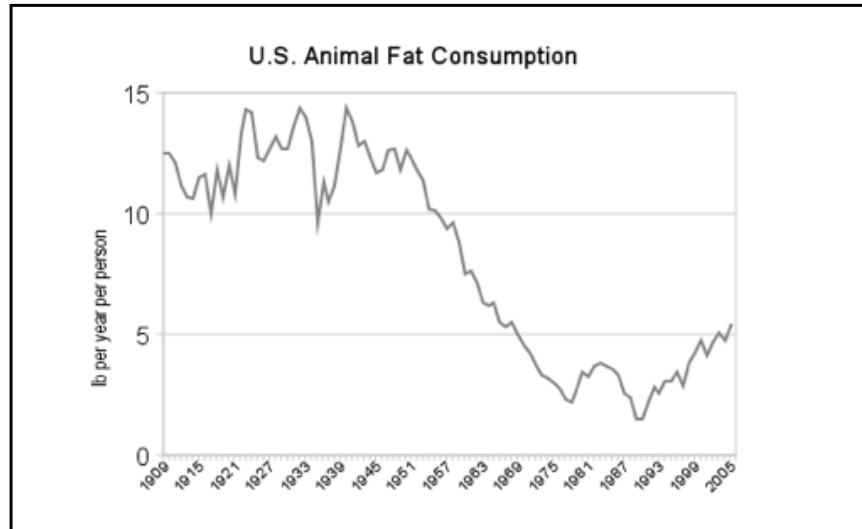
**The Gluten-Free Scanner** (free, more than 500,000 products)



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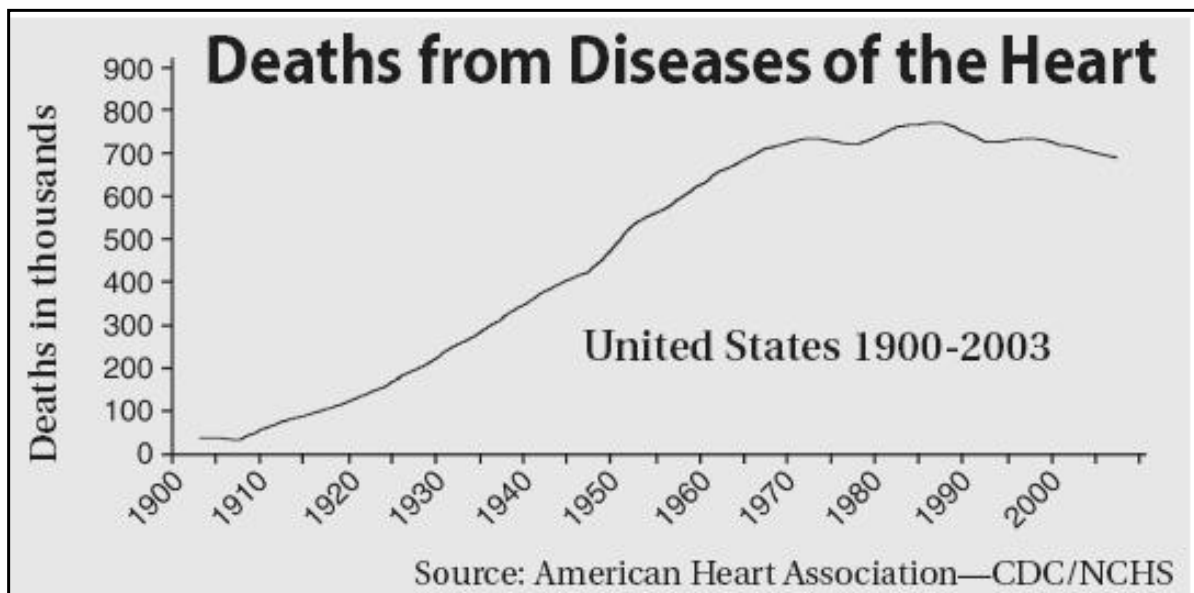
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## Does Eating Fat Give You Heart Disease?



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**SATURATED FAT**

- Meat, dairy products, eggs
- Coconut and palm oil
- Solid at room temperature
- Increases LDL and HDL

**UNSATURATED FAT**

- Vegetable oils
- Liquid at room temperature
- Increases HDL, lowers LDL
- Includes monounsaturated
  - Olive oil, avocados, peanuts, almonds
- Polyunsaturated
  - Omega 3
    - EPA/DHA: fish/shellfish
    - ALA: flax, walnut, soy, canola
  - Omega 6
    - Corn oil, safflower oil, sunflower oil

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## Saturated Fat Debate

- Three large meta analyses (21 studies, 12 studies, and 76 studies) have all failed to show any significant evidence that saturated fat increases the risk for heart disease.
- It also has failed to find any significant evidence that increasing polyunsaturated fats and decreasing saturated fats lowers your heart risk.
- Include a variety of fats in your diet!



Siri-Tarino, *Amer J Clin Nutr* 2010; 91 (3): 535–46.  
Schwingshackl L, et al. *BMJ Open* 2014; 4(4):e004487.  
Chowdhury R, et al. *Ann Intern Med* 2014; 160(6):398–406.

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- Ethical and humane treatment of farm animals is an important consideration. Many reasons to support organic and grass fed/finished animals.
- Grass fed higher in conjugated linoleic acid, stearic acid, vitamins A and E.
- *Organic* pastured dairy and meats are up to ~50% higher in omega 3 fatty acids and were only given organic feed and no growth hormones or antibiotics.

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## Red Meat and Cancer

- **Poultry/turkey and fish** neutral or beneficial effects regarding cancer/health.
- The American Institute for **Cancer** Research has made the following recommendations regarding red meats (**beef, lamb, pork**) based upon the data that links them to an increased risk of colon cancer:
  - **Limit red meats to < 18 ounces** per week.
  - **Avoid processed** red meats (e.g., bologna, salami, hot dogs, corned beef)

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## Fish and Seafood

- Fish and seafood are excellent sources of omega 3's
  - Beneficial for helping to prevent atherosclerosis and maintaining healthy blood pressure and blood flow.
  - Promote brain health and may help reduce the risk of depression.
  - Necessary for the health of the eyes. Can help reduce dry eye syndrome.
  - Crucial for health pregnancy and childhood development.
  - Help quell inflammation, which has been linked to many chronic disorders.



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## Choose Your Seafood Wisely

### The Seafood Watch App

Available for iOS and Android

It's easier than ever to get the latest recommendations for seafood and sushi, learn more about the seafood you eat, and locate or share businesses that serve sustainable seafood.

[View our App FAQs](#)

**Features**

- Get free, up-to-date seafood recommendations
- Search for seafood quickly and easily by common market name
- Search for sushi by Japanese name as well as common market name
- Find restaurants and stores near you that serve ocean-friendly seafood
- Access in-depth conservation notes and reports

 A black smartphone displays the Seafood Watch app. The screen shows the Monterey Bay Aquarium logo, the app title 'Seafood WATCH', and the subtitle 'YOUR GUIDE TO SUSTAINABLE SEAFOOD'. Below this is a search bar with the text 'SEARCH FOR SEAFOOD OR SUSHI' and two buttons: 'SEAFOOD A-Z' and 'FIND SEAFOOD NEAR YOU'.

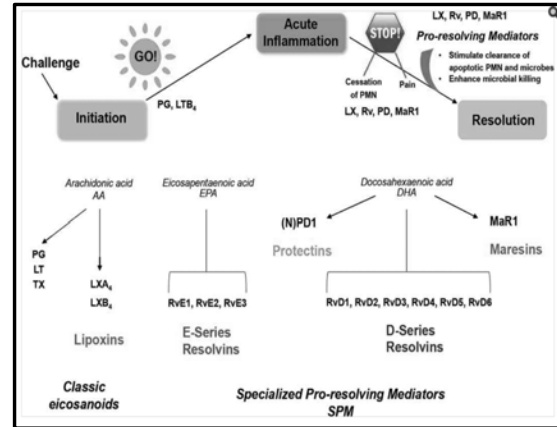
<https://www.seafoodwatch.org/seafood-recommendations/our-app>

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## Resolution Biology

- Research shows that resolution of self-limited acute inflammation is an active, programmed response.
- **Omega 3 fatty acids** produce specialized **pro-resolving mediators** (SPM) – resolvins, protectins and maresins.
- These active resolvers of inflammation, show great promise as therapeutics for the treatment of periodontitis and other inflammatory diseases.



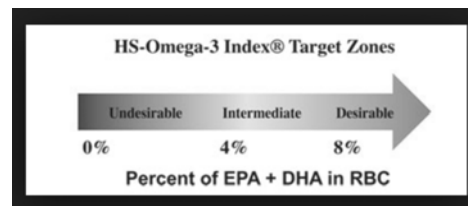
VanDyke TE. Pro-resolving mediators in the regulation of periodontal disease. *Mol Aspects Med* 2017 Dec;58:21-36.

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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.”



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## Canadians and Omega 3: Not So Good

- The Omega-3 Index indicates the percentage of EPA+DHA in red blood cell fatty acids.
- Canadian government found that the mean Omega-3 Index level of Canadians aged 20-79 was 4.5%.
  - Levels higher for women, older adults, Asians and other non-white Canadians, omega-3 supplement users, and fish consumers; levels lower for smokers and people who were obese.
- Fewer than 3% of adults had levels associated with low CHD risk; 43% had levels associated with high risk.

Langlois K, et al. *Health Rep* 2015; Nov 18;26(11):3-11

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## 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.

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## 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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## Omega 3 and Asthma: Impressive

- Reduced intake of omega-3 fatty acids may be a contributing factor to the increasing prevalence of wheezing disorders.
- Reviewers found that supplementation with omega-3 fatty acids in the third trimester of pregnancy ***reduced the absolute risk of persistent wheeze or asthma and infections of the lower respiratory tract in offspring by approximately 33%.***



Bisgaard H, et al. N Engl J Med 2016; Dec 29;375(26):2530-9

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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)
  - Ethyl ester (EE)
  - Phospholipid krill oil (PL)
  - Triglyceride salmon oil (TG)

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

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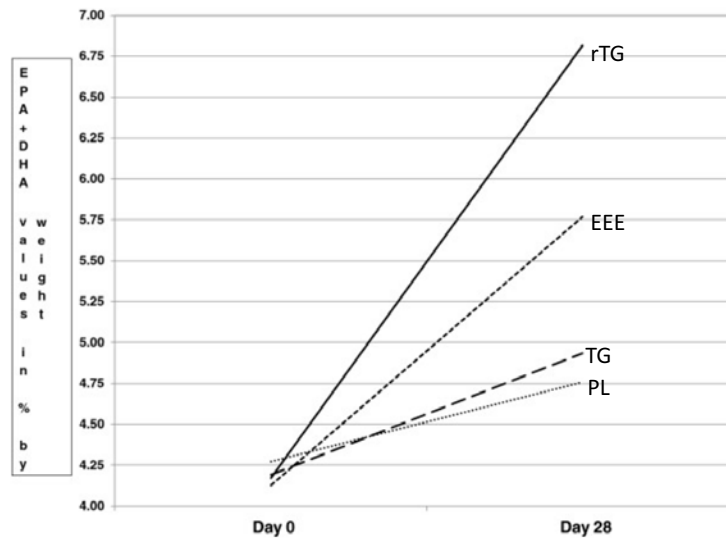
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## Dosing According to Manufacturer's Recommendations

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				
	Wholemega® 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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Mean levels of EPA + DHA for four supplement groups at Day 0 and Day 28.

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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.**”

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

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## Coconut Oil (*Cocos nucifera*)

- Extensively used in tropics/subtropics. Rich in medium chain saturated fatty acids (e.g., lauric acid), MAY be less likely stored as adipose tissue and less likely to promote insulin resistance and inflammation.
- Possesses antibacterial and antifungal activity (great for topical use). Study of 60 patients found oil-pulling (10 minutes, 2 tsp) equivalent to chlorhexidine in reducing *S. mutans*.
- **If using refined coconut oil use ORGANIC only:** no chemical solvents. Smoke point: 450 F.
- **"Virgin" coconut oil** obtained from fresh mature kernel of coconut by mechanical or natural means with or without the application of heat.



McCarty MF, et al. *Open Heart* 2016; 3(2):e000467.

Eyres L, et al, *Nut Rev* 2016; 74(4):267-80

Kaushik M, et al. *J Contemp Dent Pract* 2016;17(1):38-41.

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## Olive Oil

- Cornerstone of Mediterranean diet.
- Rich in **monounsaturated fat oleic acid (73%)**, antioxidants, and modest levels of vitamin E and K.
- **Oleocanthal mimics ibuprofen** in reducing inflammation.
- Protects against **heart disease and stroke; lowers total cholesterol, LDL-C, triglycerides; improves HDL, has a mild blood pressure lowering effect.**
- May offer protection against **Alzheimer's disease, diabetes and cancer** as part of a healthy diet.
- Keep **refrigerated** for optimal shelf life.
- To find top olive oils that meet rigorous quality and taste standards: [www.bestoliveoils.com](http://www.bestoliveoils.com)



Hemaez A, et al. *Arterioscler Thromb Vasc Biol* 2014; 34(9):2115-9.

Crous-Bou M, et al. *BMJ* 2014;349:g6674

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## Full or Low Fat Dairy?

- Full fat dairy products may help protect against type 2 diabetes. Fat slows absorption of milk sugar, causing slower rise in blood sugar, and lower/slower release of insulin. No evidence full fat dairy increases risk of heart disease.
- Full fat dairy **recommended** for **women trying to get pregnant** as it reduces anovulatory infertility.
- Full fat dairy improves **acne**, low fat dairy aggravates it.
- Full fat dairy **lower in lactose**, better tolerated by lactose intolerant individuals.



Chavarro JE, et al. *Hum Reprod* 2007; 22(5):1340-7.  
Alexander DD, et al. *Br J Nutr* 2016; 115(4):737-50

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## Dairy Products



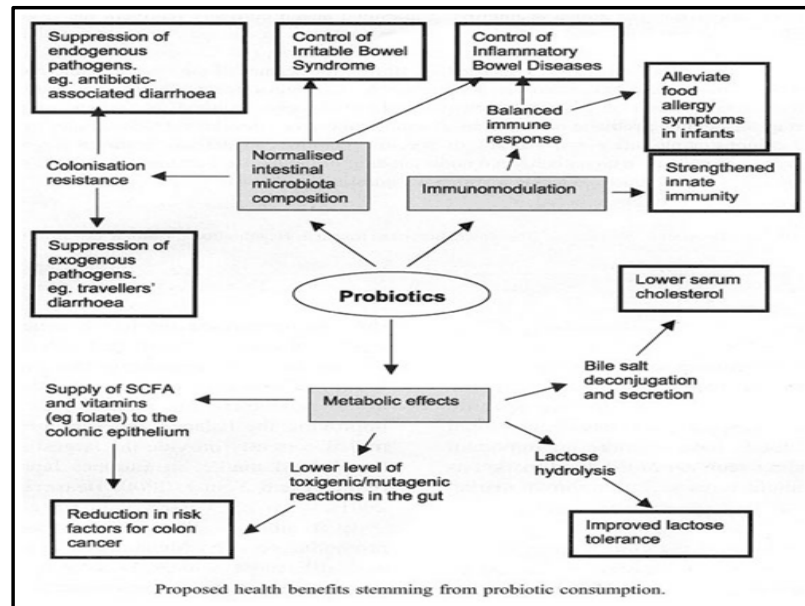
- Lactase produced by intestinal cells allows lactose to be digested/absorbed. Enzyme activity is highest after birth.
- 30% of global population produces enough lactase to digest/absorb lactose in adulthood; in majority declines to 5-10% of what was produced in childhood.
- When more lactose is consumed than can be digested, bloating, gas and diarrhea occur.
- Consumption of dairy products may protect against periodontal disease in both children and adults.
- Very good source of protein (~8 grams per cup of milk, 6 ounces of yogurt, 1.5 ounces cheese)

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- Fermented foods (kimchi, pickles, sauerkraut, kombucha, miso, tempeh, yogurt, kefir) are all rich in probiotics.
- Supplementation may be useful in certain health conditions: increase response to vaccinations in elders, when taking antibiotics, during pregnancy, as an adjunctive treatment in clinical management of dental caries and periodontal diseases.
- Strain specificity is vitally important.

Allaker RP, et al. Use of Probiotics and Oral Health. *Curr Oral Health Rep* 2017; 4(4): 309–318.



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## Evidence Based Products for Oral Health

INDICATION FOR ADULT HEALTH																
Brand Name	Probiotic Strain	Dosage Form	CFU/Dose	No of Doses/Day	ID	AAD	CDAD	TD	C	FAP	IBS	IBD-UC	IBD-P	HP	OH	LDL-C
Dentaq™ Oral and ENT Health Probiotic Complex	<i>S. salivarius</i> BAA-1024 <i>L. plantarum</i> SD-5870 <i>L. reuteri</i> SD-5865 <i>L. acidophilus</i> SD-5212 <i>L. salivarius</i> SD-5208 <i>L. paracasei</i> SD-5275	Lozenge	1B/lozenge	2 lozenges											II 40-44	
Gum® PerioBalance®	<i>L. reuteri</i> ATCC 55730 100M <i>L. reuteri</i> ATCC PTA 5289 100M	Lozenge	200M/lozenge	2 lozenges											II 52,53	
OralBiotics™ [BLIS K12]	<i>Streptococcus salivarius</i> K12	Lozenge	1B/lozenge	1-5 lozenges											II 50,51	

® - Product requires refrigeration

usprobioticguide.com

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## What About Eggs?

- Provide essential fatty acids, proteins, *choline*, vitamins A and B12; selenium, and other critical nutrients.
- Egg consumption (dietary cholesterol) not associated with an increased risk of heart disease in the general population.
- Look for organic eggs and omega 3 enriched whenever possible.
- One egg provides ~ 6grams protein



Shin JY, et al. *Am J Clin Nutr* 2013; 98(1):146-59

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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 the first three years of a child's life, where animal models show it improves cognitive function in adulthood, prevents age-related memory decline, and protects the brain from the neuropathological changes associated with Alzheimer's disease (AD), and neurological damage associated with epilepsy, fetal alcohol syndrome, and Down's syndrome.
- New daily value set in 2016: **550 mg per day**

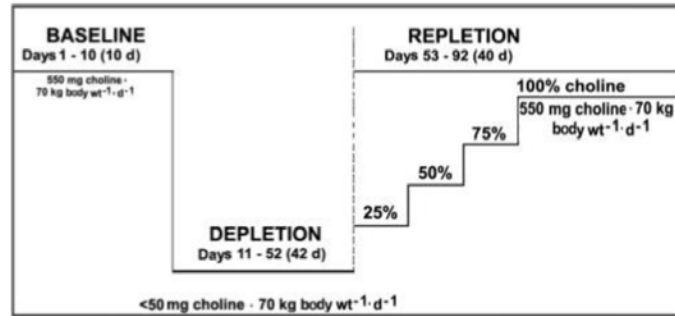
Jiang X, et al. *Trends Endocrinol Metab* 2014; 25(5):263-73.

Jiang X, et al. *FASEB J.* 2012;26(8):3563-3574.

Wozniak JR, et al. *Nutr Res* 2013; 33(11):897-904

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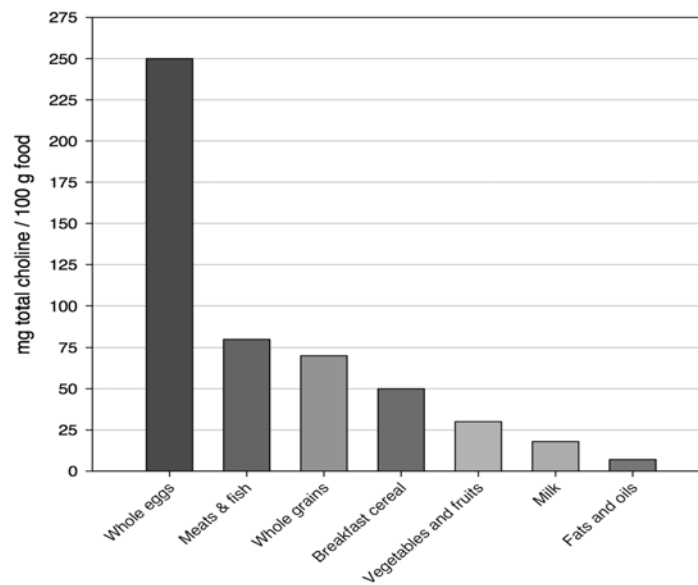
- 57 healthy adults were fed choline-deficient diets under controlled conditions.
- Results showed that 77% of men, 80% of postmenopausal women, and 44% of premenopausal women developed fatty liver, liver damage, and/or muscle damage.
- Dysfunction corrected when choline was reintroduced into diet.

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

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Choline in Foods: <http://nalcd.nal.usda.gov/download/47335/PDF>



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## Protein



- 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. You need ~8 grams protein per 20 pounds body weight for adults.
  - 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
  - Avoid processed red meats, include modest amounts of other meats

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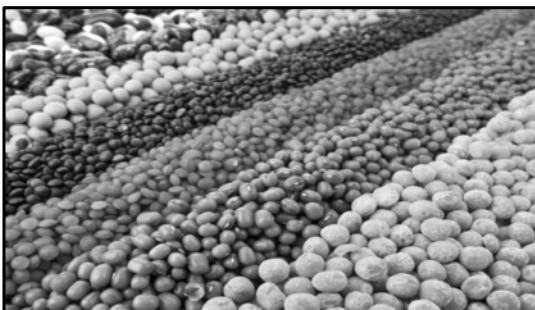
## Protein Rich Foods

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) lettuce	2
Fruit	1 fruit or 125 mL (½ cup)	1

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## Legumes: The “*Pulse* of Health”



- Soak larger dried legumes (kidney, chickpeas, black & red beans) for 4-24 hours in cold water before cooking. Change water 1-2 times to reduce gas.
- Use 3 cups water per cup of legumes in cooking.
- Use ladle to occasionally remove foam on top when cooking legumes
- Rinse canned beans before use to remove sodium
- Lentils are quick and easy to prepare - rinse till clear and remove any small stones/grit.
- Prepare large bag of lentils and then freeze half for future use.
- Add vinegar, salt, etc. at end of cooking time.

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## Soy Milk

- Highest in protein of dairy alternatives (almond milk has 1 gram protein per cup)
- Good source of B-vitamins and is least processed of most commercially available dairy alternatives.
- High in phytic acid, however, which can impair absorption of nutrients such as calcium, iron and zinc. (Fermented soy: no phytic acid: miso, tempeh)
- Very high soy intake in the presence of low iodine can impact thyroid.
- Purchase organic, non-GMO soy and look for unsweetened products to avoid high sugar.
- 1 cup soy milk ~ 8 grams protein



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## Protein and Fracture Risk



- Framingham Osteoporosis Study found **higher protein intakes** (60-83g/d versus 46g/d) in elder men and women (mean 75 years) were associated with a **37% decreased risk of hip fracture**.
- Women's Health Initiative found 20% increase in protein intake (15-18% of energy intake) improved bone mineral density maintenance and marginally lowered forearm fracture risk.
- Systematic review of **29 studies found that protein intakes above the current RDA have a beneficial role in preventing hip fractures and BMD loss**. No differences between animal or plant proteins, although data in this area were scarce.

Misra D, et al. *Osteoporosis Int* 2011; 22(1):345-349.  
Beasley JM, et al. *Am J Clin Nutr* 2014; 99(4):934-940.  
Calvez J, et al. *Eur J Clin Nutr*. 2012;66(3):281-295.  
Wallace TC, et al. *J Am Coll Nutr* 2017; 36(6):481-496

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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

- 1 in 20 were helped (vertebral fracture prevented)
- 1 in 100 were helped (hip fracture prevented)

### Harms in NNT

- A small number were harmed

### Benefits in Percentage

- 94% saw no benefit after 3 years of treatment
- 5% avoided a vertebral fracture
- 1% avoided a hip fracture

### Harms in Percentage

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

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## 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) showed **calcium plus vitamin D supplementation** produced a significant 15 % reduced risk total fractures and 30% reduced risk hip fracture.
- Vitamin D supplementation 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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## Endocrine Society Guidelines

- Serum 25(OH)D level is used to determine vitamin D status
  - **Sufficiency** is 30 ng/mL (75 nmol/L) and above
  - **Insufficiency** defined as 21-29 ng/mL
  - **Deficiency** defined as <20 ng/mL
- **66.8 million Americans** 1 year and older had vitamin D levels between **12-20 ng/ml**
- **23 million Americans** 1 year and older had serum levels **less than 12 ng/ml**
  - Most at risk were women and non-Hispanic blacks.

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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## Endocrine Society Guidelines for Treating Deficiency

- All adults who are vitamin D deficient should be treated with 50,000 IU of vitamin D2/D3 once per week for 8 weeks or 6000 IU of vitamin D2/D3 daily to achieve a blood level of 25(OH)D *above 30 ng/ml, followed by maintenance therapy of 1500–2000 IU/d.*



Holick MF, et al. *J Clin Endocrinol Metab* 2011; 96(7):1911-30

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## Vitamin D

To get 600 IU/d Vitamin D3:

- 3-4 ounces sockeye salmon, cooked
- 11.4 ounces water-packed tuna
- 26 oil-packed sardines
- 15 large eggs
- 6 cups fortified milk OR
- 30-45 ounces yogurt



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## Calcium: Deficiency and Risk

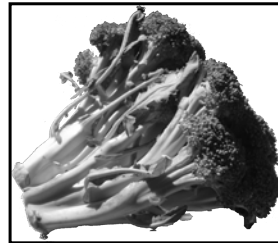
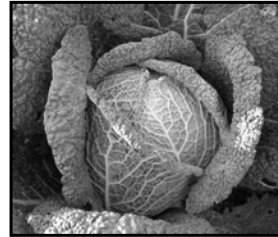
- One of first signs of calcium deficiency is **muscle aches of thighs and arms, with minimal exertion**. Long term deficiency leads to **poor bone development/loss of bone mineral density**, numbness and **tingling in the fingers**, lethargy, poor appetite, **abnormal heart rhythms** and convulsions.
  - 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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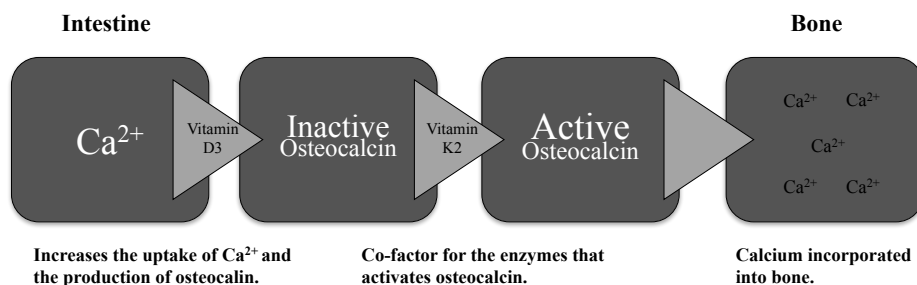
## Vitamin K

- There are two main forms of vitamin K.
  - Phylloquinone, or vitamin K1, is synthesized by plants and makes up 90% of the vitamin K obtained in the diet. Best sources are green leafy vegetables. Fat-soluble so should be eaten with some healthy fat.
  - Menaquinone, vitamin K2, is result of bacterial action in GI tract converting K1 to K2 or obtained directly from food sources such as meat, egg yolks, fermented dairy and soy (e.g., miso, natto).



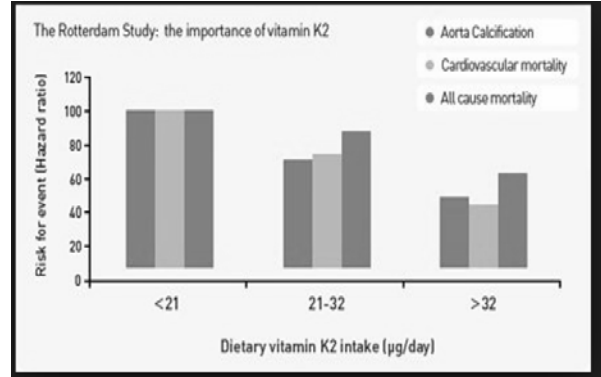
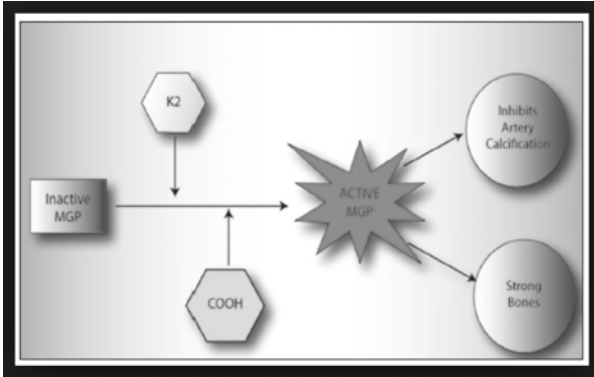
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Geleijnse JM, et al. *J Nutr.* 2004;134(11):3100-5

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## Vitamin K and Fracture

- Epidemiological studies consistently show link between higher vitamin K status and reduction of fracture risk.
- Elder men and women in highest quartile of dietary vitamin K had a relative risk for hip fracture of 0.35.
- Systematic review found that majority of vitamin K intervention studies showed a reduction in BMD loss and improved bone biomarkers.
- 3 year trial of K2 (180 mcg/d) in postmenopausal women showed preservation of BMD in the lumbar spine and slowing of the rate of bone loss in the femoral neck.

Cockayne S, et al. *Arch Intern Med.* 2006;166(12):1256-1261.

Knapen MHJ, et al. *Osteoporosis Int.* 2013;24(9):2499-2507.

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## Real State of Our Nutrition

- 90 million Americans are vitamin D deficient (using the Endocrine Society guidelines  $< 20\text{ng/mL}$ )
- 30 million are deficient in vitamin B6
- 18 million people have B12 deficiency
- ~16 million have very low serum vitamin C
- 13% of Latinas and 16% of African American women (ages 12-49) are iron deficient
- Women 25-39 overall have borderline iodine insufficiency

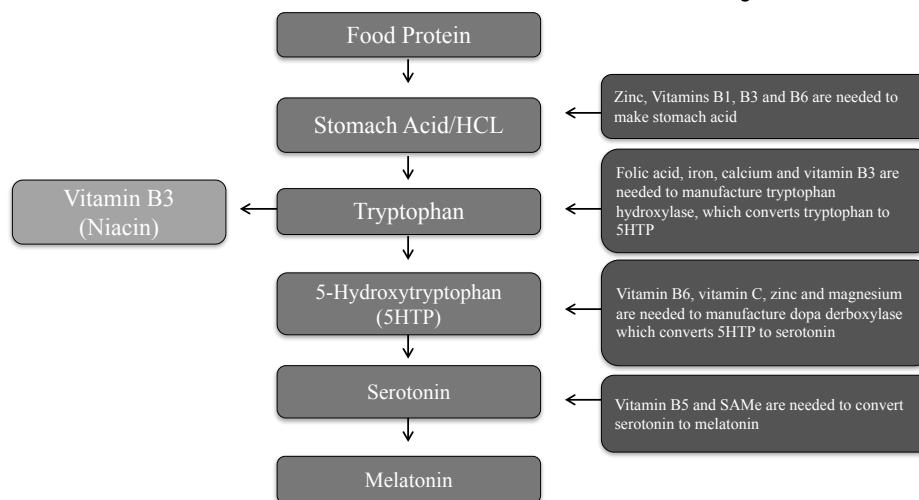


CDC: 2<sup>nd</sup> National Report on the Biochemical Indicators of Diet and Nutrition in the U.S. population

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## Serotonin and Melatonin Pathways



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## Vitamin B6 (Pyroxidal-5-Phosphate)

- Critically involved in production of serotonin, dopamine, melatonin, hemoglobin, protein metabolism, energy production, and more.
- Deficiency: depression; impaired cognition, attention, memory, and sleep. Increased risk for heart disease, stroke and colorectal cancer.
- Data from the Normative Aging Study show individuals in lowest tertile of vitamin B<sub>6</sub> concentration have significant loss in cognitive ability over five years,
- Common OTC analgesics and oral contraceptives lower B6 levels. **30 MILLION** Americans are deficient in B6.
- Serum PLP < 20 nmol/L = deficiency, PLP 20-30 nmol/L risk CVD/stroke.
- Need ~6 mg per day to maintain normal serum level.



Larsson SC, et al. *JAMA* 2010; 303(11):1077-83  
 Morris MS, et al. *Am J Clin Nutr* 2008; 87(5):1446-54  
 Ulvik A, et al. *Am J Clin Nutr* 2014; 100(1):250-5

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## To Get 1.5 mg B6 in Food

- 2.5 bananas
- 12 Tbsp. roasted sunflower seeds
- 8 ounces chicken breast
- 8 ounces sockeye salmon
- 3.5 cups raw diced avocado
- 3 cups sweet potatoes
- 15 cups of milk OR
- 20 Tbsp. peanut butter



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## Case 41-year old Female

- Strict vegan for 2.5 years. Disturbance of taste (unable to sense flavor of variety of fruits and vegetables), fatigue after simple daily activities, paresthesia of the anatomic structures innervated by the mandibular division of the trigeminal nerve on her left side, disturbance of memory and slowing mental faculty. No meds. No significant medical or dental history.

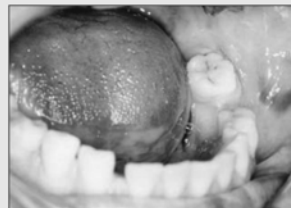
Pontes HA, et al. *J Can Dent Assoc* 2009; 75(7):533-7.

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**Figure 1a:** Papillary atrophy and erythema involving the lateral border of the tongue before treatment.



**Figure 1b:** Erythema involving the mucosa of the cheek and the anterior portion of the tongue.



**Figure 1c:** Well-circumscribed erythematous macules seen on the lateral border of the tongue.



**Figure 1d:** Erythema involving the mucosa of the right cheek.

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## Laboratory Tests

Test	Normal range (female)	Patient's values
RBC count (cells/ $\mu$ L)	3.90–5.03	1.63
Hemoglobin (g/dL)	12.0–15.5	7.2
MCV (fL)	80–100	144
Hematocrit (%)	36–45	23.4
RDW (%)	13 $\pm$ 1.5	25
Serum folate (ng/mL)	3–16	7.73
Serum cobalamin (pmol/L)	118–716	71.8

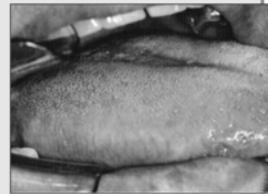
MCV = mean corpuscular volume; RBC = red blood cell; RDW = red cell distribution width.

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**Figure 2a:** Dramatic resolution of erythema and all pathologic symptoms after 1 week of treatment with parenteral doses of cobalamin and folic acid.



**Figure 2b:** Absence of papillary atrophy and erythema previously seen on the lateral border of the tongue.



**Figure 2c:** Tissue regeneration on the mucosa of the cheek appeared complete after 2 weeks of treatment.



**Figure 2d:** Complete tissue regeneration on the tongue after treatment.

Patient treated with 1000 mcg B12 IM per week for 4 weeks and 1 mg folate daily.  
Symptoms disappeared after 14 days of treatment.

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## Vitamin B12

- **Atrophic gastritis affects 10%-30% of people over 60** years of age causing malabsorption of food bound vitamin B12.
- Low vitamin B<sub>12</sub> 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 frankly** deficient in vitamin B12.
- Supplement with 20-100 mcg per day.

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

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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.



Meta analysis: 29 studies (8,089 patients) found **245% increased risk of B12 deficiency associated with metformin use.**

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

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## Vitamin C

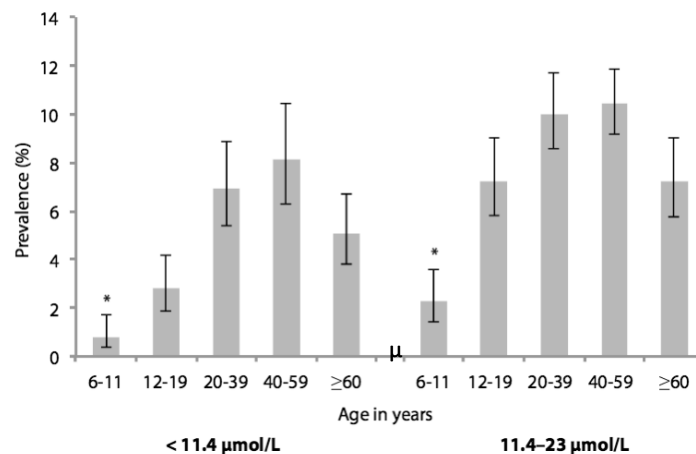
- Potent antioxidant, activates folate, needed to convert tryptophan to serotonin, cofactor in synthesis of carnitine, thyroxin, norepinephrine, dopamine and immune cells
- Vitamin C levels decline rapidly during periods of emotional and physical strain, and illness.
- Malaise and lethargy early symptoms.
- Skin changes, easy bruising, gum disease, loose teeth, slow healing wounds, dry mouth, dry eyes. emotionally labile.
- Inflammation of interdental and marginal gingiva followed by bleeding, ulceration, and bad breath.
- Swelling of periodontal membranes occur, followed by loss of bone and loosening of the teeth.



Hemila H, et al. Cochrane Database Syst  
Rev 2013; Jan 31;1:CD 000980

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**Figure H.1.f.** 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.

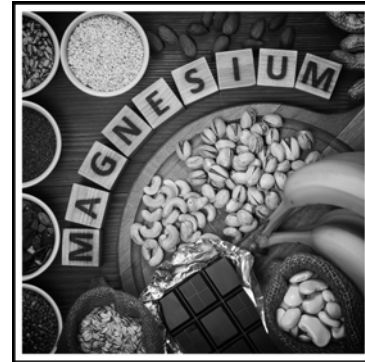
Error bars represent 95% of confidence intervals. \*Prevalence in children is significantly lower than prevalence in persons 20 years and older ( $p < 0.05$ ).

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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, osteoporosis, migraine headache, 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. **Magnesium required for the activation of vitamin D.**
- FDA requires warning that **proton pump inhibitors can cause dangerously low magnesium levels.**



Rosano A, et al. Nutr Rev 2010;70(3):153-64

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## Magnesium: Diabetes and the Heart

- Higher magnesium intake associated with **lower risk of type 2 diabetes**, especially in the setting of poor carb-quality (high GL) diets.
- Meta-analysis found that circulating Mg levels are inversely associated with incidence of **coronary heart disease, hypertension, and type 2 diabetes.**
- Magnesium supplementation **300-400 mg per day safe** – caution in those with renal failure. At this time, **do not rely on topical application** of magnesium to raise mag levels.

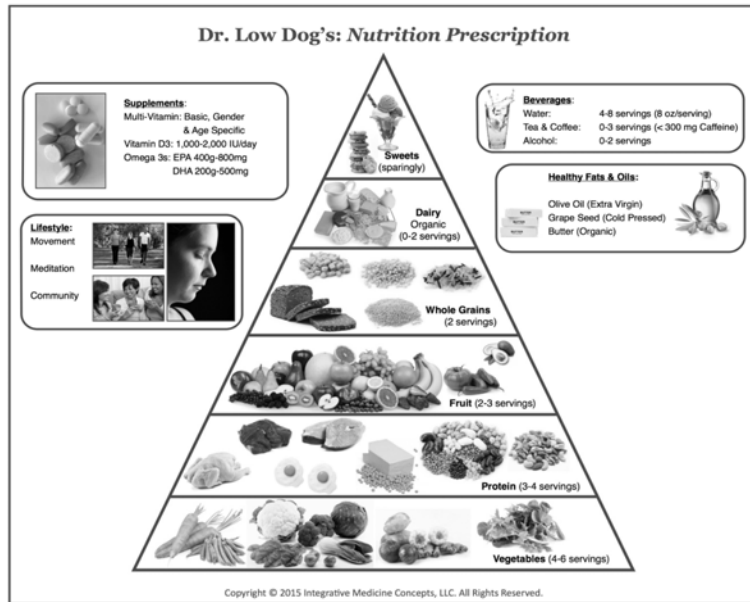
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