

Nutrition, Dietary Supplements and Their Relationship to Oral Health



Tieraona Low Dog, MD

Founder: Medicine Lodge Ranch

National Geographic's: *"Life Is Your Best Medicine," "Healthy At Home,"*
and *"Fortify Your Life"*

www.DrLowDog.com

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Tieraona Low Dog, M.D. Blog Books Resources Events Study with Tieraona Q

Helpful Health Resources



Medicine Lodge Ranch

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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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Nutrition Matters

- Oral cavity is **intersection of medicine and dentistry** and window into the general health of an individual..
- **>100 systemic diseases and upward of 500 medications have oral manifestations**, typically more prevalent in elders.
- **Diabetes bidirectional relationship with periodontal disease; inflammation** impairs body's ability to use **insulin** and high blood sugar provides **ideal environment for infection**, including gum infections. Strong evidence that **treating one condition positively impacts the other**.

Garton BJ. Root caries and diabetes: risk assessing to improve oral and systemic health outcomes. *Aust Dent J.* 2012;57(2):114-122.

Alpert PT. Oral health: the oral-systemic health connection. *Home Health Care Manag Pract.* 2017;29(1):56-59.

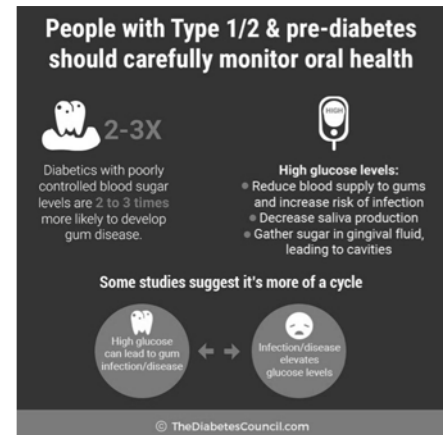
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Diabetes Matters to Us All

- “There is strong evidence that *people with periodontitis have elevated risk for dysglycemia and insulin resistance.*”
- *Periodontitis* associated with an *increased risk* of type 2 diabetes.”
- **Strong link between obesity and periodontal disease.**
- **Oral microbiota** significantly altered and **less diverse** in obese individuals compared to non-obese controls.



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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Obesity and Periodontal Disease

- There is **strong link between obesity and periodontal disease** in adults, children and various global geographic locations.
- NHANES: **overweight person with central obesity**, prevalence of **tooth loss increased 31%**, compared to person with similar BMI but no central obesity, and increased by **40%**, compared with **normal-weight person** without central obesity.
- **Oral microbiota** significantly altered and **less diverse** in obese individuals compared to non-obese controls.

Kang J, et al. Association between central obesity and tooth loss in the non-obese people: Results from the continuous National Health and Nutrition Examination Survey (NHANES) 1999-2012. *J Clin Periodontol* 2019 Feb 21. doi: 10.1111/jcpe.13091.

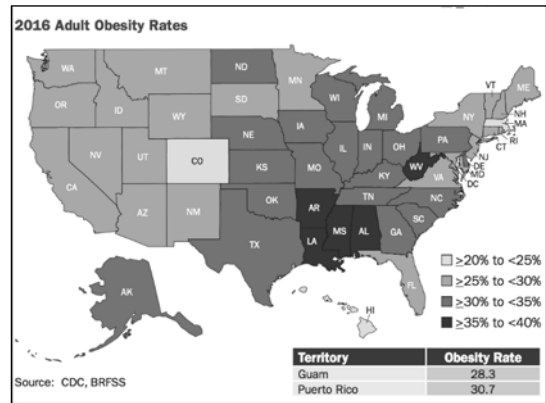
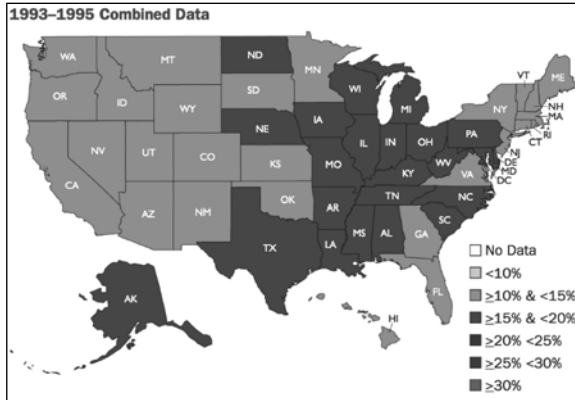
Tam J, et al. Obesity alters composition and diversity of the oral microbiota in patients with type 2 diabetes mellitus independently of glycemic control. *PLoS One*. 2018 Oct 1;13(10):e0204724.

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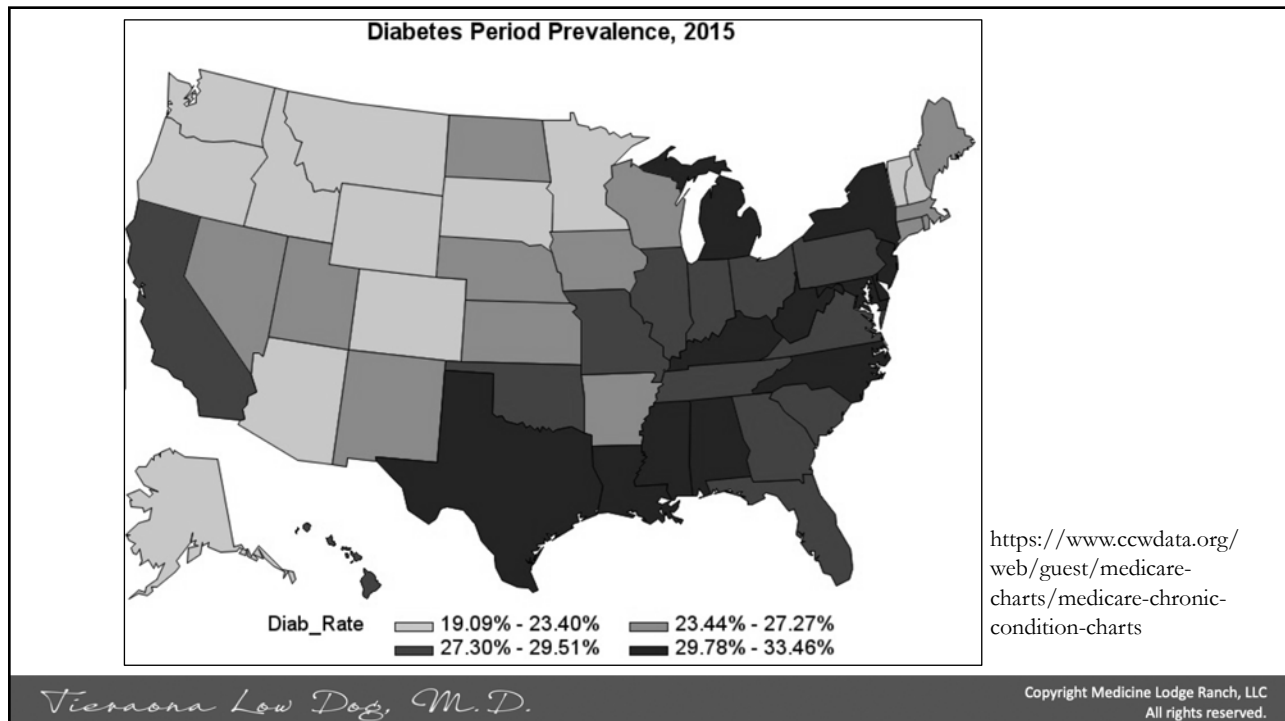
The Changing Landscape of Adult Weight



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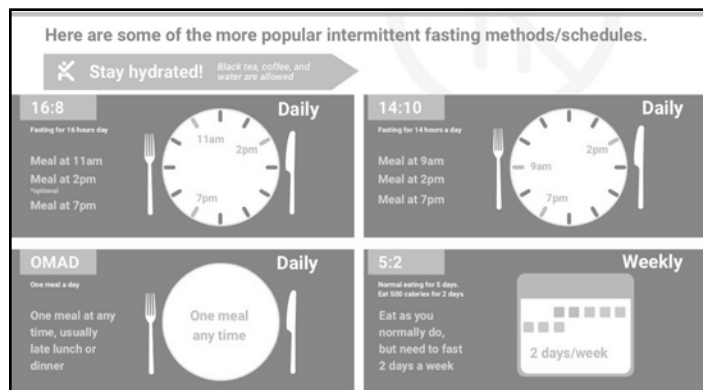
Intermittent Fasting

- In our development as a species, food sources were sometimes abundant and sometimes scarce.
- Periods of eating and periods of fasting probably the norm. Theory of thrifty genes states these fluctuations are required for optimal metabolic function.
- Intermittent fasting is one way to replicate this evolutionary pattern.
- Scientific evidence suggests our bodies respond to intermittent fasting in ways that may ultimately protect us from diseases of aging by improving cardiovascular and cognitive function, as well as risk factors for developing metabolic diseases.

Varady KA, et al. Alternate-day fasting and chronic disease prevention: a review of human and animal trials. *Am J Clin Nutr* 2007; 86(1): 7-13

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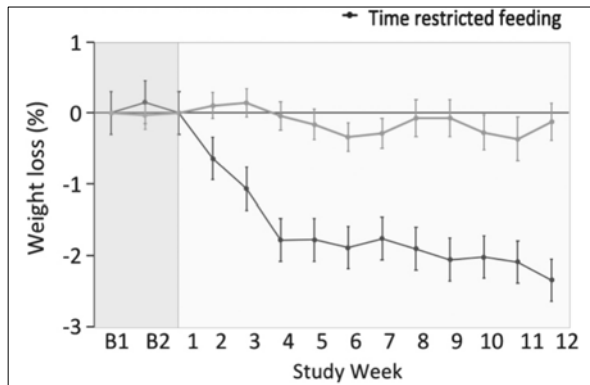
Intermittent Fasting

- There are many variations. Two of the most popular are:
 - 16/8 method – restrict the time you eat to 8 hours/day and fast for 16 hours in between
 - 5:2 diet– eat only 500-600 calories on two non-consecutive days, and eat normally the other five days

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Pilot Study: Intermittent Fasting 16:8



Gabel L, et al. Nutr Healthy Aging 2018; 4(4): 345-53

- 23 obese people 16:8 IF for 12 weeks, 23 matched controls.
- Two week baseline run-in.
- IF group had increased weight loss ($p < 0.001$), decreased total calories and lower systolic blood pressure, compared to controls.

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IF Impact on Metabolism



- IF lowers inflammatory mediators in healthy adults during Ramadan.
- Some studies show alternate day fasting improves insulin sensitivity, reduces triglycerides and increases HDL-C.
- More research needed.

Santos HO, et al. Impact of Intermittent Fasting on the Lipid Profile: Assessment Associated With Diet and Weight Loss. *Clin Nutr ESPEN* 2018; 24:14-21

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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).

- **100 healthy participants** 2 study arms tested FMD 5 consecutive days/mo. for 3 months.
 - **1100 calorie first day, 700 calories for 4 days (plant based, multivitamin).** Ate whatever they wanted rest of the month.
- **Reduced body weight, total body fat; lowered blood pressure, cholesterol, triglycerides and IGF-1.**
- **Effects noted 3 months AFTER study ended.**

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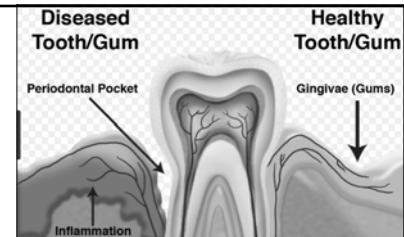
INFLAMMATION.....



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Inflammation and the Oral Cavity



- Inflammation and periodontal disease well established.
- **Dietary Inflammatory Index** based on measuring inflammation in the body in response to specific foods (1900 studies)
- Tobacco and alcohol major risk factors for oral and pharyngeal cancers, but in large cohort, **higher DII scores increased risk of oral/pharyngeal cancer.**
- NHANES – those with highest DII score had **16% more teeth lost compared to those with lowest scores.**

Shivappa N, et al. Inflammatory potential of diet and risk of oral and pharyngeal cancer in a large case-control study from Italy. *Int J Cancer* 2017; 141(3):471-479; Kotsakis GA, et al. Diet-borne systemic inflammation is associated with prevalent tooth loss. *Clin Nutr* 2018 Aug;37(4):1306-1312.

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Inflammatory Food Ratings

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

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

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[LEARN MORE](#)

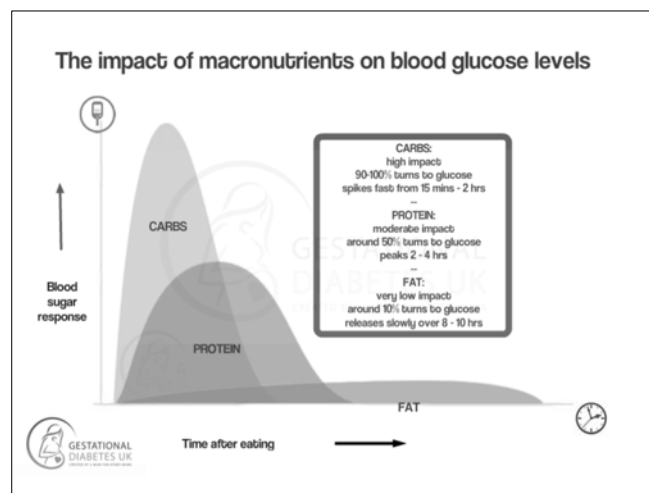
<https://imaginehealthy.org>

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Carbohydrates

- Provide majority calories most diets
 - Body's preferred fuel source
 - Largest contributor to the control of **blood sugar**
 - **Half** of carbohydrates in North American diet come from: bread, soft drinks, cakes, cookies, donuts, quick breads, sugars, syrups, jams, white potatoes (including chips) and breakfast cereal.

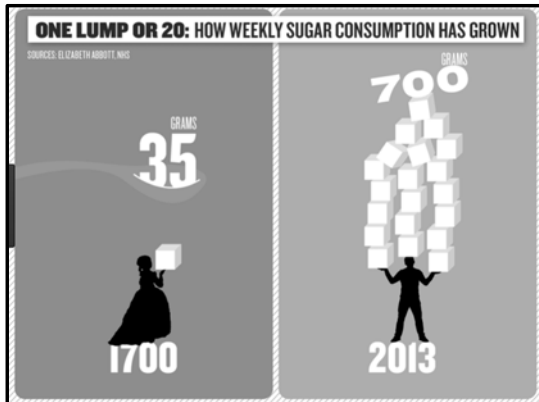


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Too Little Fiber, Too Much Sugar



Sugars contribute to dental caries and periodontal disease: bacteria ferment them and produce acid, demineralizing tooth structure.

Canadians average daily sugar intake:

- **101 grams (24 tsp) children 1-8 years**
- **115 grams (27 tsp) children 9-18 years**
- **85 grams (20 tsp) for adults - lower due to increase intake “diet” sodas.**

Langlois K, et al. Change in total sugars consumption among Canadian children and adults. *Health Rep* 2019 Jan 16;30(1):10-19.

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Glycemic Index/Load

- **Glycemic load** is measurement of impact of carbohydrates on *blood sugar/insulin*.
- International **consensus** conference concluded that given **consistency of scientific evidence**, diets **low in glycemic index/load** should be promoted in the prevention and management of *diabetes* and coronary heart disease, and are **particularly important** in individuals with insulin resistance.

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.

Low Glycemic Diet Calculator



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Glycemic Load

Individual Food Portion

Low	0-10
Moderate	11-19
High	20+

Whole Day

Low	< 80
Moderate	80-120
High	>120

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Food	Serving Size	Glycemic Load	Food	Serving Size	Glycemic Load
Grapefruit	½ large	3	Spaghetti	1 cup	38
Apple	1 medium	6	Brown rice	1 cup	23
Banana	1 large	14	White rice	1 cup	33
Raisins	1 small box	20	White bread	1 slice	10
Watermelon	1 cup	8	Whole grain bread	1 slice	5
Carrots	1 large	5	Bagel, cinnamon raisin	1 3.5 inch	24
Orange	1 medium	6	Pumpernickel bread	1 slice	6
Sweet potato	1 cup	17	Macaroni and cheese	1 cup prepared	31
Baked potato	1 medium	28	Chocolate doughnut	1 doughnut (80 g)	25
French fries	1 medium serving	26	Glazed doughnut	1 doughnut (80 g)	12
Snickers	1 bar	35	Kellogg's Frosted Flakes	¾ cup	20
Reese's cup	1 miniature	2	Kellogg's Special K	1 cup	14
White table wine	5 ounces	1	Post Bran Flakes	¾ cup	12
Red table wine	5 ounces	1	Post Raisin Bran	1 cup	25
Grape juice	6 ounces	12			

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Gluten

- Some people have an autoimmune condition known as celiac disease, where their immune system interacts negatively with gluten, a storage protein in cereal grains. The ONLY treatment is complete avoidance of gluten.
 - Celiac symptom checklist: (celiac.org/celiac-disease/resources/checklist/)
- Other individuals may be allergic to wheat, not all grains, just wheat. 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.....

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Foods to Avoid with Celiac

- Atta (chapatti flour)
- Barley (flakes, flour, pearl)
- Beer, ale, lager
- Breeding and bread stuffing
- Brewers yeast
- Bulgur
- Communion wafers
- Couscous
- Croutons
- Dinkel (also known as spelt) *
- Durum *
- Einkorn *
- Emmer *
- Farina
- Farro (also known as spelt) *
- Fu **

- Graham flour
- Hydrolyzed wheat protein
- Kamut *
- Malt, malt extract, malt syrup and malt flavoring, malt vinegar
- Malted milk
- Matzoh, matzoh meal
- Modified wheat starch
- Oatmeal, oat bran, oat flour and whole oats ***
- Pastas
- Rye bread and flour
- Seitan ****
- Semolina

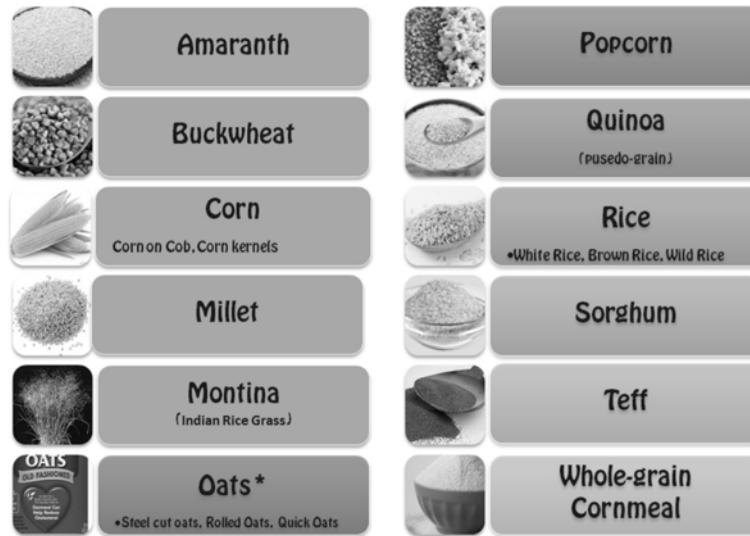
- Spelt (also known as farro or faro, dinkel) *
- Triticale
- Wheat bran
- Wheat flour
- Wheat germ
- Wheat starch
- *All types of wheat
- **Dried gluten product
- ***Often contaminated with wheat and barley
- ****Meat like dish made with gluten

From www.celiac.ca

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Gluten Free

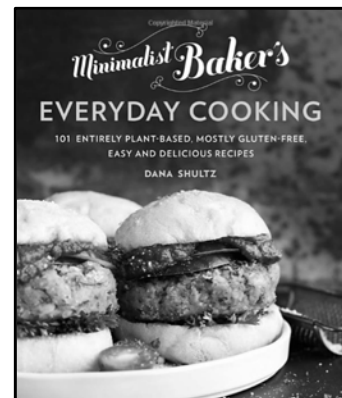
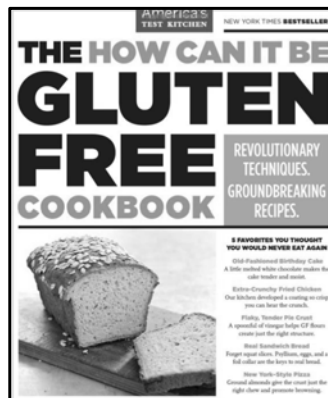
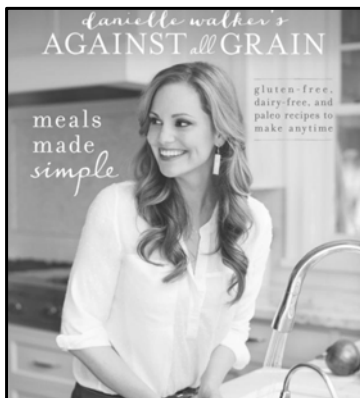


*May be contaminated with gluten; but oats are gluten-free, naturally.

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Some of My Favorite Gluten Free Cookbooks



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Nutrition Facts		
Serving Size 1/2 cup (40g)		
Servings Per Container 28		
Amount Per Serving		
Calories 190	Calories from Fat 90	
% Daily Value*		
Total Fat 10g		15%
Saturated Fat 5g		25%
Trans Fat 0g		
Cholesterol 15mg		5%
Sodium 115mg		5%
Potassium 60mg		2%
Total Carbohydrate 24g		8%
Dietary Fiber 1g		4%
Sugars 18g		
Protein 2g		
Vitamin A 4% • Vitamin C 2%		
Calcium 2% • Iron 8%		
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:		
	Calories:	2,000 2,500
Total Fat	Less than	65g 80g
Saturated Fat	Less than	20g 25g
Cholesterol	Less than	300mg 300mg
Sodium	Less than	2,400mg 2,400mg
Potassium		3,500 mg 3,500 mg
Total Carbohydrate		300g 375g
Dietary Fiber		25g 30g
Calories per gram:		
Fat 9 • Carbohydrate 4 • Protein 4		

Nutrition Facts		
Serving Size		1 1/4 Cup (58g)
Servings Per Container		About 6
Amount Per Serving		
Calories 180	Calories from Fat 15	
% Daily Value*		
Total Fat 2g		3%
Saturated Fat 0g		0%
Trans Fat 0g		
Polyunsaturated Fat 1g		
Monounsaturated Fat 0g		
Cholesterol 0mg		0%
Sodium 115mg		5%
Potassium 390mg		11%
Total Carbohydrate 40g		13%
Dietary Fiber 13g		52%
Soluble Fiber 1g		
Insoluble Fiber 12g		
Sugars 8g		
Protein 12g		17%
Vitamin A 0% • Vitamin C 0%		
Calcium 4% • Iron 10%		
Phosphorus 20% • Magnesium 15%		
* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.		
	Calories:	2,000 2,500
Total Fat	Less than	65g 80g
Sat. Fat	Less than	20g 25g
Cholesterol	Less than	300mg 300mg
Sodium	Less than	2,400mg 2,400mg
Potassium		3,500mg 3,500mg
Total Carbohydrate		300g 375g
Dietary Fiber		25g 30g
Protein		50g 65g

Carbs to Fiber Ratio

- Total carbs to dietary fiber
- Divide the **grams of carbohydrates by 10**.
- Corn flakes far left, Kashi GoRise cereal right.
 - >10:1 is poor
 - <10:1 is good
 - <6:1 is great

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Consider Ancient Grains



- Teff, einkorn, emmer, amaranth, millet, quinoa, black rice, black barley, and spelt.
- Generally, they have more protein, fiber, and vitamins than modern grains.
- People who do not have celiac but have wheat intolerance often can consume ancient grains.

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What is the Low FODMAP Diet?

- FODMAP are highly fermentable but poorly absorbed short-chain carbohydrates and polyols. Studies have shown that in some people, they can be a big cause of irritable bowel syndrome (IBS).
 - Gas, cramping, diarrhea
- Studies show that by eliminating wheat derivatives, lactose-containing dairy products, many vegetables and beans, and several types of fruits can improve IBS.

Barrett JS. *Journal of Gastroenterology Hepatology* 2017; Mar;32 Suppl 1:8-10.

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F	Fermentable: Fermentable carbohydrates are sugars that are broken down and digested by bacteria in our intestines, producing gas and other by-products.
O	Oligosaccharides: Oligosaccharides are short chains of carbohydrate molecules linked together. <ul style="list-style-type: none"> • Fructans (a chain of fructose molecules) and galacto-oligosaccharides (a chain of galactose molecules) are oligosaccharides that humans cannot break down and properly absorb in the small intestine.
D	Disaccharides: Disaccharides are two carbohydrate molecules linked together. <ul style="list-style-type: none"> • Lactose, the sugar found in milk and dairy products, is a disaccharide composed of glucose and galactose. Lactose must be broken down by the digestive enzyme lactase before it can be absorbed in the small intestine. In people with lactose intolerance, the level of lactase enzyme is insufficient to properly digest lactose and lactose travels to the colon where fermentation occurs.
M	Monosaccharides: Monosaccharides are single carbohydrate molecules. <ul style="list-style-type: none"> • Fructose, the sugar found in many fruits and some vegetables, is a monosaccharide and does not require any digestion before it is absorbed. When foods containing equal amounts of fructose and glucose are eaten, glucose helps fructose to be completely absorbed. However, when fructose is present in greater quantities than glucose, fructose absorption depends upon the activity of sugar transporters located in the intestinal wall. The ability to absorb excess fructose varies from person to person. In people with fructose malabsorption, the capacity of sugar transporters is limited and excess fructose travels to the colon where fermentation occurs.
A	And
P	Polyols: Polyols, or sugar alcohols, are a type of carbohydrate that humans can only partially digest and absorb in the small intestine. <ul style="list-style-type: none"> • Polyols, such as sorbitol, mannitol, xylitol, maltitol and isomalt, mimic the sweetness of sucrose (table sugar), however, because their absorption is much slower, only a small amount of what is eaten is actually absorbed. Polyols are often used as low-calorie sweeteners in sugar-free and diet products.

www.CDHF.ca

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LOW FODMAP GROCERY LIST

Always check ingredients on packaged foods to ensure they comply with the latest low FODMAP diet guidelines.

GRAINS Gluten free pasta (rice, quinoa, corn) Millet Oats Oat bran Polenta Quinoa (black, red, white) Rice (brown, white, basmati) Rice bran BRAND NAME CEREALS Ancient Harvest Quinoa Flakes Bob's Red Mill Highly Toasty Hot Cereal Cheerios Eden Organics Brown Rice Flakes Hot Cereal Envirokidz Gorilla Munch Envirokidz Peanut Butter Panda Puffs BREADS Udi's White Sandwich Bread Sourdough (white, wheat, goat) Food for Life Multi Seed English muffins Millet Bread Food for Life Brown Rice Tortillas Rudi's Flour Tortillas Corn tortilla FLOURS AND BAKING SUPPLIES Blukit, Gluten-free Pancake and Baking Mix Dark chocolate Flour (corn, millet, quinoa, sorghum, buckwheat, rice) King Arthur GF Multi-Purpose Flour Niponiste (perfect flour blend waffles & pancake mix, brownie mix, blonde mix, muffin mix) Pure Maple Syrup Starch (potato, tapioca, corn) Stevia Sugar (palm, brown, granulated) SPICES All spice Black pepper Cardamom Chili powder Chinese Five Spice Cinnamon Cloves Coriander Seeds Cumin Curry Powder Mustard Seeds Nutmeg Paprika Saffron Star Anise Turmeric PROTEIN Beef Chicken Fish Egg Pork Lamb Tuna (canned) Tofu (firm)	NUT BUTTER Smucker's Peanut Butter Sugar Peanut Butter Teddie Peanut Butter 363 Smooth Almond Butter (Whole Foods) NUTS/SEEDS (allow one handful per sitting) Almonds Brazil nuts Chestnuts Chia seeds Macadamias Peanuts Pecans Pine nuts Poppy seeds Pumpkin seeds (pepitas) Sesame seeds Sunflower seeds Walnuts PRODUCE VEGETABLES Alfalfa sprouts Asparagus Bamboo shoots Bean sprouts Beets (limit to 4 slices) Bok choy Bell pepper Broccoli (limit 1/2 cup) Bok Choy Carrots Capers Cabbage (common, red) Corn (half a cob) Celeriac Celery (1/4 stalk) Chives Chili pepper Collard greens Cucumber Eggplant Endive Fennel bulb Ginger Green beans Kale Kabocha squash Leek (green leaves only) Lettuce Olives (green, black) Parsnip	Potato, white Radish Rutabaga Scallions (green part only) Spinach Seaweed (nor) Summer squash Sweet potato (limit to 1/2 cup) Swiss chard Turnips Water chestnuts Zucchini FRUIT (limit to one serving per meal) Avocado (limit to 1/8) Banana (frozen) Blueberries Cantaloupe Coconut Clementine Dragonfruit Grapes Honeydew melon Kiwifruit Lemon Lime Orange Papaya Passion fruit Pineapple Plantain Raspberries Rhubarb Strawberry Tangerine HERBS Basil Cilantro Lemongrass Rosemary Parsley Tarragon Thyme DAIRY CHEESE Cheddar Swiss Colby Monterey Goat Havarti Brie Camembert Mascarpone MILK Lactose free Coconut milk (canned only) Almond milk Hemp milk YOGURT/KEFIR Green Valley lactose free yogurt Lifeway kefir (plain only)	OILS/CONDIMENTS Avocado oil Butter (sticks and spreadable) Canola oil Coconut oil Dairy blend (70% butter, 30% oil) Extra virgin and virgin olive oil Olive oil Peanut oil Rice bran oil Sesame oil Sunflower oil Vegetable oil JAMS/SPREADS Fish Sauce Marmalade jam Mayonnaise Miso Paste Mustard Oyster sauce Rice wine vinegar Sarabeth's (Cranberry Relish, Strawberry Rhubarb Spreadable Fruit) Soy sauce Wasabi SNACKS+SWEETS Almond (almond horn cookies, peanut butter cookies) Barney Butter snack pack (smooth, raw+chia, cocoa+coconut) Blue Diamond Almond Nut Thins Gilbert's Super Dooper Snickerdoodles Sensational Sugar cookies Ginnybakes (chocolate chip love + buttercrisp love mini cookies) Justin's dark chocolate peanut butter cups Kettles Baked Potato Chips (sea salt) Keto frozen dessert (chocolate, coconut) Laki rice crackers Lundberg Rice Chips (sea salt) Mary's Gone Crackers (original) Rice Cakes Simply gum (mint, cinnamon, ginger) Snyder's Of Pretzels Tortilla Chips 88 Acres dark chocolate sea salt bars BEVERAGES Cranberry Juice (100%, containing no HFCS) Tea (black, green, peppermint, white) Water
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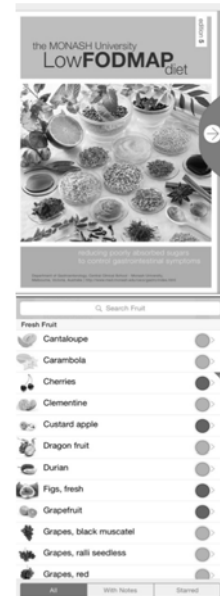
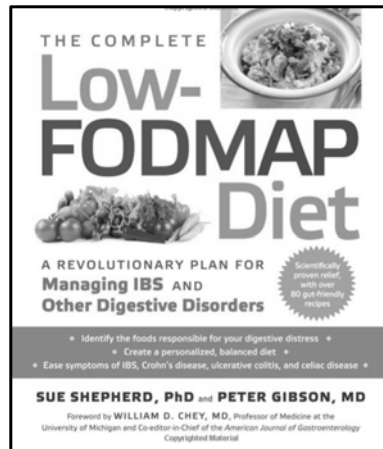
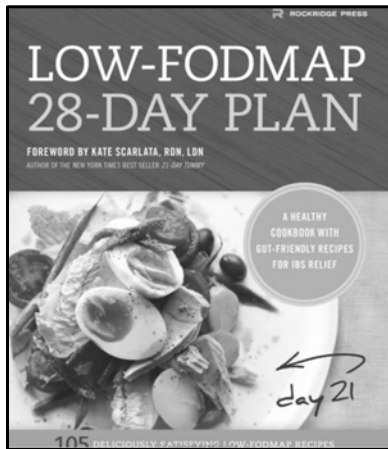
References: Packaged Food Ingredients list, USDA National Nutrient Database, National Library of Medicine, MedlinePlus, The University of Toronto, Food and Drug Administration, and other reliable sources. The information is for informational purposes only and is not intended to be used as a substitute for professional medical advice. Always consult your healthcare provider for more information. Please consult your healthcare provider for more information.

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Great Resources

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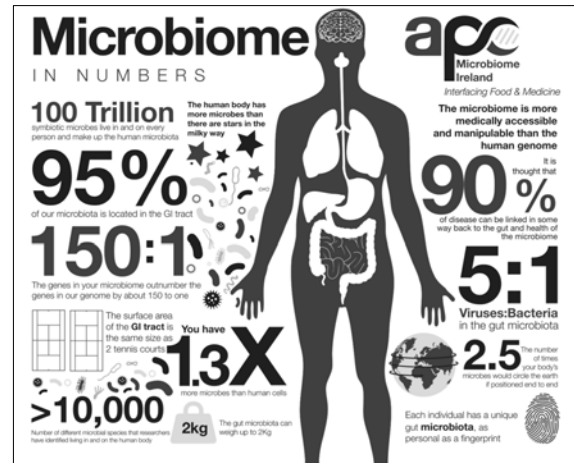


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Definitions

- *Microbiome*—collective genomes of microorganisms in particular environment
- *Microbiota*—community of microorganisms themselves.
- Lower diversity is marker of *dysbiosis* (microbial imbalance) in gut and is associated with autoimmune disease, obesity, metabolic conditions, and is common in elders.



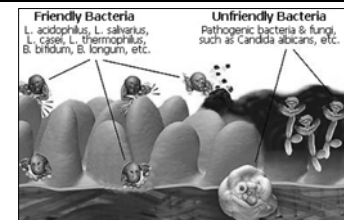
Valdes AM, et al. *BMJ* 2018;361:k2179

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Microbiota.....

- **Train and modulate immune system** (e.g., skin, gut)
- **Convert skin oils** to compounds that keep **skin supple and lower pH**
- **Block adhesion and suppress growth of pathogenic bacteria**
- Break down carbs and **make n-butyrate, energy** for intestinal cells but also crucial for maintaining **tight junctions** to **reduce permeability**.
- Make **ARA and DHA**, signal brain cells to divide (infants). Gut and brain neurons communicate. Gut microbes make serotonin, melatonin, GABA, and others.
- **Produce vitamins** and assist in building **amino acids**.
- Help maintain **blood pressure** (complex carbs → formate → impact salt processing)



Wilkins T, et al. Probiotics for Gastrointestinal Conditions: A Summary of the Evidence. *Am Fam Physician* 2017 Aug 1;96(3):170-178.

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It's the Fiber Folks!



- Diets **high in fiber** and **low in sugar** increase *Bifidobacteria*, preventing toxins from passing through **intestinal wall** into **bloodstream**.
- Prebiotics: **un-digestible plant fiber** acts as food for microbiota.
- Bananas, onions, garlic, leeks, Jerusalem artichoke, apple skin, chicory root, dandelion greens, beans, wheat flour just a few examples of prebiotic foods.

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Obesity and Microbiota?

- **Early disruption** of gut microbiota (C-section, antibiotics) = **too few** *Bifidobacteria* can contribute to obesity.
- **Diet high in sugar, simple carbs, and fat** encourages growth of microbes better at **extracting** energy from food, signaling body to store energy as fat.
- Bacteria transplanted from overweight mice to thin mice make the thin mice gain weight.



Federico A, et al. Gut microbiota, obesity and metabolic disorders. *Minerva Gastroenterol Dietol* 2017;63(4):337-344.

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Sugar Substitutes – Better?



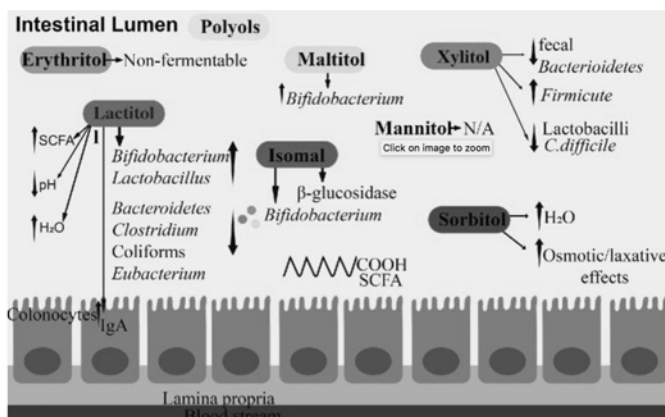
Nettleton JE, et al. Reshaping the gut microbiota: Impact of low calorie sweeteners and the link to insulin resistance? *Physiol Behav* 2016;164(Pt B):488-93.

- Sugar substitutes frequently **1000 times sweeter** than sucrose.
- Despite GRAS status by regulatory agencies, sugar substitutes **can have negative effects** on gut microbiota.
- **Sucralose and saccharin disrupt** balance and **diversity** of gut microbiota. **Sucralose increases bacterial pro-inflammatory genes.**

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Stevia and the Polyols



Ruiz-Ojeda F, et al. Effects of sweeteners on the gut microbiota: a review of experimental studies and clinical trials. *Adv Nutr* 2019; 10(S1): PMC6363527

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Impact of Certain Diets

- 21 healthy people had substantially **different gut microbiota** profiles after four weeks on **gluten-free** diet; **significant reduction** in key beneficial microbe species.
- Low FODMAP diets lead to **significant reduction in Bifidobacterium** and **profound changes in the microbiota and metabolome**; duration and clinical relevance are not known.



Bonder MJ, et al. The influence of a short-term gluten-free diet on the human gut microbiome. *Genome Med* 2016;8:45
 McIntosh K, et al. FODMAPs alter symptoms and the metabolome of patients with IBS: a randomised controlled trial. *Gut* 2017;66:1241-51.

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THE BENEFITS OF FERMENTED FOODS

BY APAGE

WHY EAT FERMENTED FOODS?

<p>ENZYMES</p> <p>Increased enzyme content helps you absorb nutrients, reducing the need for vitamins and supplements.</p>	<p>PROBIOTICS</p> <p>These good bacteria help restore balance in the gut and aid digestion and immune health.</p>	<p>SAFETY</p> <p>The lactic acid created during the fermentation process kills E. coli, making it safer to consume than raw vegetables.</p>	<p>PRESERVATION</p> <p>The lacto-fermentation process stores food longer than canning without depleting nutrients.</p>	<p>NUTRITION</p> <p>The fermentation process increases the nutritional value by enriching certain nutrients.</p>
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<https://irishhealthstores.com/news-events/fermented-foods/>

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Table 1 | Examples of foods, nutrients, and dietary patterns that influence human health linked to their effects

Dietary element	Effect on gut microbiome	Effect on health outcomes mediated by gut microbiome
Low FODMAP diet	Low FODMAP diet increased Actinobacteria; high FODMAP diet decreased abundance of bacteria involved in gas consumption ⁵⁸	Reduced symptoms of irritable bowel syndrome ⁵⁶
Cheese	Increased <i>Bifidobacteria</i> , ^{97,98} which are known for their positive health benefits to their host through their metabolic activities. ⁹⁹ Decrease in <i>Bacteroides</i> and <i>Clostridia</i> , some strains of which are associated with intestinal infections ⁹⁸	Potential protection against pathogens. ¹⁰⁰ Increased production of SCFA and reduced production of TMAO ⁹⁹
Fibre and prebiotics	Increased microbiota diversity and SCFA production ^{22,101,102}	Reduced type 2 diabetes ²² and cardiovascular disease ¹⁰³
Artificial sweeteners	Overgrowth of Proteobacteria and <i>Escherichia coli</i> . ¹⁰⁴ <i>Bacteroides</i> , <i>Clostridia</i> , and total aerobic bacteria were significantly lower, and faecal pH was significantly higher ⁴⁷	Induced glucose intolerance ¹⁰⁵
Polyphenols (eg, from tea, coffee, berries, and vegetables such as artichokes, olives, and asparagus)	Increased intestinal barrier protectors (<i>Bifidobacteria</i> and <i>Lactobacillus</i>), butyrate producing bacteria (<i>Faecalibacterium prausnitzii</i> and <i>Roseburia</i>) and <i>Bacteroides vulgatus</i> and <i>Akkermansia muciniphila</i> . ¹⁰⁷ Decreased lipopolysaccharide producers (<i>E coli</i> and <i>Enterobacter cloacae</i>) ¹⁰⁶	Gut micro-organisms alter polyphenol bioavailability resulting in reduction of metabolic syndrome markers and cardiovascular risk markers ¹⁰⁸
Vegan	Very modest differences in composition and diversity in humans and strong differences in metabolomic profile compared with omnivore diet in humans ⁵⁰	Some studies show benefit of vegetarian over omnivore diet, ¹⁰⁹ others fail to find a difference ¹¹⁰

Valdes AM, et al. Role of gut microbiota in nutrition and health. *British Medical Journal* 2018;361:j2179

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Fish and Seafood



- Excellent source of protein high in **omega 3 fatty acids**. Provide **vitamin D** and **contribute valuable nutrients: selenium, iodine, magnesium, iron and copper.**
 - Fish/seafood have **positive effect on oral health**
 - **Help reduce atherosclerosis and maintain healthy blood pressure**
 - **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.**
 - **Quells inflammation**

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Protein

- Study conducted in Denmark suggested an **inverse relationship between high protein intake and periodontitis.**

- Adegboye AR, et al. Calcium, vitamin D, casein and whey protein intakes and periodontitis among Danish adults. *Public Health Nutr.* 2016;19:503–510. doi: 10.1017/S1368980015001202.

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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Protein Maintains Healthy Bones

- Framingham Osteoporosis Study: **higher protein intakes** (60-83g/d versus 46g/d) in men/women (mean 75 years) associated with **37% decreased risk of hip fracture.**
- Systematic review **29 studies:** **protein intakes above current RDA have beneficial role in preventing hip fractures and BMD loss.**



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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Protein Intake and Fracture in Men

- **Osteoporotic Fractures in Men Research** (5,875 men; mean age 73.6 years), **higher protein** intake associated with **8% decreased risk of major osteoporotic fracture**.
- Increased **dairy protein** associated with **20% decreased risk**, and **non-dairy animal protein** with a **16% decreased risk**, of hip fracture.
- **Plant protein was not associated** with decreased risk of hip fracture in men.



Langsetmo L, et al. The Association Between Protein Intake by Source and Osteoporotic Fracture in Older Men: A Prospective Cohort Study. *J Bone Miner Res* 2017; Mar;32(3):592-600

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Eggs Primary Source of Choline

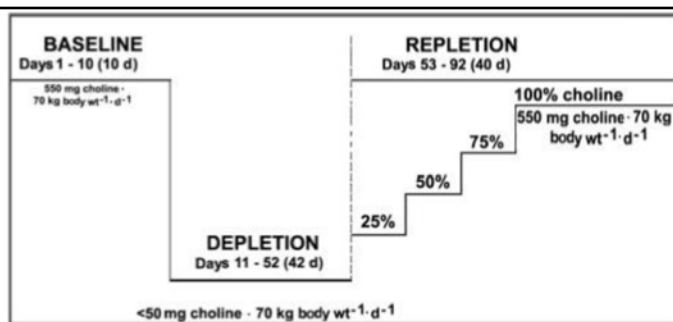
- Choline water soluble nutrient in B-vitamin family necessary for preventing non-alcoholic fatty liver disease and crucial during pregnancy and early childhood.
- Deficiency in pregnancy may be associated with permanent changes in brain function that negatively impact intelligence, memory, mood regulation, and stress response in baby.
- New DV set by FDA in 2016: 550 mg per day



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

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- 57 healthy adults 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.
- Liver dysfunction corrected when choline was reintroduced into diet.

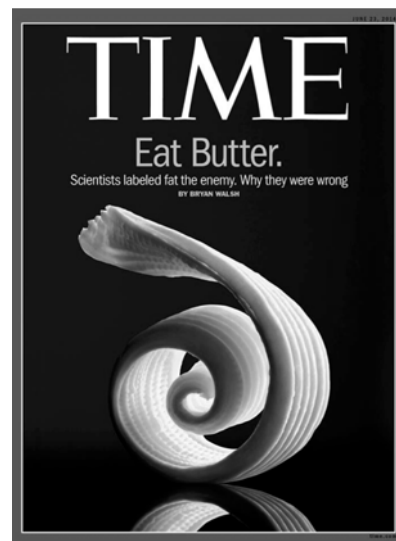
Fischer LM, et al. *Am J Clin Nutr*. 2007;85(5):1275-1285.

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Saturated Fat Debate

- Three large meta analyses (21 studies, 12 studies, and 76 studies) **failed to show significant evidence that saturated fat increases risk for heart disease.**
- Failed to find significant evidence that **increasing polyunsaturated fats and decreasing saturated fats lowers heart risk.**
- ***This does not mean gorging on saturated fats....***



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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Dietary Fat and Cancer: Systematic Review

- **No associations** found for prostate, esophageal, gastric, renal, bladder, lung, skin, or postmenopausal breast cancer by **total intake or types of dietary fat**.
- **May be an association between total dietary fat and premenopausal breast cancer.**
- Limited-suggestive evidence positive association for **ovarian CA** with intake of saturated fats.

Schwab U, et al. *Food Nutr Res* 2014; 10:58. doi: 10.3402/fnr.v58.25145.

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Keto Diet: Clinical Trial

- **RCT women with ovarian or endometrial cancer** randomly assigned to ketogenic diet (**70:25:5** energy from fat, protein, and carbohydrate) or American Cancer Society diet (high-fiber, low-fat).
- **Body composition, fasting serum insulin and IGF-I** obtained at baseline and at end of 12 weeks.
- Those on keto diet **had statistically significant reduction in fasting insulin and IGF-1 levels, and greater reduction in visceral fat.**

Cohen CW, et al. A Ketogenic Diet Reduces Central Obesity and Serum Insulin in Women with Ovarian or Endometrial Cancer. *J Nutr* 2018; 148(8):1253-1260.

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The Uncertainty of Science

- Recent review: 61 articles; 55 cohorts, 4.2 million participants.
 - Low-certainty evidence: reduction in unprocessed red meat intake of 3 servings/week associated with very small reduction in risk for cardiovascular mortality, stroke, heart attack and type 2 diabetes.
- Review: 118 articles, 56 cohorts, >6 million participants
 - Possible absolute effects of red and processed meat consumption on cancer mortality and incidence are very small; certainty of evidence is low to very low.

Zeraatkar D, et al. Red and Processed Meat Consumption and Risk for All-Cause Mortality and Cardiometabolic Outcomes: A Systematic Review and Meta-analysis of Cohort Studies. *Ann Intern Med.* 2019. DOI: 10.7326/M19-0655

Han MA, et al. Reduction of Red and Processed Meat Intake and Cancer Mortality and Incidence: A Systematic Review and Meta-analysis of Cohort Studies. *Ann Intern Med.* 2019. DOI: 10.7326/M19-0699

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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 **vitamin C deficiency**
- 13% of Latinas and 16% of African American women (ages 12-49) are **iron deficient**
- Women **25-39** overall have **borderline iodine insufficiency**



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

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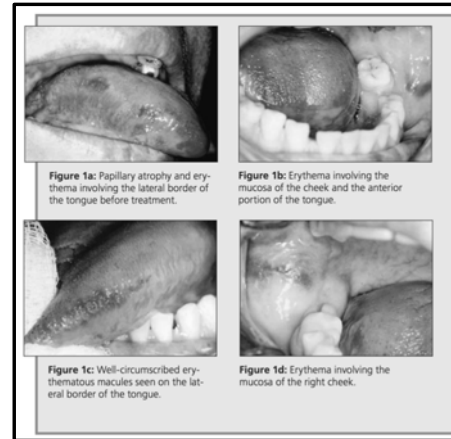
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Case: 41-year old Female

- **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. Vegan for 2.5 years.** No significant medical or dental history.

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



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Laboratory Tests & After Treatment

Test	Normal range (female)	Patient's values
RBC count (cells/ μ 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.



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

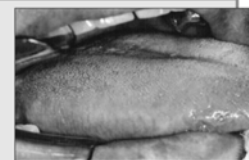


Figure 2b: Absence of papillary atrophy and erythema previously seen on the lateral border of the tongue.



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

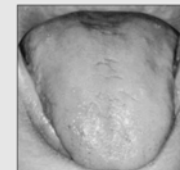
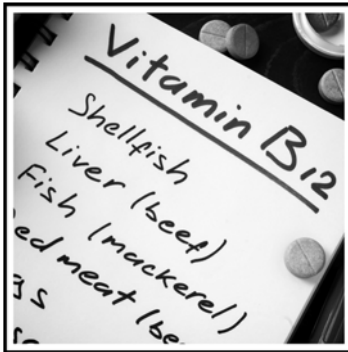


Figure 2d: Complete tissue regeneration on the tongue after treatment.

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Vitamin B12 Deficiency



Bird JK, et al. *Nutrients* 2017; doi: 10.3390/nu9070655
 Jung SB, et al. *Intern Med J* 2015; 45(4):409-16.
 Out M, et al. *J Diabetes Complications* 2018; 32(2):171-178.;
 Niafar M, et al. *Intern Emerg Med* 2015; 10(1):93-1026

- Institute of Medicine recommends adults > 50 yrs get B12 from **fortified foods/supplements**
- Deficiency: **tingling/numbness** in hands and feet, **fatigue**, shortness of breath, **loss of appetite**, **joint pain**, **depression**, **loss of taste and smell**, **cognitive impairment**, and **dementia**.
- 2015 meta-analysis: **80% increased risk B12 deficiency after 10 months of regular PPI use.**
- Meta analysis 29 studies: **245% increased risk B12 deficiency metformin use. Low B12 shown to increase progression of diabetic neuropathy.**

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Proton Pump Inhibitors and Fracture



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

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

Wang L, et al. Proton Pump Inhibitors and the Risk for Fracture at Specific Sites: Data Mining of the FDA Adverse Event Reporting System. *Sci Rep* 2017 Jul 17;7(1):5527.

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

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Vitamin B6

(Pyroxidal-5-Phosphate)

- Involved in production of **serotonin, dopamine, melatonin, hemoglobin, protein metabolism, energy production**, and more.
- Deficiency: **depression; impaired cognition, attention, memory, and sleep.**
- **OTC analgesics and OCPs** lower B6 levels.
- 30 million Americans deficient in B6.
- Vancouver BC; **12.4% prevalence** of B6 deficiency and suboptimal status in women 19-32 years of age.
- 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
 Ho CL, et al. *Nutrients* 2016; Sep 1;8(9).

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A **26-year old African American woman** comes in for her routine dental exam. She mentions that **she craves ice all the time**, even in the winter. Dentist notes **generalized oral mucosal atrophy and pallor**. What nutrient deficiency is most likely?

- Folate
- Iron
- Calcium
- Selenium

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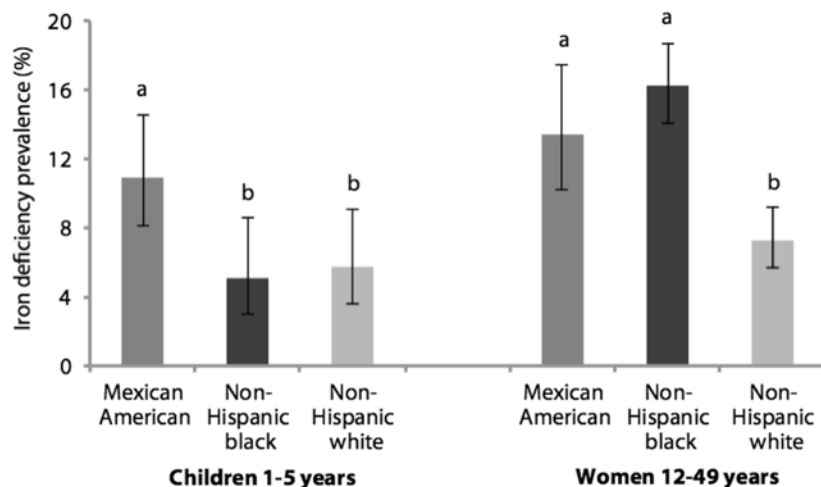


Figure H.3.a. Age-adjusted prevalence estimates of low body iron stores (<0 mg/kg) in U.S. children and women by race/ethnicity, National Health and Nutrition Examination Survey, 2003-2006.

Error bars represent 95% of confidence intervals. Bars are not sharing a common letter differ within children and women ($p < 0.05$). Age adjustment was done using direct standardization.

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- Marked differences between women in menstrual blood loss (10-250 mL per menses).
- Low iron levels *are the most common cause of anemia* in adolescent girls and can be very detrimental to *mood and cognition*, as well as *physical* well-being.
- Heavy menstrual bleeding is a significant risk for iron deficiency and is often overlooked.
- Data from cycle 2 (2009 to 2011) of Canadian Health Measures Survey, depleted iron stores were found in **13% of females aged 12-19 and 9% of females aged 20 -49.**

Iron



Blitzer J, et al. *Gynecol Endocrinol* 2014;30(8):542-8.
Nelson AL, et al. *Am J Obstet Gynecol* 2015; 213(1):97.e1-6.
Cooper M, et al. *Health Rep* 2012;23(4):41-8.

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To Get 18mg of Iron in Food

- 4 cups of raisins
- 3-5 cups instant oatmeal
- 3 cups Special K cereal**
- 3 cups cooked lentils
- 2.2 cups canned white beans
- 10 ounce beef liver
- 45 ounce chicken breasts
- 15 cups broccoli OR
- 3 cups cooked spinach



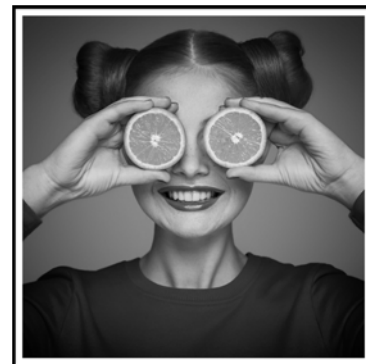
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- Potent antioxidant, **activates folate, cofactor in synthesis of carnitine, thyroxine, serotonin, norepinephrine, dopamine and immune cells**
- Levels **decline rapidly** during periods of **emotional/physical strain, and illness.**
- Deficiency: 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.

Vitamin C



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

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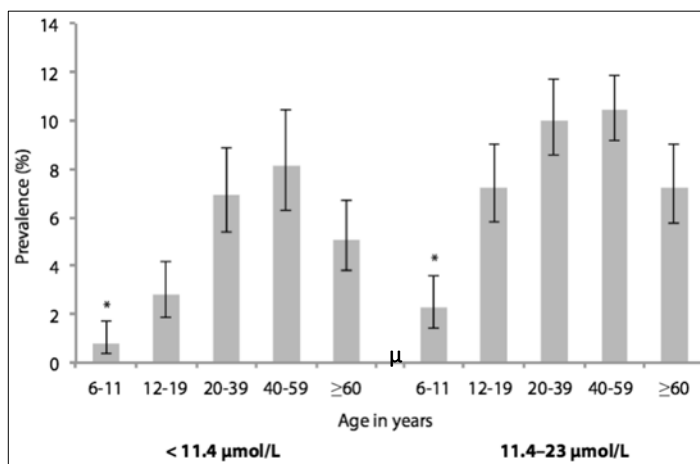


Figure H.1.f. Prevalence estimates of vitamin C deficiency (serum concentrations less than 11.4 µmol/L) and low vitamin C concentrations (11.4-23 µmol/L) in the U.S. population aged 6 years and older by age group, National Health & Nutrition Examination Survey, 2003-2006.

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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Calcium and Vitamin D: Fracture

- Meta-analysis National Osteoporosis Foundation: eight studies (n= 30,970 participants): ***all studies showed calcium plus vitamin D supplementation produced statistically significant 15 % reduced risk of total fractures and 30% reduced risk of hip fractures.***
- **Calcium, vitamins D, K2 and magnesium** contribute independently and collectively to bone health.



Weaver CM, et al (2016). Calcium plus vitamin D supplementation and risk of fractures: an updated meta-analysis from the National Osteoporosis Foundation. *Osteoporosis Int*, 27: 367-376

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Many of Us Are Deficient

- Serum 25(OH)D level used to evaluate high-risk folks
 - **Insufficiency defined as 21-29 ng/mL**
 - **Deficiency defined as <20 ng/mL**
- **66.8 million Americans** 1 year and older vit D levels between 12-20 ng/ml
- **23 million Americans** 1 year and older vit D levels less than 12 ng/ml

CDC 2nd National Report on Biochemical Indicators of Diet and Nutrition in the U.S. Population
J Clin Endocrinol Metab 2011; 96(7):1911-30

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Vitamin D and Respiratory Infection



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

- Acute respiratory infection kills **~2.65 million people/year**.
- **25 eligible randomized controlled trials (n=10,933, aged 0-95 years).**
- Vitamin D supplementation **reduced risk of acute respiratory infection** among all participants (NNT=33) and **those who were vitamin D deficient experienced the most benefit (NNT=4).**

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- Low magnesium associated with type 2 diabetes, metabolic syndrome, inflammation, high blood pressure, atherosclerotic vascular disease, sudden cardiac death, osteoporosis, migraine headache, asthma, and colon cancer.
- **Insulin resistance decreases magnesium levels and diabetics with low magnesium show more rapid disease progression and increased risk for diabetes-related complications**
- **Many benefit from 200-300 mg/d**

Magnesium



Rosanoff A, et al. *Nutr Rev* 2010;70(3):153-64
Bertinato J, et al. *Nutrients* 2017 Mar; 9(3): 296

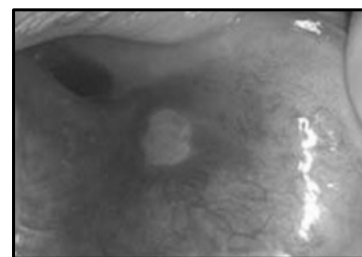
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Zinc and Oral Health

- Zinc necessary for **sense of smell, which accounts ~80% of sense of taste.**
- Zinc can help protect taste changes **in those undergoing chemotherapy or radiation.**
- “moderate quality evidence zinc supplements **improve overall taste improvement in patients with zinc deficiency/idiopathic taste disorders.**”
- Zinc deficiency detected in **28% of recurrent aphthous stomatitis patients compared to controls.**



Nagraj SK, et al. *Cochrane Database Syst Rev* 2014; 2014 Nov 26;11:CD010470.
Ozler GS. *J Laryngol Otol* 2014; 128(6):531-3
Najafizade N, et al. *J Res Med Sci* 2013; 18(2):123-6

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Resources

- *Fortify Your Life*, Tieraona Low Dog, MD with National Geographic
- Dietary Supplement Label Database: dslid.nlm.nih.gov
- NIH National Center for Complementary and Integrative Health (NCCIH): nccih.nih.gov
- Office of Dietary Supplements: ods.od.nih.gov
- Linus Pauling Institute: lpi.oregonstate.edu
- Consumer Labs: www.ConsumerLabs.com
- Natural Medicines Comprehensive Database: NaturalDataBase.com

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