

Plant-Based Diets as a Path to Health

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Why Vegan?

- ▶ For your own health
- ▶ For environmental sustainability
- ▶ For the animals

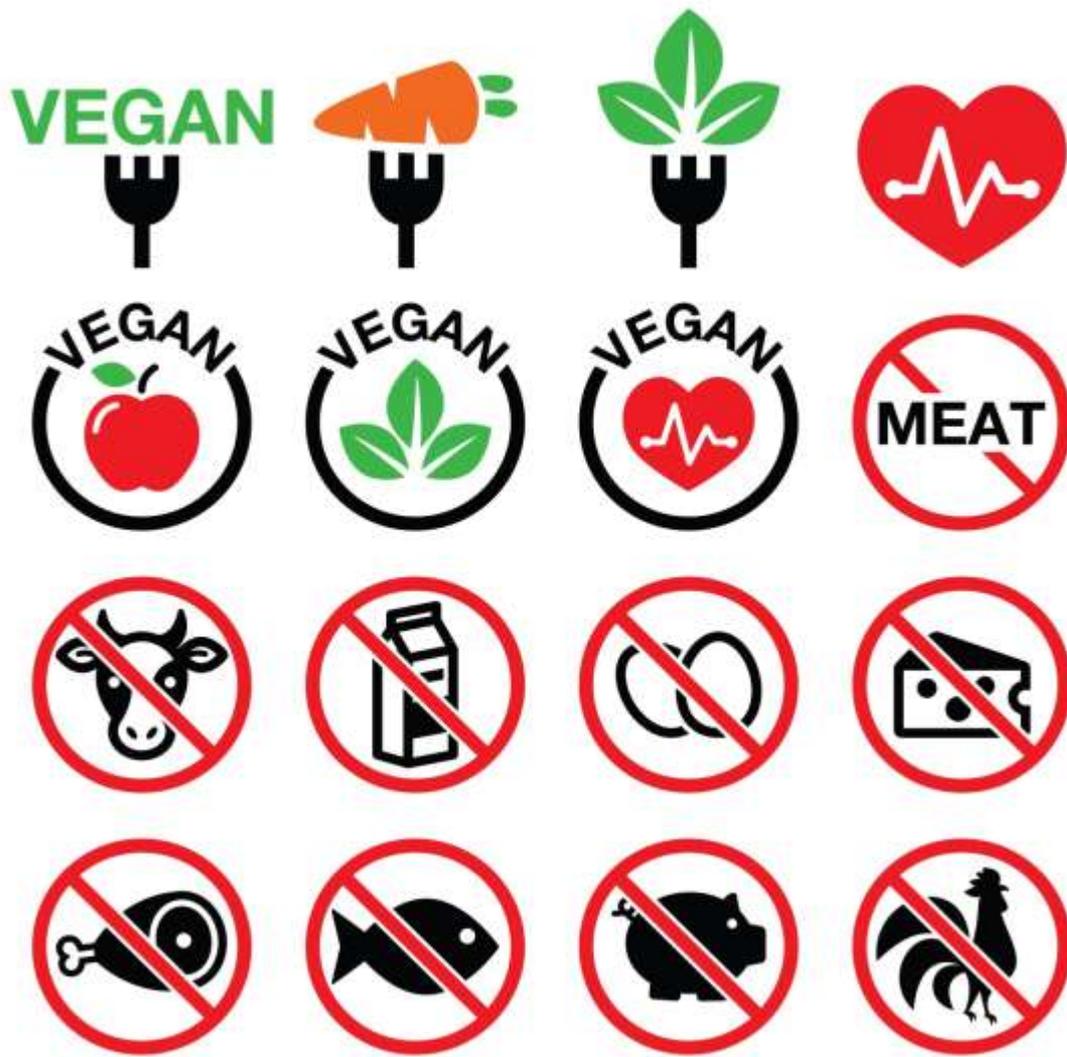


A Fundamental Difference?



Terms Describing Human Dietary Patterns

- ▶ Omnivore: eats foods of plant and animal origin, including meats
- ▶ Vegetarian: eats plants, no land or sea animals, may eat dairy and/or eggs
- ▶ Vegan: eats no foods of animal origin



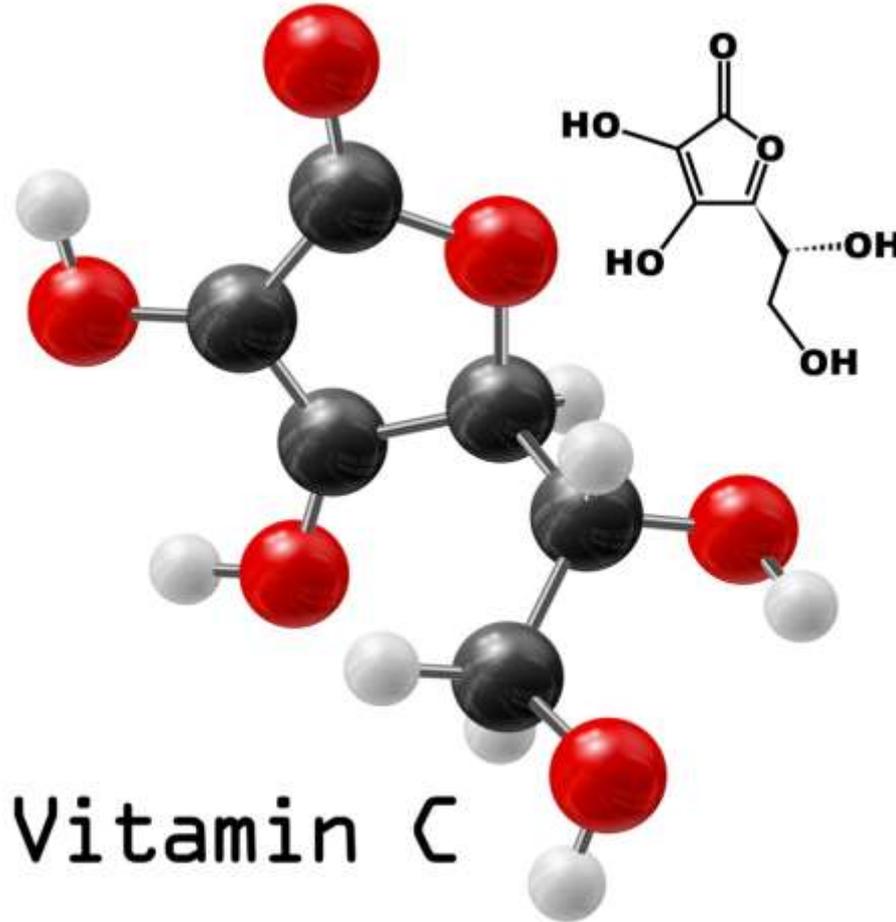
Doing It Right

- ▶ Is it possible to create a healthy vegan diet?
- ▶ Is it possible to create an unhealthy vegan diet?
- ▶ What are the critical differences?
- ▶ Whole foods, processed minimally
- ▶ Variety

Food Groups in a Plant-Based Diet

- ▶ Vegetables
- ▶ Fruits
- ▶ Whole grains
 - Whole wheat, brown rice, corn (and popcorn), oats, millet, rye, barley, quinoa, amaranth, teff, etc.
- ▶ Legumes
 - Beans (including soybeans), peas, lentils
- ▶ Nuts
 - Walnuts, almonds, Brazil nuts, cashews, etc.
- ▶ Seeds
 - Sesame, sunflower, flax, chia, hemp, etc.

Is the Fundamental Unit of Nutrition the Nutrient?



Or the whole food?



Or the whole diet?











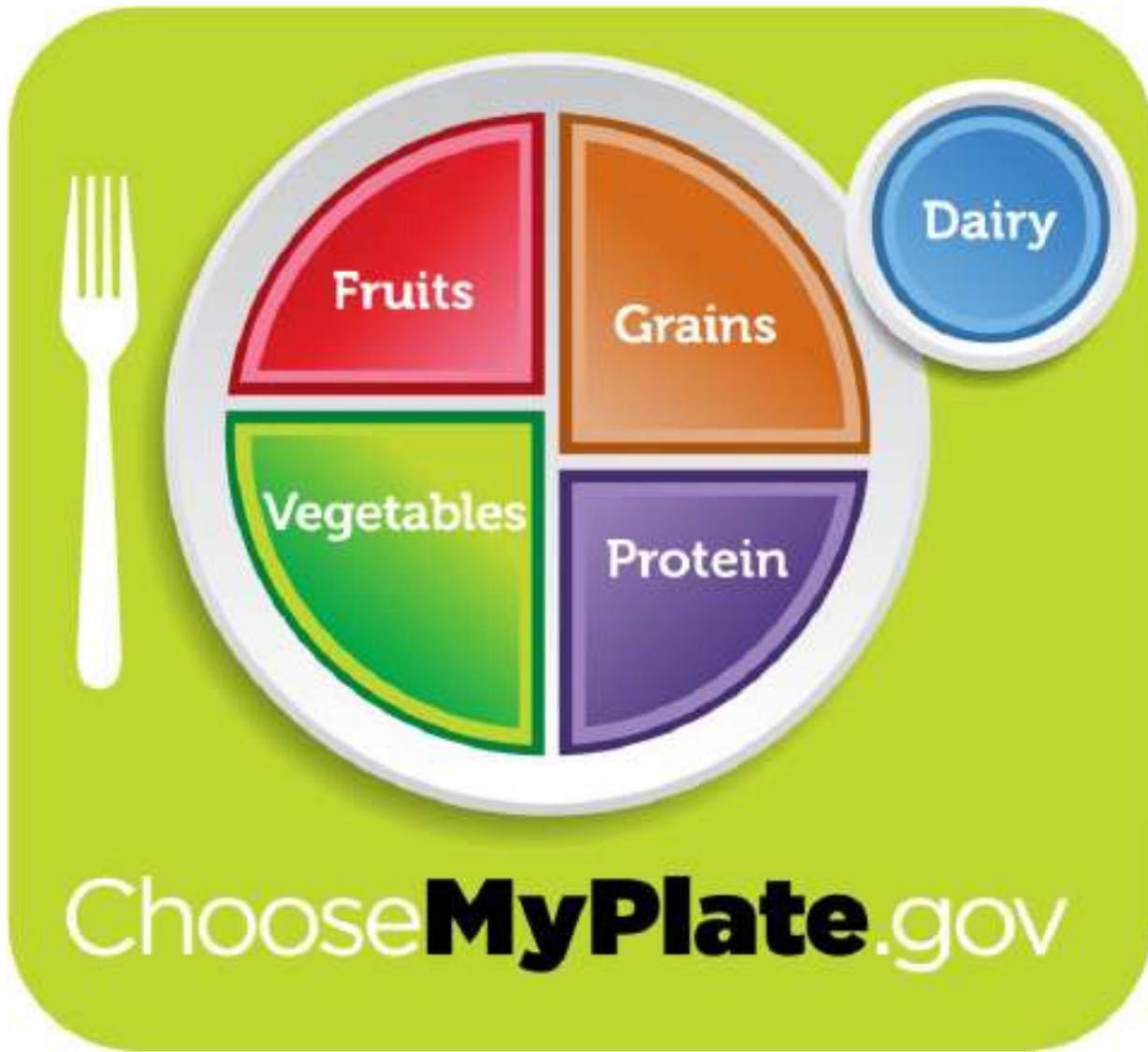
A Rare Case of Unanimity

- ▶ Agreement is universal on the health benefits of fruits and vegetables.



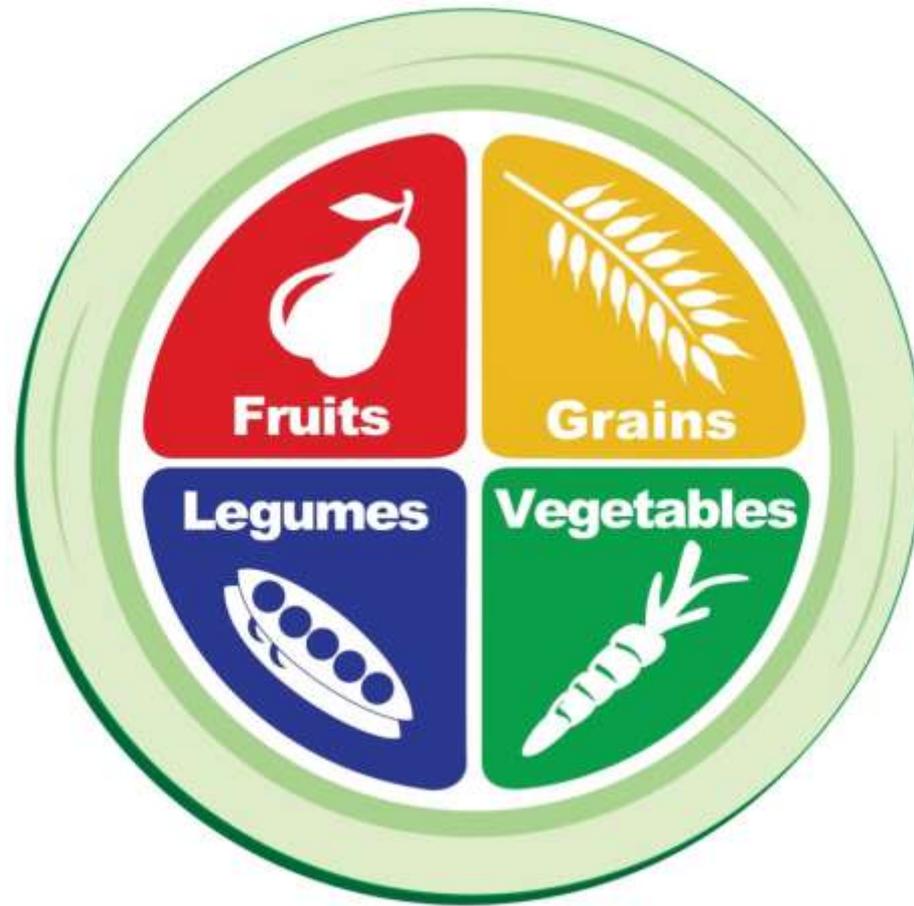
Fruits and Vegetables for Prevention

- ▶ Fruits and vegetables play a crucial role in promoting health and preventing disease.
- ▶ Strongest evidence for preventive effects of F&V is for heart disease, hypertension and stroke.
- ▶ USDA and all major health organizations recommend that 50% of daily food intake should be F&V.
 - Boeing, H., et al. (2012). "Critical review: vegetables and fruit in the prevention of chronic diseases." European Journal of Nutrition 51(6): 637-663.
 - Lock, K., et al. (2005). "The global burden of disease attributable to low consumption of fruit and vegetables: implications for the global strategy on diet." Bulletin of the World Health Organization 83(2): 100-108.



Physicians Committee for Responsible Medicine “Power Plate”

pcrm.org



Nutritional Content of Fruits and Vegetables

- ▶ Most F&V are high in fiber, low in fat
- ▶ Generally good sources of vitamins and minerals
 - But great variation from one F/V to another
 - Slavin, J. L. and B. Lloyd (2012). "Health Benefits of Fruits and Vegetables." Advances in Nutrition 3(4): 506–516.
- ▶ Some fruits and vegetables have high levels of antioxidants
 - Blueberries, cranberries, raspberries, prunes, strawberries, apples, and cherries strongest among fruits
 - Beans, artichokes, and Russet potatoes strongest among vegetables.

Phytochemical Synergy: No Silver Bullets

- ▶ Very difficult to pinpoint specific food components responsible for effects
- ▶ Complementary, overlapping and synergistic mechanisms
- ▶ Do not ever assume that the whole is the sum of its parts
 - Liu, R. H. (2004). "Potential synergy of phytochemicals in cancer prevention: mechanism of action." J Nutr 134(12 Suppl): 3479S-3485S.



Antioxidants in Apples

- ▶ Strong antioxidant activity but not specific to vitamin C content
- ▶ Synergy of biochemical constituents is key
- ▶ Research shows that an apple has 5 mg vitamin C (oranges have 70 mg) but antioxidant activity equal to 1500 mg of vitamin C.
 - Boyer, J., & Liu, R. H. (2004). Apple phytochemicals and their health benefits. *Nutr J*, 3, 5.

Whole vs. Processed Grains and Carbohydrates

Whole Grains

- ▶ Whole grains and other starch-rich carbohydrates (from legumes, tubers, and roots) are food staples throughout the world and in all Blue Zones (Okinawa, Sardinia, Loma Linda)
- ▶ Together starches can provide as much as 70% of calories in the diets of many cultures.
- ▶ Wheat is the most widely consumed grain in the United States and the world.
- ▶ In U.S., followed by corn and oats.

Current Evidence Summary

- ▶ “Current scientific evidence indicates that whole grains play an important role in lowering the risk of chronic diseases, such as coronary heart disease, diabetes, and cancer, and also contribute to body weight management and gastrointestinal health.”
 - Jonnalagadda, S. S., et al. (2011). "Putting the Whole Grain Puzzle Together: Health Benefits Associated with Whole Grains—Summary of American Society for Nutrition 2010 Satellite Symposium." The Journal of Nutrition 141(5): 1011S–1022S.

Whole Grains, Heart Disease and Diabetes

- ▶ Most research on whole grains has focused on heart disease and diabetes
- ▶ Consistent pattern >> more whole grains, less heart disease.
- ▶ Also more whole grains >> less diabetes
 - Mellen, P. B., et al. (2008). "Whole grain intake and cardiovascular disease: a meta-analysis." Nutr Metab Cardiovasc Dis 18(4): 283-290.
 - Ye, E. Q., et al. (2012). "Greater whole-grain intake is associated with lower risk of type 2 diabetes, cardiovascular disease, and weight gain." J Nutr 142(7): 1304-1313.

Refined Carbohydrates and Diabetes

- ▶ U.S. national data from 1909 to 1997 shows strong correlation between:
 - increased consumption of refined carbohydrates (largely white flour and sugar)
 - decreased consumption of dietary fiber
 - increasing prevalence of Type 2 diabetes in the United States during the 20th century.



Refined Carbs and Diabetes (2)

- ▶ Data are consistent in that obesity and the prevalence of diabetes increased proportionately to the increase in consumption of refined carbohydrates in the United States.
 - Gross, L. S., et al. (2004). "Increased consumption of refined carbohydrates and the epidemic of type 2 diabetes in the United States: an ecologic assessment." Am J Clin Nutr **79**(5): 774–779.

Dr. Neal Barnard's Diet Reverses Diabetes

- ▶ 2006 NIH-funded study of 100 subjects at George Washington University Medical School
 - ▶ Low-fat (no added oils) vegan diet vs. American Diabetes Association diet (2003 version)
 - ▶ To isolate diet effects, no exercise increase
 - ▶ Measures taken at start and then at 22 weeks
-
- Barnard, N. D., et al. (2006). "A low-fat vegan diet improves glycemic control and cardiovascular risk factors in a randomized clinical trial in individuals with type 2 diabetes." *Diabetes Care* 29(8): 1777-1783.
 - Barnard, N. D., (2009). A low-fat vegan diet and a conventional diabetes diet in the treatment of type 2 diabetes: a randomized, controlled, 74-wk clinical trial. *Am J Clin Nutr*, 89(5), 1588S-1596S.

Barnard Study (2)

- ▶ Decrease in medications
 - 43% of vegan group
 - 26% of ADA group
- ▶ Weight loss
 - 6.5 kg in vegan group
 - 3.1 kg in ADA group
- ▶ HbA1c
 - Vegan average .96 lower
 - ADA average .56 lower

Dr. Dean Ornish's Diet Reverses Heart Disease

- ▶ 1990 RCT published in *Lancet*
 - Low-fat vegetarian diet
 - Exercise
 - Stress management
 - Smoking cessation
- Ornish, D., et al. (1990). "Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial." Lancet 336(8708): 129-133.
- Ornish, D., et al. (1998). "Intensive lifestyle changes for reversal of coronary heart disease." JAMA 280(23): 2001-2007.

Ornish Study (2)

- ▶ 28 in experimental group, 20 in usual care group.
- ▶ Duration: 1 year.
- ▶ 195 heart lesions analyzed by scans
- ▶ 82% in Ornish program group showed decrease in arterial blockage (plaque)
- ▶ The worse the blockage, the greater the improvement

Ornish Study (3)

- ▶ Usual care (American Heart Association Guidelines) group had worsening of blockage.
- ▶ Lifestyle change group
 - 91% fewer episodes of angina
 - 42% reduction in angina duration
- ▶ Control group (AHA Guidelines)
 - 165% rise in angina episodes
 - 39% rise in severity

Dr. Caldwell Esselstyn's Heart Disease Research

- ▶ 20-year nutritional study on diet and heart disease
- ▶ “Plant-based, oil-free diet cannot only prevent and stop the progression of heart disease, but also reverse its effects.”
- ▶ Most were told by their cardiologists that they had less than a year to live.
- ▶ Within months on Dr. Esselstyn's program, their cholesterol levels, angina symptoms, and blood flow improved dramatically. 20 years later, they remained free of symptoms.
 - J Fam Pract 41(6): 560-568.
 - Am J Cardiol 84(3): 339-341, A338.

Wheat Controversies



Celiac Disease – Severe Gluten Reaction

- ▶ Existence and prevalence of celiac disease universally accepted
- ▶ People with CD must avoid gluten-containing grains
- ▶ Celiac applies to whole or refined grains w/gluten
 - Gluten is the common term for several different proteins (including gliadin) in wheat, rye, barley.
- ▶ U.S. celiac disease prevalence: 1 in 141 (.7%)
 - Rubio-Tapia, A., et al. (2012). "The prevalence of celiac disease in the United States." Am J Gastroenterol 107(10): 1538–1544.

How Common Is Non-Celiac Gluten-Sensitivity?

- ▶ Answer is not known, in part because definition is unclear
 - No standard laboratory tests that confirm whether a patient has GS.
 - Best method at this time to assess if a patient has GS is to perform an elimination diet.
- ▶ Best estimates of NCGS by experts between 5–10%
 - Antonio Fasano, MD, Harvard Medical School
 - [“Five Myths About Gluten,”](#) Washington Post (2015)

Glyphosate (Roundup), GMO Crops and Health

- ▶ Monsanto's Roundup is world's most widely used pesticide/herbicide
- ▶ Used in many ways, including on pre-harvest wheat (except organically grown wheat)
- ▶ Kills the wheat plant for earlier harvest
- ▶ How do we determine whether adverse reaction to wheat is from gluten, glyphosate, or both?
 - Mesnage, R., et al. (2014). "Major pesticides are more toxic to human cells than their declared active principles." Biomed Res Int 179691.
 - Swanson NL et al. (2014). "Genetically engineered crops, glyphosate and the deterioration of health in the United States of America." Journal of Organic Systems, 9(2).



Phytates (Phytic Acid)

- ▶ Phytic acid is present in the seeds of all plants
 - Grains: wheat, corn and rice
 - Legumes, beans, nuts, seeds
- ▶ Concern regarding its binding to certain minerals, thereby decreasing their bioavailability

Phytate Paradox

- ▶ Phytate also has anti-inflammatory, antioxidant and anticancer effects
- ▶ So, good news or bad news?
- ▶ How to evaluate this?
- ▶ Loss of bone density?
- ▶ People who eat more whole grains have better bone density than people who eat less.

Clues Toward Understanding the Paradox

- ▶ Human gut microbiota (“friendly” bacteria) produce the enzyme phytase
- ▶ A diet rich in phytate stimulates the intestinal microbiota to degrade phytate
- ▶ Can break linkage between phytate and minerals.
- ▶ Most efficient in vegetarians.
 - “It was the vegetarians’ microbiota that particularly degraded up to 100% phytate to myo–inositol phosphate.”
 - Markiewicz, L. H., et al (2013). Diet shapes the ability of human intestinal microbiota to degrade phytate--in vitro studies. *J Appl Microbiol*, 115(1), 247–259.

Legumes



Legumes

- ▶ Beans, peas and lentils, as well as peanuts and soy
- ▶ Also called “pulses”
- ▶ Source of micronutrients: potassium, magnesium, folate, iron, and zinc
- ▶ Among the only plant foods rich in lysine, an amino acid
- ▶ Per serving, legumes are the strongest source of fiber
- ▶ Rich in polyphenols (antioxidants)

More on Legume Nutrients

- ▶ High fiber, low fat, low calorie
- ▶ Inexpensive, nutrient-dense form of protein
- ▶ A key protein source in vegan and vegetarian diets
 - All legumes, especially soy
 - Tempeh is the most concentrated source of whole plant food protein (18g protein in one serving)

Other Legume Characteristics

- ▶ Low glycemic index (good for diabetics and others)
- ▶ High in resistant starch (not digested in small intestine), prebiotic
- ▶ Contain components such as lectins and protease inhibitors sometimes termed “antinutrients”

“Antinutrients” Destroyed by Cooking, Sprouting

- ▶ Animal studies show raw bean or soy flour causing various dysfunctions.
- ▶ Crucial to cook these foods, preferably in water, although dry heat also effective
 - Small percentage of antinutrients (lectins, trypsin inhibitors) remain
 - Not enough to cause trouble for most people
- Liener, I. E. (1994). Implications of antinutritional components in soybean foods. *Crit Rev Food Sci Nutr*, 34(1), 31–67.

Legumes Reduce Risk of Diabetes

- ▶ Study of 64,227 middle-aged Chinese women found that total legume consumption, which included soybeans, peanuts, and other legumes, was associated with a 38% lower risk of developing Type 2 diabetes.
- Villegas, R. et al. (2008). Legume and soy food intake and the incidence of type 2 diabetes in the Shanghai Women's Health Study. *Am J Clin Nutr*, 87(1), 162-167.

Legumes Reduce Risk of Heart Disease

- ▶ Study that examined the effect of legume intake on cardiovascular disease risk
 - ▶ Followed 9632 men and women for 19 years
 - ▶ Those who ate dry beans, peas, or peanuts at least 4x/wk had a risk of coronary heart disease 21% lower than those who ate them less than once weekly.
- Bazzano et al. (2001). Legume consumption and risk of coronary heart disease in US men and women: NHANES I Epidemiologic Follow-up Study. *Arch Intern Med*, 161(21), 2573–2578.

Legumes Reduce Inflammation

- ▶ 486 female teachers in Teheran
- ▶ Evaluated “total consumption of lentils, peas, chickpeas, different kinds of beans including broad beans ...”
- ▶ More legume intake, less inflammation
 - Esmailzadeh, A., & Azadbakht, L. (2012). Legume consumption is inversely associated with serum concentrations of adhesion molecules and inflammatory biomarkers among Iranian women. *J Nutr*, 142(2), 334–339.

Types of Beans, Legumes

- ▶ Pinto, navy, black, white, red beans
- ▶ Kidney, Canellini, Northern, garbanzo beans (chickpeas)
- ▶ Lima, adzuki, black-eyed peas
- ▶ Red lentils, green lentils, brown lentils
- ▶ Green peas, split peas, yellow split peas
- ▶ Soybeans











Soybeans

- ▶ Mainstay in Asian cuisines
- ▶ Strongest source of plant protein
- ▶ Most common soy foods are tofu, soymilk, tamari (soy sauce), miso, edamame and tempeh











Soy and Cancer

- ▶ American Cancer Society current review of evidence (2012):
 - Soy is an excellent protein, a good alternative to meat
 - A rich source of phytochemicals including isoflavones, “which have weak estrogenic activity and may protect against hormone-dependent cancers.”
 - Traditional soy foods like tofu may decrease risk of breast, prostate, and endometrial cancers.
 - “Unknown” whether this applies to soy protein isolate
 - “Limited or no data” to support use of supplements of isolated soy phytochemicals re: cancer.
- Kushi L. H. et al (2012). American Cancer Society guidelines on nutrition and physical activity for cancer prevention. *CA: A Cancer Journal for Clinicians*, 62(1), 30–67.

Soy and Breast Cancer Prevention

- ▶ Soy appears to protect against the development of breast cancer.
 - ▶ Women who ate soy four times a week or more during adolescence and adulthood were nearly 50% less likely to develop breast cancer than women who ate soy less than once a month.
- Wu, A. H., et al (2002). Adolescent and adult soy intake and risk of breast cancer in Asian-Americans. *Carcinogenesis*, 23(9), 1491–1496.

Soy and Current Breast Cancer

- ▶ Research has advanced significantly in the past several years regarding effects of soy on existing breast cancer.
- ▶ Previous concern that although soy had preventive effect for women who had never had breast cancer, it might worsen existing breast cancer.
- ▶ Until more was known, prudent approach was to advise women with current or past breast cancer to avoid soy.
- ▶ New research shows that women with existing breast cancer who eat the most soy have fewest recurrences.

Current Breast Cancer (2)

▶ Soy and chemotherapy

- Large California study (1000+ at Kaiser Permanente in Oakland) on women with breast cancer undergoing chemotherapy with tamoxifen
- Patients whose diets contained **foods** with the highest amounts of the soy isoflavone, daidzein, had approximately a 60% reduction in breast cancer recurrence compared to those eating the lowest levels of soy.

- Guha, N., et al (2009). Soy isoflavones and risk of cancer recurrence in a cohort of breast cancer survivors: the Life After Cancer Epidemiology study. *Breast Cancer Res Treat*, 118(2), 395–405.

More on Soy and Breast Cancer

- ▶ Shanghai Breast Cancer Survival Study
- ▶ Large study of 5042 female breast cancer survivors in China.
- ▶ Looked at breast cancer recurrences, breast cancer–related deaths, and total deaths.
- ▶ Follow–up of 3.9 years.
- ▶ Conclusion: soy food intake is associated with lower recurrence and death rates.

- Shu, X. O., et al (2009). Soy food intake and breast cancer survival. *JAMA*, 302(22), 2437–2443.

Nuts and Seeds



Health Benefits of Nuts

- ▶ Rich in unsaturated fatty acids, vegetable protein, fiber, minerals (like calcium and magnesium), vitamin E, antioxidants.



Research on Nuts

- ▶ Research on nuts is limited
 - ▶ Nuts associated with less heart disease and gall bladder disease.
 - ▶ Limited evidence also suggests beneficial effects for high blood pressure, cancer, and inflammation.
- Ros, E. (2010). "Health benefits of nut consumption." Nutrients 2(7): 652-682.



Protein Content of Nuts

- ▶ Protein in 1-oz. serving (a handful)
 - Higher: almonds and pistachios at 6g
 - Middle: walnut, hazelnut, Brazil nut at 4g
 - Lower: macadamia, pecan at 2-3g



Fat in Nuts

- ▶ Fat in 1-oz. serving
 - Pistachio low at 13g
 - Macadamia, pecan, and Brazil high at 19–20g



Which Nut is This?



Minerals in Nuts

- ▶ **Magnesium**: Brazil nuts highest at 107mg; pecans and pistachios low at 34mg
- ▶ **Potassium**: Pistachio high at 291; macadamia low at 104
- ▶ **Selenium**: Brazil nut highest at 544 mcg/oz.
 - No other food of any kind over 100 mcg

Calories in Nuts

- ▶ Nuts are filling, relatively high calorie
- ▶ Calories correlate well with fat content
- ▶ In 1-oz serving, calorie count between 160s (pistachios) and low 200s (macadamias), except chestnuts very low-calorie at 69

Fiber in Nuts and Seeds

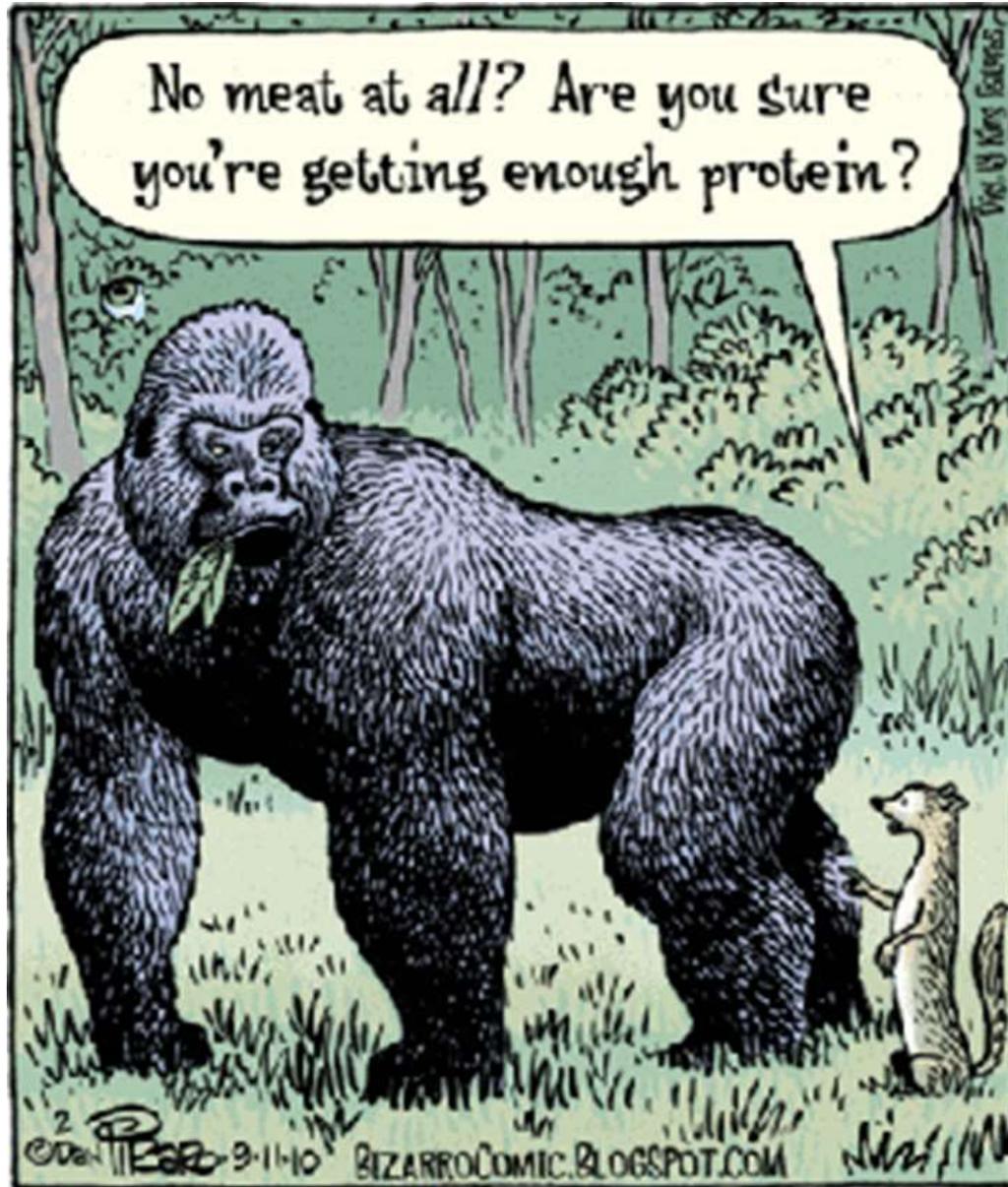
- ▶ Nuts and seeds are strong in dietary fiber.
- ▶ Fiber slows the rate of digestion so blood sugar rise is gradual.
 - Helps avoid spike and crash pattern
- ▶ Almonds = 3.5g; sunflower = 3.1g; pistachios = 2.9g; pecans = 2.7g

What Seed is This?



Flax Seeds and Hypertension

- ▶ Study with 110 patients w/peripheral artery disease
 - ▶ 30g/day flax meal (6g per tablespoon).
 - ▶ Systolic blood pressure drops by ~10 points, and diastolic drops by ~7 in the flaxseed group compared with placebo after 6 months.
 - ▶ Very substantial improvement.
-
- Rodriguez-Leyva, D., et al. (2013). "Potent Antihypertensive Action of Dietary Flaxseed in Hypertensive Patients." Hypertension 62(6): 1081-1089.



No meat at all? Are you sure you're getting enough protein?

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Protein

- ▶ The goal is to meet protein needs, not to maximize intake.
- ▶ World Health Organization says average sized–man needs 56 grams/day, average woman 48 grams.
- ▶ Based on 2000 calories/day:
 - Typical Asian diets: 40–70 grams/day of protein
 - Typical Western diets: 75–160 grams/day of protein
 - Low carbohydrate diets can go considerably higher
- ▶ Key point: protein needs can be met with diet of 100% plant foods.
- ▶ How do vegans accomplish this?

Protein Per Serving in Plant Foods

- ▶ Tofu (8 oz) – 9g
- ▶ Plain Soymilk (1 cup) – 8g
- ▶ Tempeh (4 oz) – 18g
- ▶ Peanut Butter (2T) – 8g
- ▶ Beans (1 / 2 cup) – 8g
- ▶ Peanuts (1 / 2 cup) – 19g
- ▶ Almonds (1 / 2 cup) – 14g

Protein Per Serving in Plant Foods (2)

- ▶ Sunflower Seeds (1 / 2 cup) – 13g
- ▶ Whole grain bread (one 1 oz. slice) – 3–4g
- ▶ Broccoli (1 cup) – 5g
- ▶ Mushrooms (1 cup) – 3g
- ▶ Brown rice (1 cup) – 5g
- ▶ Pasta (1 cup) – 6g

Example of Protein Content at a Vegan Breakfast

- ▶ 2 slices 100% whole grain toast
 - $2 \times 4 = 8\text{g}$
- ▶ 2 T of nut butter on toast
 - 8g
- ▶ 1 cup soymilk
 - 8g
- ▶ $8 + 8 + 8 = 24\text{g}$ of your 48g (female) or 56g (male) daily needs, at just one meal.
- ▶ Can also add fresh fruit to this breakfast

Vitamin B12

- ▶ Vegans **MUST** have B12 supplements or fortified foods
- ▶ This is the one nutrient that modern plant-based diets do not supply in sufficient amounts.
- ▶ RDA is 2.4 micrograms/day
- ▶ Typical supplementation is 1000 mcg 2x/week
- ▶ Danger is pernicious (macrocytic) anemia, involving damage to nerves and stomach lining.
 - 100% avoidable by remembering to take B12.

Sources of B12

- ▶ Supplements: Between 10 mcg/daily and 2,000 mcg/weekly
- ▶ Also in fortified foods such as soy milk or certain cereals.

Fiber

- ▶ First brought to public attention by work of British physician Denis Burkitt in the 1970s.
- ▶ Previous winner of Nobel Prize in Medicine
- ▶ Work on fiber based on his experiences in Africa
- ▶ Institute of Medicine (part of U.S. National Academy of Sciences) now recommends 14g fiber per 1000 calories
 - Average person needs ~30+ grams/day at 2000+ calories

More on Fiber

- ▶ 2.5g/serving = qualifies as “good source” on Nutrition Facts panel
 - ▶ 5g/serving = “excellent” source
 - ▶ Average American intake is just 15g/day, half of what we need.
-
- Slavin, J. L. (2008). "Position of the American Dietetic Association: health implications of dietary fiber." J Am Diet Assoc 108(10): 1716–1731.

Fiber in Foods

- ▶ Fiber is contained in the cells and cell walls of plants
- ▶ Zero fiber in animal foods
- ▶ Most processing of foods diminishes fiber
 - brown rice vs. white
 - whole wheat bread vs. white (or “wheat”)

Benefits of Fiber

- ▶ Treating or preventing constipation, hemorrhoids and diverticulosis
 - There are other potential influences on constipation
- ▶ Helps control blood sugar
- ▶ Helps lower blood cholesterol
- ▶ Encourages weight loss. Has no calories, yet provides a "full" feeling because of its water-absorbing ability.
- ▶ Helps remove excess sex hormones from system, thus anti-cancer (breast, prostate).

Fiber Content of Foods Per Serving

- ▶ Beans – 7–8g
- ▶ Whole Grains – 4–5g
- ▶ Typical fruits – 3–5g
 - Raspberries (1 cup) – 8.0
 - Blueberries (1 cup) – 3.5

Mayo Clinic Link for Amount of Fiber in Foods

- ▶ Typical Vegetables – 2–5g per cup
 - Potato – 3g
 - Broccoli – 5g
 - Peas – 9g
- ▶ [Mayo Clinic Link for Fiber Content](#)

Calcium Requirements

- ▶ WHO recommends 750–800 mg (2004) for people in developing nations
- ▶ U.S. standards higher >> 1000+ milligrams per day
- ▶ Fracture rates of vegans are higher than other groups **but among vegans consuming at least 525 mg/day calcium, the fracture rates are lower.**
 - Appleby, P., Roddam, A., Allen, N., & Key, T. (2007). Comparative fracture risk in vegetarians and nonvegetarians in EPIC-Oxford. *Eur J Clin Nutr*, 61(12), 1400–1406.

Plant-Based Sources of Calcium

- ▶ Dark leafy greens
 - ▶ Collards, kale, others (200+ mg)
 - ▶ 40 to 70% of the calcium is absorbed from kale, collards, broccoli and turnip greens vs. 32% from dairy products
 - ▶ Calcium not as bioavailable in spinach, chard, beet greens
- ▶ Tofu, navy, pinto beans
(100–150 mg/4 oz.)
- ▶ Blackstrap molasses
(140 mg/Tbs)
- ▶ Corn tortillas (120 mg/2)

MEET KALE:

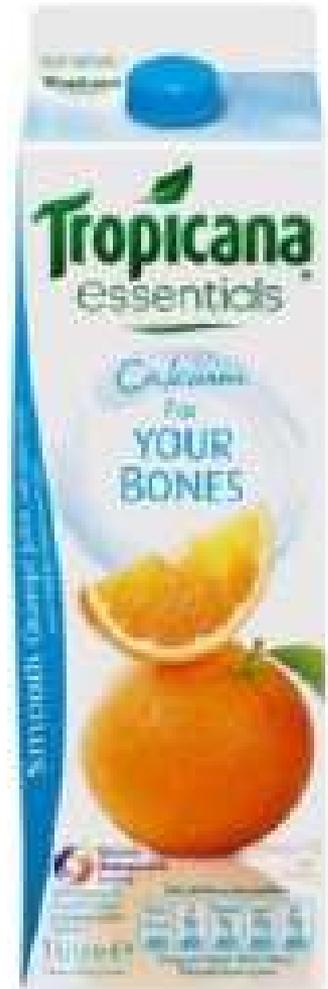


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Plant Sources of Calcium (2)

- ▶ Figs (5=135 mg)
 - ▶ Almonds (2oz=150 mg)
 - ▶ Ca-fortified orange juice
 - ▶ 1 cup=285 mg
 - ▶ Ca-fortified soy milk
 - ▶ 1 cup ~300 mg
 - ▶ calcium bioavailability equal to cow's milk
- Zhao, Y., Martin, B. R., & Weaver, C. M. (2005). Calcium bioavailability of calcium carbonate fortified soymilk is equivalent to cow's milk in young women. *J Nutr*, 135(10), 2379–2382.



Need for Dairy?

- ▶ There is a human requirement for dietary calcium
- ▶ There is no human requirement for milk or other dairy products.
- ▶ Entire cultures in parts of Asia, Africa and elsewhere use no dairy products at all.
- ▶ Calcium and protein are present in dairy and can also be found in many other foods.

Dairy Products (2)

- ▶ Fact that contradicts conventional wisdom:

Nations with the highest dairy and calcium intakes have the highest osteoporosis rates and osteoporosis-related fracture rates, not the lowest.

- ▶ Is there a causal relationship?

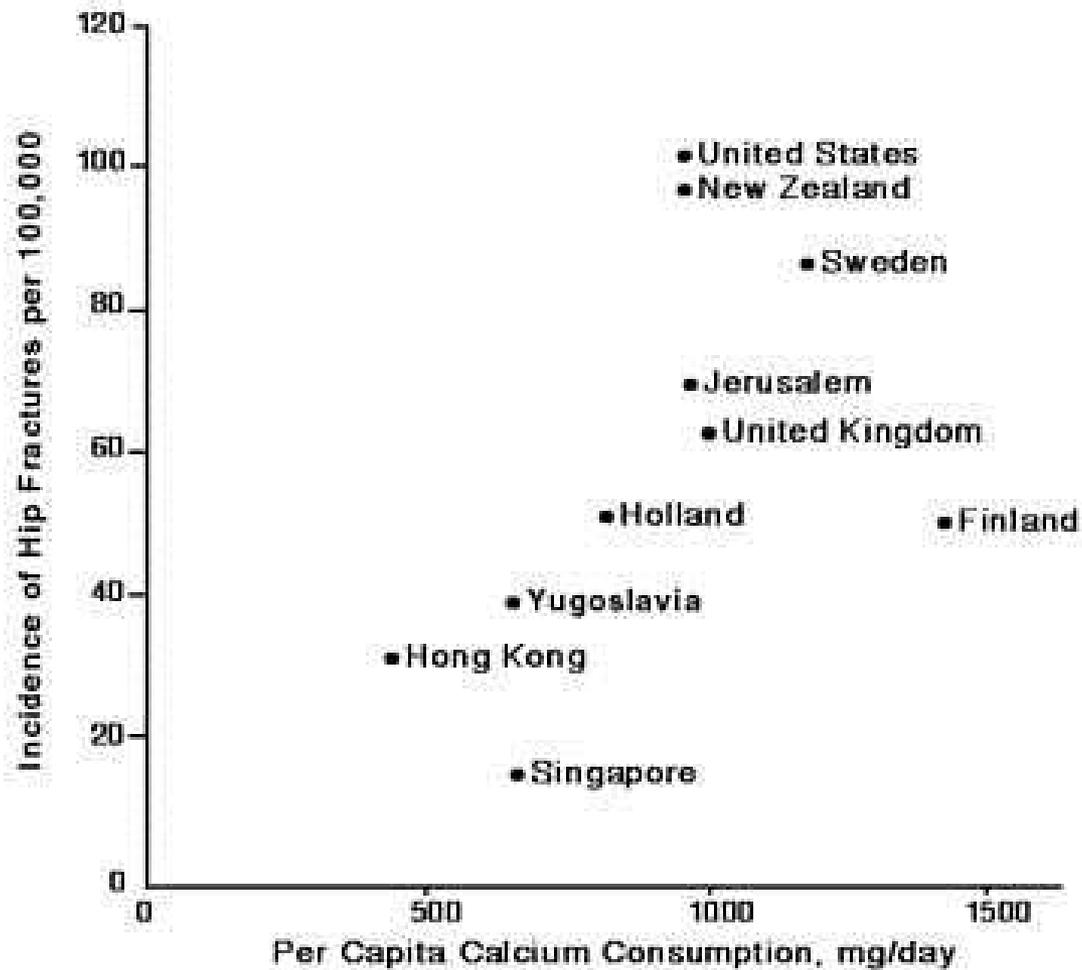


Figure: Hip fractures per calcium consumed.

Hegsted, D. M. (1986). Calcium and osteoporosis. *J Nutrition*, 116 (11), 2316- 2319.

Causal Relationship?

- ▶ Other factors may also be involved
 - Exercise vs. sedentary lifestyle
 - Types of foods eaten other than dairy
 - High-dairy nations usually high-meat as well
 - In Asian women, angulation of bones at hip joint makes hip fractures less likely than for others.
 - Brownbill, R. A., & Ilich, J. Z. (2003). Hip geometry and its role in fracture: what do we know so far? *Curr Osteoporos Rep*, 1(1), 25–31

Vitamin D

- ▶ Maintains correct blood calcium levels
- ▶ May have a role in cancer prevention
- ▶ Most natural source is sunshine
 - Light skinned people need 10–15 minutes of sunlight each day – face and hands exposed, with no SPF sunblock.
 - Darker skin >> 30 minutes a day
- ▶ SPF of 8 and above prevents Vitamin D production
- ▶ Wearing too much clothing, staying indoors, living in smoggy cities or at higher latitudes may incur need for supplements and fortified foods.

Vitamin D Supplements

- ▶ Unless a blood test shows deficiency, best to stay between 1000–2000 IU/day on supplements.
 - If deficient, can use higher doses until no longer deficient.
- ▶ Academy of Medicine puts safe upper limit at 4000 IU/day.
- ▶ Long-term safety of high doses not clear.
- ▶ Plant-based sources previously all D2 (irradiated yeast or mushrooms), not D3 (irradiated lanolin from sheep).
 - New vegan D3 sources now available (from lichens)

Building Strong Bones in Youth

- ▶ Lanou et al summary in *Pediatrics*, 2005
 - ▶ Exercise and vitamin D are key, along with vegetables and fruits
 - ▶ Let kids play in the sunshine.
 - ▶ Dairy not required, nor is excessive calcium.
- ▶ Lanou, A. J., et al (2005). Calcium, dairy products, and bone health in children and young adults: a reevaluation of the evidence. *Pediatrics*, 115(3), 736–743.



Iron

- ▶ Iron transports oxygen in the body, helps to regulate metabolism and resist infection
- ▶ Iron deficiency is common in athletes – especially endurance athletes
- ▶ Female athletes are at the highest risk
- ▶ Symptoms of iron deficiency can include fatigue, a weakened immune system and reduced ability to concentrate.
- ▶ Iron overload can increase diabetes, heart attack and cancer.

Iron Requirements

- ▶ Vegans need more milligrams per day of iron than others because of difference in absorption rates for heme (meat-based) iron and non-heme (plant-based) iron.
 - Women age 19 – 50 (33) 18 mg/day
 - Women over 50 (18) 8 mg/day
 - Men, all ages (18) 8 mg/day
- () = Academy of Medicine (1.8 times higher)
- ▶ Plant foods can provide all the iron you need.

Plant Sources of Iron

- ▶ Greens
- ▶ Beans, especially soy
- ▶ Molasses
- ▶ Web Page: [Iron in the Vegan Diet](#)

Factors That Aid Iron Absorption

- ▶ Foods that contain vitamin C:
 - Citrus
 - Melons, berries
 - Tomatoes and tomato juice
 - Broccoli, Brussels sprouts, cauliflower
 - Green and red peppers
 - Spinach, cabbage, turnip greens, other leafy greens
 - Sweet and white potatoes
 - Winter squash



Omega-3 Fatty Acids

- ▶ Anti-inflammatory
- ▶ Important for brain and nervous system function
- ▶ Heart protective
- ▶ Positive effects on blood pressure, immune function

Plant Sources of Omega-3 Fatty Acids

- ▶ Flax seeds
- ▶ Walnuts
- ▶ Hemp seeds
- ▶ Chia seeds
- ▶ Green leafy vegetables
- ▶ Can also consider additional supplementation