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NUTRITIONAL MEDICINALS, LLC
presents

**COMMON MICRONUTRIENT DEFICIENCIES
AND EFFECTIVE CORRECTIVE MEASURES**

Mark Pettus, MD, FACP, ABHM
May 31st, 2017



LEARNING OBJECTIVES

- Review the prevalence and of important nutrient deficiencies in the general population
- Review the contributing factors to the growing prevalence of important nutrient deficiencies.
- Review nutritional and supplement considerations for addressing common nutrient deficient states

ESSENTIAL MICRONUTRIENTS

- Biotin
- Folic acid
- Niacin
- Pantothenate
- Riboflavin
- Thiamine
- Vit A
- Vit B6
- Vit B12
- Vit C
- Vit D
- Vit E
- Vit K
- Calcium
- Chloride
- Chromium
- Cobalt
- Copper
- Iodide
- Iron
- Magnesium
- Manganese
- Molybdenum
- Phosphorous
- Potassium
- Selenium
- Sodium
- Zinc
- Linolenic Acid (EPA/DHA)
- Linoleic acid
- Choline
- Isoleucine
- Leucine
- Lysine
- Methionine
- Phenylalanine
- Threonine
- Tryptophan
- Valine
- Histidine

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STANDARD AMERICAN DIET (S.A.D.)

- 51% of energy obtained is from foods that are refined and processed with minimal nutrient density
- < 14% Americans consume recommended daily servings of vegetables
- < 18% Americans consume recommended daily servings of fruits



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What Americans Eat: Top 10 sources of calories in the U.S. diet

1. Grain-based desserts (cakes, cookies, donuts, pies, crisps, cobblers, and granola bars)
2. Yeast breads
3. Chicken and chicken-mixed dishes
4. Soda, energy drinks, and sports drinks
5. Pizza
6. Alcoholic beverages
7. Pasta and pasta dishes
8. Mexican mixed dishes
9. Beef and beef-mixed dishes
10. Dairy desserts

Source: Report of the 2010 Dietary Guidelines Advisory Committee

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OPTIMAL LIFESTYLE METRICS

Habit	Definition and criteria	Do you comply with it?	
		No	Yes
Smoking	Absence of regular tobacco consumption	0	1
Physical activity	Amount of moderate and vigorous physical activity (more than 10 minutes/activity) that spans more than 150 minutes per week (the amount of time dedicated to vigorous physical activity accounts for double)	0	1
Healthy diet	Daily consumption of at least 5 pieces of fruit and vegetables	0	1
Alcohol consumption	Consumption of less than 2 alcoholic beverages a day for men and 1 in the case of women	0	1

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MAKE AN EDUCATED GUESS

Of the 2 million people managed by HealthPartners, what percentage follows all four (4) conditions of the OLM?

WHAT DO YOU THINK?

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THE “OLM” UNIVERSE

Diet OLM Flag	Tobacco OLM Flag	Alcohol OLM Flag	Physical Activity OLM Flag	Number (%)
0	0	0	0	1288 (0.26%)
0	0	0	1	2363 (0.47%)
0	0	1	0	20667 (4.13%)
0	0	1	1	39918 (7.98%)
0	1	0	0	2073 (0.41%)
0	1	0	1	5783 (1.16%)
0	1	1	0	90656 (18.1%)
0	1	1	1	255344 (51.0%)
1	0	0	0	40 (0.01%)
1	0	0	1	205 (0.04%)
1	0	1	0	661 (0.13%)
1	0	1	1	4071 (0.81%)
1	1	0	0	189 (0.04%)
1	1	0	1	1386 (0.28%)
1	1	1	0	10674 (2.13%)
1	1	1	1	65026 (13.0%)

- <0.5% meet **zero** OLM component
- 5% meets **one** OLM component
- 27.5% meets **two** OLM components
- 54% meets **three** OLM components
- **13% meets four OLM components**

- 83.6% does **not** meet the diet OLM component (5 F&V daily)

N = 500,344

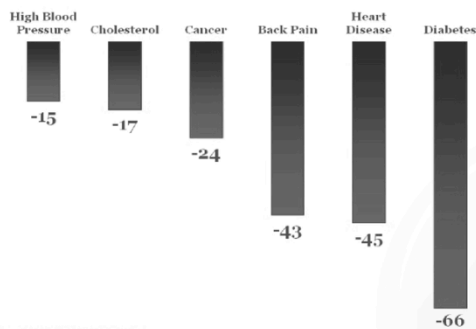
Data based on self-reported health assessment questions

Sources: Pronk, et al. Am J Prev Med 2004; 27(2S):25-33 and Pronk NP. ACSM's Health & Fitness Journal 2012;16(3):39-43.

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ADHERENCE TO OLM AND NEW DISEASE

Difference in 2-year incidence of new disease between people who adhere to OLM 0 or 1 and OLM 3 or 4 (%)



Source: Pronk NP, et al. Pop Health Manage 2010;13:289-295.

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SUSTAINABILITY

Dirt Poor: Have Fruits and Vegetables Become Less Nutritious?

Because of soil depletion, crops grown decades ago were much richer in vitamins and minerals than the varieties most of us get today



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Original Research

Changes in USDA Food Composition Data for 43 Garden Crops, 1950 to 1999

Donald R. Davis, PhD, FACN, Melvin D. Epp, PhD and Hugh D. Riordan, MD

Bio-Communications Research Institute, Wichita, Kansas (D.R.D., M.D.E., H.D.R.), Biochemical Institute, The University of Texas, Austin, Texas (D.R.D.)

Key words: Nutritive value, history, food analysis, agriculture

Objectives: To evaluate possible changes in USDA nutrient content data for 43 garden crops between 1950 and 1999 and consider their potential causes.

Methods: We compare USDA nutrient content data published in 1950 and 1999 for 13 nutrients and water in 43 garden crops, mostly vegetables. After adjusting for differences in moisture content, we calculate ratios of nutrient contents, R (1999/1950), for each food and nutrient. To evaluate the foods as a group, we calculate median and geometric mean R -values for the 13 nutrients and water. To evaluate R -values for individual foods and nutrients, with hypothetical confidence intervals, we use USDA's standard errors (SEs) of the 1999 values, from which we generate 2 estimates for the SEs of the 1950 values.

Results: As a group, the 43 foods show apparent, statistically reliable declines ($R < 1$) for 6 nutrients (protein, Ca, P, Fe, riboflavin and ascorbic acid), but no statistically reliable changes for 7 other nutrients. Declines in the medians range from 6% for protein to 38% for riboflavin. When evaluated for individual foods and nutrients, R -values are usually not distinguishable from 1 with current data. Depending on whether we use low or high estimates of the 1950 SEs, respectively 33% or 20% of the apparent R -values differ reliably from 1. Significantly, about 28% of these R -values exceed 1.

Conclusions: We suggest that any real declines are generally most easily explained by changes in cultivated varieties between 1950 and 1999, in which there may be trade-offs between yield and nutrient content.

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Changes in Food Composition

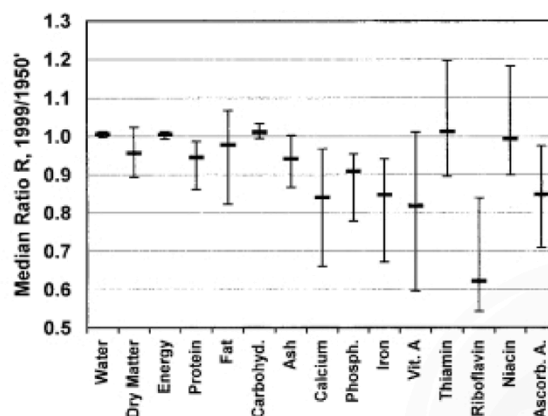



Fig. 2. Median ratios R with 95% confidence intervals for 42 to 43 foods (28 for vitamin A). R-values for ascorbic acid are slight overestimates (see discussion of group changes).

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- **Recommended Dietary Allowance (RDA)**: the average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a group.
- **Adequate Intake (AI)**: a value based on observed or experimentally determined approximations of nutrient intake by a group (or groups) of healthy people—used when an RDA cannot be determined.
- **Tolerable Upper Intake Level (UL)**: the highest level of daily nutrient intake that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the risk of adverse effects increases.
- **Estimated Average Requirement (EAR)**: a nutrient intake value that is estimated to meet the requirement of half the healthy individuals in a group.

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Proceedings of the National Academy of Sciences of the United States of America

Performing your original search, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1693790/>, in PMC will retrieve **284896** records.

Proc Natl Acad Sci U S A. 2006 November 21; 103(47): 17589–17594.
 Published online 2006 November 13. doi: [10.1073/pnas.0608757103](https://doi.org/10.1073/pnas.0608757103)

PMCID: PMC1693790

Low micronutrient intake may accelerate the degenerative diseases of aging through allocation of scarce micronutrients by triage

Bruce N. Ames*

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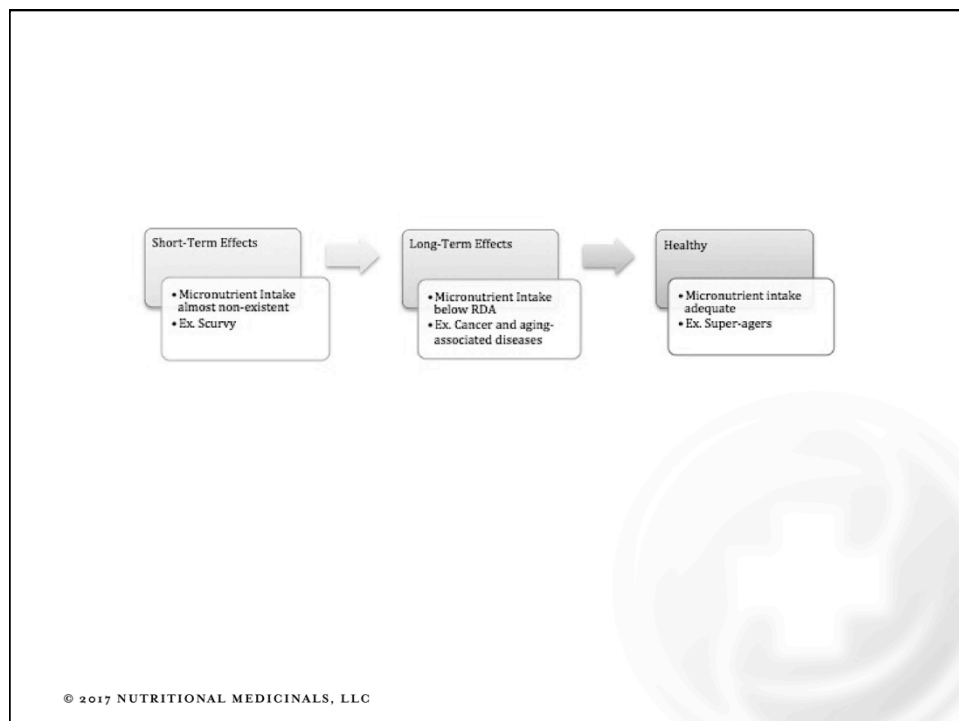
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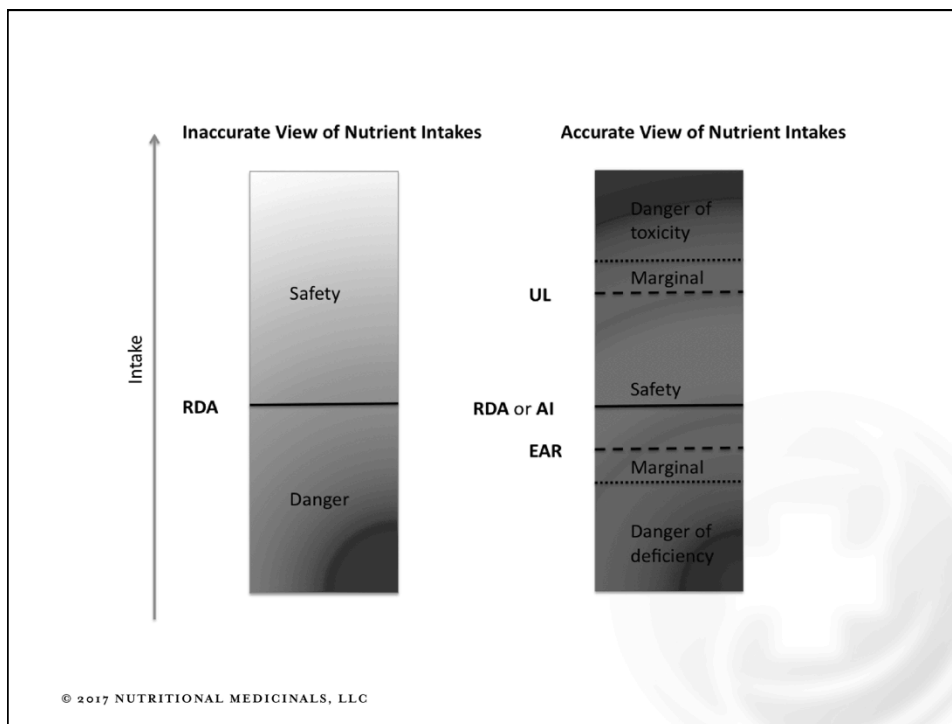
ABSTRACT

Inadequate dietary intakes of vitamins and minerals are widespread, most likely due to excessive consumption of energy-rich, micronutrient-poor, refined food. Inadequate intakes may result in chronic metabolic disruption, including mitochondrial decay. Deficiencies in many micronutrients cause DNA damage, such as chromosome breaks, in cultured human cells or *in vivo*. Some of these deficiencies also cause mitochondrial decay with oxidant leakage and cellular aging and are associated with late onset diseases such as cancer. I propose DNA damage and late onset disease are consequences of a triage

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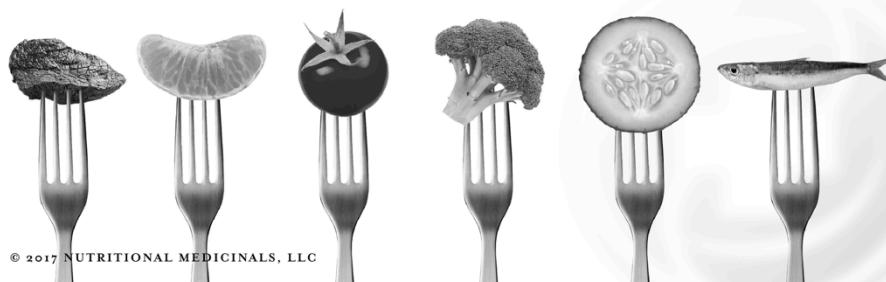
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WE NEED A BROAD SPECTRUM OF MICRONUTRIENTS FOR OPTIMAL FUNCTION

- Biochemical individualization
- Compress morbidity
- Goal to assist optimal biologic function e.g. identify "relative deficiencies".
- Our needs change over time...a very dynamic metabolic landscape
- Moving beyond vitamins and minerals e.g. sufficient fermentable fiber and phytonutrients



J Am Coll Nutr. 2015;34(2):126-34. doi: 10.1080/07315724.2014.901196. Epub 2015 Jan 7.

Comparison of prevalence of inadequate nutrient intake based on body weight status of adults in the United States: an analysis of NHANES 2001-2008.

Agarwal S¹, Reider C, Brooks JR, Fulgoni VL 3rd.

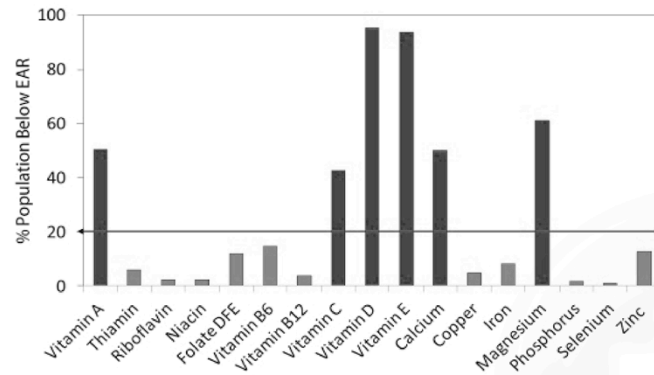


Figure 1: Percentage of the adult population (aged 19 years) with vitamin and mineral intakes below the EAR for individuals (data from NHANES 2001-2008). Usual intakes from foods were estimated by using the National Cancer Institute (NCI) method (Agarwal, 2014).

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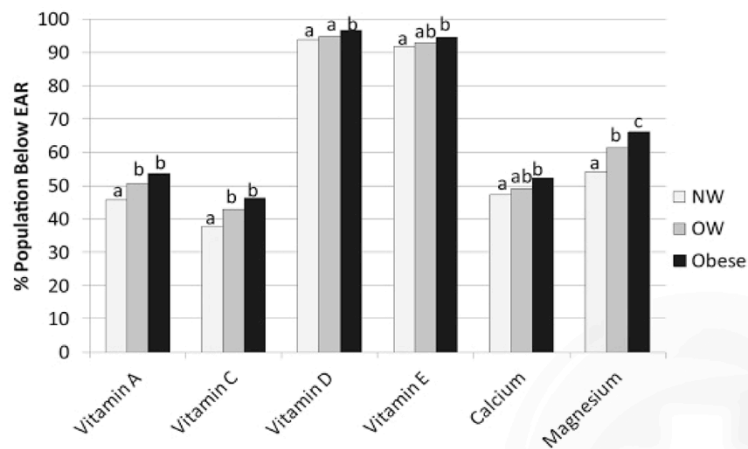


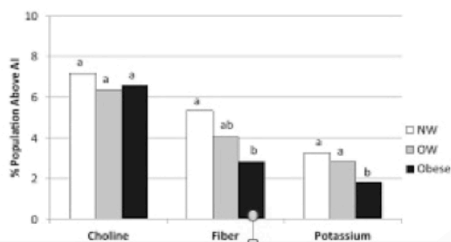
Figure 2: Percentage of the adult population (aged 19 years) by body weight status with vitamin and mineral intakes below the EAR for individuals (data from NHANES 2001-2008). Usual intakes from foods were estimated by using the National Cancer Institute method. a,b,c Bars with different letters are significantly different at $p < 0.05$ (Agarwal, 2014).

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No RDA for choline, fiber and potassium. It is estimated that 93% Americans are deficient in choline, 95% fiber, and 97% Potassium!

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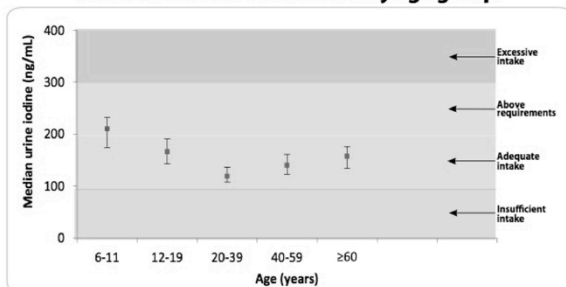
**CENTER FOR DISEASE CONTROL
(TESTING BLOOD AND URINE)**

- 90 million Americans deficient in vitamin D
- 30 million Americans deficient in vitamin B6
- 18 million Americans deficient in vitamin B12 (using MMA)
- 16 million Americans deficient in vitamin C
- 8 million Americans deficient in iron;
Latinos 12%; blacks 16%; children ages <5 years of age 7-10%
- Many women ages 25-39 with "borderline" low iodine levels



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Urine iodine levels in females by age group



Women 20-39 years of age have the lowest urine iodine levels compared to all other age groups. Iodine intake in young women merits special attention to ensure the best possible brain development of the fetus during pregnancy.

Additional information on iodine is available online at <http://www.cdc.gov/nutrition/everyone/basics/iodine/index.html>

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COMMON SIGNS OF NUTRIENT DEFICIENCY

- Poor night vision-Vit A
- Chelitis - B12, Fe, Zn
- Glossitis - B Vitamins
- Spooning, spotted or ridged nails - Zn, Fe
- Easy bruising - Vit K
- Muscle weakness - Vit D
- Muscle cramps- K, Mg
- RLS/Neuropathy - Fe, B12, Folate



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DRUG-NUTRIENT INTERACTIONS

- Alcohol- zinc, magnesium, phosphorous, B1, B2, B6 and Folate
- Antibiotics - Vitamin K
- Diuretics - potassium, magnesium, zinc, B6
- Metformin - B12
- Trimethoprim - Folate

" Do Not Mix Certain Medication With Food"

Food you eat may interact with certain drugs
Read the medication leaflet carefully to avoid
drug-food interactions



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PROTON PUMP INHIBITOR DRUGS

- Proton pump inhibitors not only block the release of stomach acid but also something else called "intrinsic factor," making it impossible to absorb vitamin B12.
- It's well known that calcium is best absorbed in the presence of acid.
- Proton pump inhibitors are thought to inhibit active transport of magnesium in the intestine, leading to deficiencies and potentially serious health outcomes.



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PROTON PUMP INHIBITOR DRUGS

- Your absorption of folic acid is inhibited, disrupting the production of new cells, which helps your body grow and repair itself.
- The absorption of zinc is impaired, which is needed for many enzyme reactions in the body.
- The inhibition of dietary iron can contribute to anemia over a long period of time



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LABS

- 25 hydroxy-vitamin D
- B12 and Methylmalonic acid
- Folate
- MTHFR
- RBC magnesium and zinc
- Omega 3/6 Index (want 8+ %)
- Urine iodine
- Urinary Organic Acids-Metabolic Profile



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FERRITIN/B6

- Best biomarker for iron stores
- Should check in children with ADHD; adults with anemia; RLS
- Iron deficiency and hypothyroidism
- B6 (pyridoxine) important for neurotransmitters, folate synthesis, conversion of ALA to DHA
- Decreased with inflammation-conditionally essential -triglyceride
- Pyridoxine and Riboflavin (B2-dairy) to Pyridoxyl-5 phosphate (PLP)
- ? RDA higher e.g. 4-6 mg
- Vitamin C lower in chronic inflammatory and stress states



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MULTIVITAMIN-MINERAL SUPPLEMENTS

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Vitamin and Antioxidant Supplements for Primary Prevention of Cardiovascular Disease

No benefit found

In Summary, for those who took the vitamins/antioxidants:

Benefits in NNT	Harms in NNT
<ul style="list-style-type: none"> None were helped (preventing death, stroke, heart disease or cardiovascular events) 	<ul style="list-style-type: none"> None were harmed (medication side effects)

View As: **NNT** %

Details for this Review

Source: Myung SK, Ju W, Oh SW, et. al. Efficacy of vitamin and antioxidant supplements in prevention of cardiovascular disease: systematic review and meta-analysis of randomised controlled trials. *BMJ* 2013 Jan 18;346:f10. Bjelakovic G, Nikolova D, Gluud LL, Simonetti RG, Gluud C. Antioxidant supplements for prevention of mortality in healthy participants and patients with various diseases. *Cochrane Database Syst Rev* 2012;3:CD007176. Marti-Carvajal AJ, Solà I, Lathyris D, Karakitsiou DE, Simancas-Racines D. Homocysteine-lowering interventions for preventing cardiovascular events. *Cochrane Database Syst Rev*. 2013 Jan 31;1:CD006612.

Efficacy Endpoints: Decrease in major cardiovascular events (cardiovascular death, fatal/non-fatal MI, angina, sudden cardiac death, fatal/non-fatal stroke, and TIA)

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MAGNESIUM RICH FOODS

Magnesium Content of Foods			
milligrams per 3.5 ounce serving			
Kelp	760	Soybeans, cooked 88	Dandelion greens 36
Wheat bran	490	Spinach	Garlic 36
Wheatgerm	336	Brown rice	Raisins 35
Almonds	270	Lentil, dried	Green peas, fresh 35
Cashews	267	Figs, dried	Potato with skin 34
Nutritional yeast	231	Swiss chard	Crab 34
Buckwheat	229	Apricots, dried	Snap beans 32
Peanuts	206	Dates	Banana 33
Sesame, whole	181	Collard leaves	Sweet potato 31
Millet	162	Shrimp	Blackberry 30
Wheat	160	Sweet corn	Beets 25
Pecans	142	Avocado	Broccoli 24
English walnuts	131	Cheddar cheese	Carrot 23
Wild rice	129	Parsley	Celery 22
Rye	115	Prunes	Beef 21
Tofu	111	Sunflower seeds	Milk 13
Beet greens	106	Beans, cooked	
Coconut, dried	90	Barley	



CHOLINE-RICH FOODS

Food	Serving	Total Choline (mg)
Beef liver, pan fried	3 ounces*	355
Wheat germ, toasted	1 cup	172
Egg	1 large	126
Atlantic cod, cooked	3 ounces	71
Beef, trim cut, cooked	3 ounces	67
Brussel sprouts, cooked	1 cup	63
Broccoli, cooked	1 cup, chopped	62
Shrimp, canned	3 ounces	60
Salmon	3 ounces	56
Milk, skim	8 fl oz.	38
Peanut butter, smooth	2 tablespoons	20
Milk chocolate	1.5-ounce bar	20

*A three-ounce serving of meat or fish is about the size of a deck of cards.



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12 FOODS HIGH IN ZINC



Oysters



Chicken



Cheddar Cheese



Cashews



Watermelon Seed



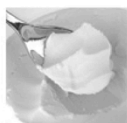
Almonds



Milk



Red Meat



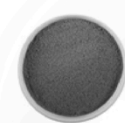
Yoghurt



Pumpkin Seed



Salmon



Cacao/Cocoa
Dark Choc

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POTASSIUM RICH FOODS

World's Healthiest Foods rich in potassium		
Food	Cals	DRI/DV
Beet Greens	39	37%
Lima Beans	216	27%
Swiss Chard	35	27%
Sweet Potato	180	27%
Potatoes	161	26%
Soybeans	298	25%
Spinach	41	24%
Avocado	240	21%
Pinto Beans	245	21%
Lentils	230	21%

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PREBIOTIC RICH FOODS

Selectively stimulate growth and/or activity of intestinal bacteria

- Jerusalem Artichoke
- Apples
- Asparagus
- Bananas
- Burdock Root
- Chicory
- Garlic
- Kiwi
- Legumes (including soy beans)
- Onions, Leeks
- Peas



Courtesy Kathie Swift MS RDN LDN FAND EBQ
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FIBER: FOOD FOR THE MICROFLORA



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SUPPLEMENT CONSIDERATION

- Magnesium glycinate (citrate/threonate) :
300-600 mg/day (GFR > 45 ml/min)
- Zinc carnosine: 15-30 mg/day
- Cholecalciferol (don't forget sunshine)
2,000-4,000 units/day to level 30+ ng/dl
- B-complex
- Methylated B12/folate (MTHFR)
- Potassium citrate 40-60 mEq/day



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SPECIAL DIETARY-NUTRIENT CONSIDERATIONS

TYPE OF DIET	RESTRICTED FOODS	NUTRIENTS OF CONCERN
Vegetarian (lacto-ovo)	Meat, poultry, fish/seafood	Iron, Zinc, Omega 3 fatty acids, Protein
Lacto-vegetarian	Meat, poultry, fish/seafood, eggs	Iron, Zinc, Omega 3 fatty acids, Protein
Ovo-vegetarian	Meat, poultry, fish/seafood, dairy products	Calcium, Iron, Zinc, Vitamin B12, Vitamin D, Omega 3 fatty acids, Protein
Vegan	All animal products including meat, poultry, fish/seafood, eggs, and dairy products	Calcium, Iron, Zinc, Vitamin B12, Vitamin D, Omega 3 fatty acids, Protein
Gluten-free	Wheat, rye, barley and their derivatives. Oats unless certified gluten-free.	B vitamins, Iron, Fiber

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NUTRIGENOMICS

- **Vitamin D and CYP2R1:** converts D3 into 25-hydroxy D3; consider if someone's serum levels are not increasing as predicted by supplementation dose
- **APOE4:** lipoprotein made in the liver that binds to cholesterol and recycles it in the liver. It also transports cholesterol (astrocytes) to neurons in the brain.
- **25% heterozygote** resulting in higher LDL which usually increases on a more liberal fat diet. 3-fold increase risk of Alzheimer's



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NUTRIGENOMICS

- Folate and MTHFR: Thymine synthesis and methylation
40% population heterozygous which results in a 40% reduction in functional MTHFR
- 10% homozygous with 80-90% reduction in the functional efficiency of MTHFR
- Supplementation with 5-methyltetrahydrofolate
- Vitamin B12 and FUT2: 49% population might have reduced absorption of B12
- Vitamin A and BCMO1: 20-40% population with trouble converting provitamin A carotenoids to active form of vitamin A retinol



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THANK YOU!



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