How Not to Die

Book by Michael Greger

This summary by Allen Cheng

Picture the end of your life. Do you want to die from heart disease? Cancer? Diabetes?

I certainly don't. In How Not to Die, Michael Greger argues that a plant-based, whole-food diet has been scientifically shown to reduce the most common diseases leading to death.

Citing thousands of references from scientific literature, Greger covers the top 15 causes of death (from heart disease to Parkinson's) and describes how diet can reduce each cause of death. He then gives his recommendation for "The Daily Dozen" foods to eat to maximize health benefits.

In this summary of How Not to Die, I'll start with the main points of the book, as well as my major criticisms. Then we'll work chapter by chapter, disease by disease, and end with his top daily diet recommendations.
Main Points of *How Not to Die*

- Diet is the #1 contributor to global disease burden, even beyond smoking
- A plant-based, whole-food diet has been shown to decrease your likelihood of getting a panel of diseases
- Genetics only explains a small portion of disease inheritance, in most cases - a large portion of disease is under your control
- **Diet can reverse disease,** not just halt it. It's not too late if you already have heart disease or diabetes
- Preventing disease is better than treating it. Drugs have side effects, and some disease is irreversible
- In studies, are vegetarians healthier solely because they tend to be skinnier? No - in population studies, **plant-based diets show lower mortality even controlling for BMI,** wealth, and other confounding factors
- Supplementation doesn’t cover the entire effect of whole foods (like fiber and other micronutrients). Supplement extracts also have risk of contaminants and toxicity. Better to eat whole foods
- Meat itself seems negatively correlated with health and mortality, even controlling for vegetable intake. In other words, if group 1 eats vegetables, and group 2 eats the same amount of vegetables but adds meat, group 2 shows higher mortality and risk of disease.
- Why does plant-based diet improve health? Humans evolved over millions of years eating primarily vegetables, so many of our biological responses to food were wired to prehistoric diets. Processed foods now contain much more fat, sodium, and caloric density than we evolved eating. Our normal biological processes haven't adapted to surviving on modern diets
- Modern foods are so nutrient dense that they amplify the dopamine reward circuit. After eating ice cream, ordinary mangos are nowhere near as enjoyable. By eating whole foods, you can reset this sensitivity. See more on [how habits are formed](#)
- Regulation of food is often strongly influenced by industry. Just like how the tobacco industry fought to show smoking didn’t cause cancer, there is a strong agriculture lobby promoting meat and processed foods

**My Complaints about *How Not to Die***

*How Not to Die* contains many good ideas, and it's one of the most rigorously cited mass-market books I've seen.

That said, because it's written for a wide audience and doesn't want to bog readers down in scientifically precise language, Michael Greger sometimes cuts corners on his claims. Here are my major complaints:

- **The magnitude of effects is important.** Does eating organic blueberries have a 5% effect or a 50% improvement of health, compared to conventionally grown blueberries? Does meat eating cost 1 year of life, or 5 years? Often Greger simply says the difference "is significant" - but this is a statistical term, which laymen may misconstrue as "the difference is huge." I find he does this more when the difference is small (below 5%). When the difference is big, he'll use the actual number ("a 20% difference!"). This is misleading and over-represents the effects of some diet choices.
• Whenever Greger says something has "up to a [X%] difference", this is misleading. When doing statistical analysis, science uses confidence intervals - "the effect can be as low as 1%, as high as 10%, and an average of 5%." Greger would sometimes represent this to mean "up to 10% improvement." This is misleading as it over-represents the likely effect.

• Many of the underlying cited studies are questionable in scientific rigor – small sample sizes, unclear controls, unclear selection of patient group, sometimes funded by agricultural groups, only one study done. Remember that all scientists have an agenda and naturally bias toward publishing positive results. But based on a single study, he might say confident blanket statements like “citrus protects DNA from damage.” By far the most convincing studies are large population studies, or large randomized controlled trials, which I highlight below.

• Occasionally I find that his interpretations of research is questionable. For instance, to promote organic foods, he says “organic fruits and vegetables do appear to have more nontraditional nutrients like polyphenol antioxidants.” However, his cited study found “no consistent differences in plasma or urine carotenoids, polyphenols, vitamins E and C content, LDL cholesterol, antioxidant activity, ability to protect against DNA damage, immune system markers between participants consuming organic and conventional diets.” Now, they do say slightly different things – he’s talking about nutrient density in foods, and the study is talking about blood levels. But it’s disingenuous to use this citation to back up his point. By far he says what most of his references say, but it occurred more often than I expected, making me shade his recommendations down a notch.

• As an omnivore, I’d like to have the other side explored – what are ANY benefits of eating meat? Of supplements? He might believe that there is no evidence that shows eating meat has any benefits, but he doesn’t articulate this strongly or often enough.

• Greger is clearly angry at some parts of the system, like the influence of agriculture industry on legislation and the influence of pharmaceutical companies on healthcare practices. I appreciate his rage, but I’d rather he keep it to an isolated chapter rather than peppering it throughout the book, when it's incongruous.

The Most Convincing Studies Highlighted

• Fruit and veg consumption reduces stroke by 30% and coronary heart disease by 20% when controlled for typical factors (like BMI, smoking, alcohol)
• The Nurses’ Health Study showed that consumption of processed and unprocessed red meat was associated with increased risk of death from cancer and heart disease, and shorter life spans. Each increase of 1 serving of meat per day causes hazard ratio of 1.13 for unprocessed red meat and 1.20 for processed red meat.
• Similar conclusion from NIH-AARP study, showing overall mortality hazard ratio of 1.31 or 1.36 for men and women between highest and lowest quintile of red meat eaters. Both of these control for BMI, smoking, alcohol, physical activity, energy intake, and vegetable consumption. So meat itself looks damaging, even after controlling for vegetables.
• Ornish Lifestyle Heart Trial showing that lifestyle changes could reverse heart disease, reducing stenosis by 8% over 5 years, compared to 28% worsening for control.
• The PREDIMED randomized controlled trial showed that the Mediterranean diet with olive oil or nuts reduced risk of stroke by 30-50% and reduced mortality risk by 39%.

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• A Taiwanese population study showed that even eating just a little meat (a serving every few days) increased the rates of diabetes by 2x in men and 4x in women, compared to vegetarians.
• How Not to Die discusses hazard ratios a lot. Here's a primer on how hazard ratio affects lifespan

Preface

• US healthcare runs on a fee-for-service model: doctors get paid for pills and procedures they perform, not for patient health outcomes. Thus lifestyle is undervalued in medical care
• most medical schools don’t have any courses on nutrition (this is true in my experience at Harvard Medical School. Also, we focused primarily on diagnosing and treating disease, not preventing it)

Introduction

• our genes only account for 10-20% of risk for most leading causes of death like high BP, heart attacks, cancer
• when people move from low- to high-risk countries, their disease rates change to those of the new environment. Eg Japanese person moving to America raises risk of heart disease
• even though life span in America has increased slightly over the past decades, the quality of life at the end is worse
• the author argues diet is behind all of this – specifically, a whole-food plant-based diet discouraging meat, dairy products, eggs, and processed foods
• lapsed vegetarians who went back to meat eating increased heart disease odds by 146%, stroke by 152%, diabetes by 166%, weight gain by 231%, and life expectancy drop by 3.6 years
• women who eat more whole plant foods reduce breast cancer odds by 90%
• whole plant foods have been associated with longer telomeres; refined foods and meat with shorter telomeres; caloric restriction and exercise didn’t improve telomere length, so seems like it was quality of food eaten
• not smoking, not being obese, half hour of exercise a day, and eating healthier = 78% of chronic disease risk
• drugs can’t protect you fully and have side effects. This is like mopping up the floor around an overflowing sink instead of turning off the faucet
Part 1: How Not to Die from Disease

How Not to Die from Heart Disease

Annual deaths: 375,000

- coronary heart disease didn’t use to exist in some populations. When people move from low-risk to high-risk areas, their disease rates increase to match their new homes
- atherosclerotic plaque can be seen in childhood
- **elevated cholesterol and LDL is the only risk factor for atherosclerotic plaque.** To reduce LDL, reduce intake of trans fat, saturated fat, and dietary cholesterol
- a single unhealthy meal can stiffen your arteries in hours
- optimal LDL is 50-70 mg/dL, and total cholesterol under 150 mg/dL. Usual recommendation is <200 mg/dL and <100mg/dL, but keep in mind this is in a country where heart disease is #1 killer
- heart disease is reversible – plaques can actually reverse! Your body wants to heal itself. But if you cut yourself and keep slicing open the cut 3 times a day, it’s not going to heal
- possible cause of meat effects on plaque: bacterial endotoxins that trigger inflammation, even when cooked
- Brazil nuts lower LDL within hours and last a month later
- 3-4 shots of kale juice a day for 3 months lower LDL and boost HDL as much as running 300 miles
- [from part 2] **diet of 6-8 sweet potatoes/day lowered BP by 5/4 points** even in presence of drugs (may not be controlled for sodium intake)
- statins are good for patients who won’t comply with diet, but they have risks for liver and muscle damage and diabetes
- fish oil shows no proven benefit for overall mortality, heart attack, or stroke
- why doesn’t this receive more public attention? In 1977, US Senate committee released dietary guidelines cutting down animal-based foods, but meat/milk/egg lobby pressured this removal from the report.
- why don’t doctors promote diet enough? Tomato effect – for a long time, tomatoes were considered poisonous. Professional organizations often funded by food companies to influence doctor recommendations. [Allen note: also, doctors are eventually trained to
How Not to Die from Lung Disease

Annual deaths: 296,000

- lung cancer (160,000), COPD (140,000), asthma (3,000)

**Lung Cancer**

- male and female smokers are 23x and 13x more likely to get lung cancer
- if you think the lobbyist effect sounds nutty, remember that Philip morris had Whitecoat Project to get doctors to publish studies invalidating links between secondhand smoke and lung disease
- within a year of quitting, risk of heart disease drops to half of current smokres
- smokers eating a single stalk of broccoli a day show 41% fewer DNA mutations in bloodstream
- extract of isothiocyanate from cruciferous vegetables showed stunting of cancer growth
- curcumin in turmeric causes drop in DNA mutation rate in smokers and reactivate apoptosis in cancer cells
- 1/4 of lung cancer comes in never-smokers. Frying fumes culd be cause as they release volatile mutagenic chemicals.
- Smokers who stir-fry meats every day lead to 3x lung cancer odds vs smokers who stir-fry foods other than meat daily. Heterocyclic amines from muscle tissue
- mothers exposed to grilled meat fumes (polycyclic aromatic hydrocarbons) associated with smaller head size and lower IQ
- bacon releases nitrosamines, cause DNA mutations more than beef patties

**COPD**

- caused by inflammation in lung
- one extra serving of fruit = 24% lower risk of dying from COPD, possibly due to antioxidant and anti-inflammatory. Eating cured meat increases, possibly nitrites

**Asthma**

- kids living in areas where whole plant diet more common was significantly less likely to show wheezing, allergic eczema, asthma.
- removing eggs, dairy improves asthma within 8 weeks. Adding fruits vegetable reduced exacerbation rate by half
- antioxidants from fruits and veg thought to neutralize free radicals in respiratory tract. Oxidation by-products lowered with plant-based diet
- supplements don’t work – equivalent servings of fruit and veg in pill form didn’t improve asthma
- some unmanageable asthma patients even dropped asthma altogether after switching to plant-based diet
How Not to Die from Brain Diseases

Annual deaths: stroke (130,000), Alzheimer’s (85,000)

Stroke

- caused by clogged artery in brain leading to brain death
- reduce risk by reducing cholesterol and blood pressure and improving blood flow and antioxidants
- increasing fiber by 7g a day reduces risk by 7%. At max, eat minimum 25 g/day of soluble fiber and 47 g/day of insoluble fiber
  - not exactly sure why. helps control cholesterol and blood sugar, which reduces atherosclerotic plaque
  - may also lower blood pressure, reducing risk of brain bleeds
- 1,640 mg increase of potassium associated with 21% reduction in stroke
  - best source: greens, beans, sweet potatoes. Not bananas
- citrus reduces stroke risk, possibly through hesperidin, which increases blood flow throughout body
  - 3 experimental groups: orange juice, hesperidin solution, and control. Hesperidin lowered blood pressure and increased endothelial reactivity. OJ performed best
  - in another study, women with poor digit circulation were placed in cold room. Those who drank OJ cooled half as fast
- Sleep: lowest risk is 7-8 hours a night. Much more or much less than this increases risk of stroke
- Antioxidants:
  - Summary story: your body needs energy to function, and oxygen normally plays a critical role. Because it’s very reactive, it also tends to steal electrons, becomes a radical oxygen species, and oxidizes substances like DNA, causing mutations.
  - Antioxidants slow this down by placating oxygen and reacting with it instead of your DNA. Physiologically, they prevent circulation of oxidized fats that can damage blood vessels, decrease artery stiffness, prevent blood clots from forming, lower blood pressure, lower inflammation
  - In population studies, people who eat most antioxidant-rich foods had lowest health risks
  - Plant foods contain 64x more antioxidants than animal foods
    - [Allen note: Why? Theory: animals are constantly active and can ward off oxidative stress. But plants are inactive during the night when sun sets, so they need more antioxidants to protect]
  - Foods that brown slowly (like mango) have more antioxidants.
  - Antioxidant supplements don’t seem to help
  - Herbs and spices: adding cinnamon, oregano can add a lot to antioxidant power

Alzheimer’s

- Caused proximally by amyloid plaques in the brain, damaging neurons and neuronal networks
  - Total cure for people with Alzheimer’s is likely impossible, given the networks have been damaged. But prevention may be possible
- Distally, Alzheimer’s could be a vascular disease
- Atherosclerosis is associated with Alzheimer’s and lost brain function
- Cholesterol may seed amyloid plaques. Autopsies show Alzheimer’s brains have significantly more cholesterol buildup.

- **Not just genetics**
  - Migration studies show that Japanese men in the US have dramatically higher Alzheimer’s rates; African-Americans show higher risk than Africans in Nigeria
  - Closest link is to animal fat consumption
    - Non-meat eaters cut risk of dementia in half
  - A mutated ApoE4 gene is implicated for increasing Alzheimer’s risk dramatically (homozygous = 9x, heterozygous = 3x). ApoE4 is major cholesterol carrier in brain
    - Controlling blood pressure and cholesterol cuts risk from 9x to 2x
  - Whole plant foods
    - Lower ratio of saturated and unsaturated fats is protective. In a population, highest saturated fat intake = 60% greater chance of cognitive deterioration
    - Antioxidants may cross blood-brain barrier and protect against oxidative damage, inhibiting formation of plaques
      - Women who ate one serving of blueberries and two servings of strawberries a week had slower rates of cognitive decline, by as much as 2.5 years
      - People who drank fruit and vegetable juices regularly had 76% lower risk of Alzheimer’s
      - Caused by polyphenols – concord grapes and cranberries especially rich
    - Saffron
      - Better than placebo in improving cognitive function among patients with mild dementia
      - As effective as donepezil (Aricept) in double-blind study
    - Reducing advanced glycation end products (AGEs)
      - AGEs are formed by dry heating fat- and protein-rich foods. Chicken, bacon, hot dog are worst offenders. Baking, broiling, and grilling are far worse than boiling or steaming
      - Accelerate aging by cross-linking proteins, causing tissue stiffness, oxidative stress, inflammation
      - Higher AGEs show accelerated loss of cognitive function
  - Exercise
    - Aerobic exercise reversed age-related shrinkage in brain and improved memory performance; no effect in stretching and nonaerobic strength-training group
How Not to Die from Digestive Cancers

- Colorectal cancer: 50,000
- Pancreatic cancer: 46,000
- Esophageal cancer: 18,000
- Digestive system covers thousands of square feet, much more than the 20 square feet of skin and hundreds of square feet of lungs. Consider your digestive tract the interface with the world

Colorectal cancer

- Among the most treatable cancers – if diagnosed before spreading beyond the colon, 5-year survival rate is 90%
- Starting at age 50 to 75, get stool testing every year, stool testing every 3 years plus sigmoidoscopy every 5 years, or a colonscopy every 10 years
- Turmeric
  - Contains curcumin, which doesn’t get absorbed well, but stays intact in digestive tract to interact with polyps
  - Has antioxidant and anti-mutagenic properties
  - Reduced the occurrence and size of polyps throughout the spectrum of colorectal cancer, from aberrant foci to benign polyps to cancerous polyps, by up to 40%
  - Cancer rates in India are much lower than in the US – 10 times more colorectal cancer in US, 12x more kidney cancer, etc. Turmeric may explain part of it, but only 7% eat meat on a daily basis, instead eating leafy vegetables and legumes.
- Stool size
  - Larger stools and faster intestinal transit time are associated with lower colon cancer
  - Good stool weight is half a pound. People with quarter pound stools have 3x rate of colon cancer
  - The larger the stool, the faster the transit time. Good time is 24-36 hours. This can be tested by eating beets, then noticing when your stool turns pink
  - Constipation can be solved with fiber
- Phytates
  - Found in seeds, grains, beans, nuts
  - Remove excess iron, which can generate hydroxyl radicals. Also inhibits growth of human cancer cells in vitro while leaving human cells alone. Has antioxidant, anti-inflammatory, anti-angiogenic, immune-enhancing (activating natural killer cells)
  - Meat eaters absorb high amounts of heme iron, which is often not counterbalanced by seed eating and phytates
  - Once feared to inhibit mineral absorption, but later found that high-phytate eating tends to have greater bone mineral density and fewer hip fractures
  - High vegetable, low-meat diets have 8x risk of colorectal cancer compared to low-vegetable, high-meat diets
  - Increasing bean consumption by ¼ cup a day cuts polyp recurrence by 65%
- Berries
  - Antioxidants, suppress cancer cell growth in vitro
Black raspberries cut polyp count of patients with familial adenomatous polyposis in half.

Red meat problems
- Eating processed and unprocessed red meat is associated with increased mortality from cancer and heart disease, and lower lifespans – even after controlling for age, weight, alcohol, exercise, smoking, family history, and intake of plant foods. Suggests there is something bad about meat itself [find link]
- Could be heme-iron – iron generates free radicals as a pro-oxidant. Meat has heme-iron, which is absorbed more effectively by the digestive tract, and is not as subject to iron absorption homeostasis compared to non-heme iron from plants. In short, if you have too much iron from your body, you stop absorbing non-heme iron from plant foods, but you keep absorbing heme iron from meat.
- Plant iron sources are whole grains, legumes, nuts, seeds, dried fruits, and green leafy vegetables
- Vitamin C helps with iron absorption

Pancreatic Cancer
- One of the deadliest cancers because of detection. 6% of patients survive 5 years after diagnosis, compared to 90% for colorectal cancer
- Risk factors are smoking, obesity, alcohol
- Animal fat
  - Fat from animal sources is associated with pancreatic cancer risk; no correlation found with plant fats
- Chicken
  - Workers who slaughter chickens have 9x odds of pancreatic and liver cancer, compared to smoking doubling odds
  - 72% increased risk of pancreatic cancer for every 50g of chicken consumed daily
  - Wart-causing chicken cancer viruses may be the cause, but not currently clear
- Turmeric
  - For pancreatic cancer patients, 2 out of 21 responded to treatment. One patient had 73% reduction in tumor size until a curcumin-resistant tumor appeared. Another showed improvement over 18 months.
  - Similar % of patients respond to chemotherapy

Esophageal Cancer
- 5-year survival rate <20%
- Risk factors are smoking, alcohol, and acid reflux (GERD)
- Acid reflux reduction through diet
  - Over past 30 years, esophageal cancer has increased sixfold (possibly due to detection but possibly due to acid reflux increase)
  - 28% of US suffers weekly heartburn, compared to 5% in Asia
• Meat-eater have 2x odds of reflux-induced esophageal inflammation compared to vegetarians
• Meat and high-fat meals are associated with acid reflux and then cancer in esophagus. Could be because cholecystokinin is triggered by meat and eggs and may relax the esophageal sphincter
  • Fiber
    o High fiber intake reduces incidence of esophageal cancer by 1/3
    o Hiatal hernias are pushing of the stomach into the chest cavity. This leads to acid reflux, which leads to cancer
    o Low-fiber diets cause straining in passing stool. This increases abdominal pressure and can push stomach out of the abdomen. Also causes hemorrhoids and diverticulosis
  • Strawberries
    o 1-2 oz of free-dried strawberries everyday for 6 months reversed in 80% of patients with precancerous esophageal lesions

Stomach Cancer (taken from Part 2)

• High sodium and meat eating are risk factors, on par with smoking or alcohol
  o High vs low salt intake showed RR = 1.68 for gastric cancer
  o Per 100g/day of meat, increase of 3.52 HR
• Korea has highest stomach cancer rates in world, possibly because of kimchi
How Not to Die from Infections

- Many infectious diseases came from animal domestication. Tuberculosis from goats; measles and smallpox from cattle; typhoid fever from chickens; cold virus from horses
- To prevent transmission when you’re sick:
  - Cough into the crook of your arm (inner elbow), not your hand
  - Sanitize your hands after every bathroom visit and handshake, before preparing food, before touching your eyes or mouth
  - Alcohol-based rubs are preferred for sanitation
- Immune system primer
  - White blood cells
    - Neutrophils destroy pathogens like bacteria and parasites directly
    - Natural killer cells kill infected cells
  - B cells
    - Produce antibodies that bind to a specific antigen (like a bacterial protein)
    - These antibodies deactivate pathogens, or signal to natural killer cells that a cell is infected
  - People suffering from allergies have lower risk for some cancers.

Reducing Infections and Boosting Immune System

- Fruits and vegetables
  - In experiment, people over 65 who ate 5+ servings of fruits/veg had a 82% greater protective antibody response to vaccine, compared to <3 servings.
  - Evolutionary theory: to reduce energy expenditure, the immune system activates itself periodically at times of greatest risk – including eating food with potential pathogens. We evolved over millions of years mainly eating plants, not meat – thus plants serve as the trigger to activate immunity
- Raw kale extract stimulates 5x antibody production in vitro
- Broccoli activates intraepithelial lymphocytes
- Phytonutrients from plants reduce toxicity of dioxins (pollution) in vitro, but effects only last for a few hours
- Blueberries (1.5 cups/day for 6 weeks) doubled natural killer counts in athletes after intense exercise, when normally it drops by half
- Cardamom activated activity of natural killer cells against lymphoma by 10x in vitro
- Probiotics: Babies delivered via C-section have increased risk for allergies. Theory is that natural birth babies are exposed to mother’s vaginal bacteria, which then reside in gut. There isn’t enough evidence yet to suggest that supplementation is necessary.
- Exercise
  - May activate IgA antibody production in saliva, eyes, nostrils
  - Aerobic exercise for 30 minutes/day, 3x a week for 12 weeks showed 50% higher IgA in saliva, compared to control
  - Elderly sedentary women have a 50% chance of getting a cold in fall; 0.5 hour/day walking reduces risk to 20%; conditioned runners have 8% risk
Overtraining, like with marathons, increases risk of infection. This can be addressed through chlorella and nutritional yeast, both reducing risk of infection and maintaining IgA/white blood cell levels.

- Mushrooms: Button mushrooms daily over a week showed 50% increase in IgA levels in saliva.

**Food Poisoning**

- Animal foods are the most common source of food poisoning. The common pathogens like *coli* are intestinal bacteria and common in feces, and plants don’t have intestines
- Food poisoning often resolves within days, but puts children and elderly at risk
- Outbreaks of food poisoning in vegetables are often caused by contamination by manure or animals and delivered to plants, eg through irrigation water
- The most common food poisoning pathogens:
  - Eggs and *Salmonella*: can survive scrambled, sunny-side-up cooking methods
  - Poultry and *Salmonella*: even when chicken is cooked well, cross contamination causes spread of bacteria to kitchen counter, faucet, refrigerator handles, etc.
  - Meat and *coli*: beef has gotten safer over time to eat, partly because of regulation on sale of contaminated beef
  - Pork and *Yersinia*
  - All meat and *difficile*: this resides in your gut and can flare up when you take antibiotics and disrupt your gut microbiome
- 80% of antibiotics go to meat industry, where poor animal living conditions tend to cause disease that needs antibiotic dosing. This leads to promotion of drug-resistant bacteria
How Not to Die from Diabetes

20 million Americans diagnosed with diabetes; 76,000 direct deaths and 50,000 cases of kidney failure, 75,000 lower limb amputations, 650,000 cases of vision loss

The Disease

- Diabetes mellitus is a condition in which blood sugar levels are chronically elevated
- High blood sugar damages nerves (leading to neuropathy and pain) and blood vessels (leading to blindness, low circulation in extremities -> amputation)
- Both major types of diabetes concern insulin, the hormone secreted by beta cells in the pancreas, that causes cells to absorb glucose from blood
- Type 1 diabetes is genetic and caused by autoimmune destruction of beta cells. Less insulin production means higher blood sugar. Treated with insulin injections
- Type 2 diabetes is caused by insulin resistance. Insulin secretion can be normal or elevated, but insulin doesn’t work as effectively, leaving sugar in your blood. Treated with drugs +/- insulin
- Prediabetes in children is increasing because of obesity. Developing diabetes in childhood cuts life expectancy by 20 years and increases risk of disease across the board

Insulin Resistance and Fat

- Heavy implication of fat on insulin resistance. 90% of type 2 diabetics are overweight
- Mechanism: fat disrupts insulin signaling (details of disruption of signaling pathway)
- Free floating fat in bloodstream is normally 100-500 um/L; obese patients have 600-800 um/L
  - Obese patients are basically spilling fat into the bloodstream constantly
- Diet, even controlling for weight, affects fat levels and insulin resistance.
  - 1927 study: group 1 had a fat-rich diet; group 2 had carb-rich diet. Insulin resistance increased in group 1 diet within days, far more than group 2
  - People eating low-carb, high-fat diets can reach same free floating fat levels

Vegetarian Diet on Diabetes

- Vegetarians cut diabetes prevalence by 61%
  - Plant-based diets improve reduce insulin resistance, improve blood sugar control, reduce LDL cholesterol
- Even controlling for weight, vegans have <50% risk of diabetes compared to omnivores
  - Between people of the same weight, vegans have less fat trapped in deep calf muscles compared to omnivores
- Possible reason: saturated vs unsaturated fats
  - Saturated fats like palmitate cause toxic byproducts, free radicals, inflammation, mitochondrial dysfunction (lipotoxicity)
  - Unsaturated fats are less harmful, easier to detoxify, and may suppress inflammation
Vegetarian diets have multiple effects relating to diabetes

- Eating fewer calories: people eat the same volume of food per meal, regardless of calorie count. Vegetables are calorically far less dense.
- Even without weight loss, plant-based diets improved insulin sensitivity and A1C levels, within weeks
- Intrinsic benefits: eating five cups of legumes each week had better effects than cutting 500 calories a day on cholesterol and insulin regulation
- Better eating habits: plant-based group felt less likely to binge and felt less hungry
- Lower potentially toxic chemicals: PCBs in salmon and canned sardines can disrupt metabolism; people with highest level of pollutants have 38x the odds of diabetes
- Higher resting metabolism: vegetarians have higher gene expression of carnitine palmitoyltransferase, which helps metabolize fats
- Better mood: plant-based group reported better quality of life and higher mood scores than conventional diet
- Reduces neuropathy pain and can restore vision loss

Even a little meat eating is destructive

- In Taiwan, Asian diet includes little meat – women ate a single serving each week, men had a serving every few days. Vegetarian men had half the odds of diabetes as occasional meat eater. Vegetarian women had 25% the odds
- Meat consumption was associated with weight gain, even after adjusting for calories. Again: even when eating the same number of calories, meat eaters tend to gain more weight. Specifically, increase in meat intake of 250 g/d (like one steak) leads to 2-kg higher weight gain after 5 years (Source)
- Poultry is potentially the most fattening meat – people eating 1oz of chicken a day had significantly greater gain in BMI than non-chicken eaters. Could be caused by fattening chickens – 100 years ago, a serving of chicken may have 16 fat calories; now, over 200 fat calories

Other Interventions on Diabetes

- Drugs can lead to increased mortality
  - Seminal NEJM study showing that intensive blood sugar management led to increased mortality compared to standard therapy. The intensive group had a lower H1AC target and were subject to more drugs and higher doses. Mortality hazard ratio of 1.22 in the intensive group
  - Insulin can accelerate aging, promote inflammation in arteries
- Gastric bypass surgery reduces diabetes in up to 83% of patients
  - But this can be with just extreme diets, without the surgery: blood sugar levels normalize within a week of eating 600 calories daily. Hypothesis: fat is pulled out of storage in muscles and liver, allowing normal function
How Not to Die from High Blood Pressure

The disease

- Cited as the #1 risk factor for death in the world (by the Global Burden of Disease Study in the Lancet), leading to 9 million deaths worldwide annually.
- Blood pressure consists of two numbers: systolic as the pressure when blood pumps through the artery, and diastolic between beats
  - 110/70 is an ideal blood pressure, even though 120/80 is cited as normal
  - 140/90 is hypertensive
- 78 million Americans have hypertension
- Hypertension promotes atherosclerosis (leading to heart attacks and strokes), puts strain on heart leading to heart failure, damages blood vessels, and leads to kidney disease
- BP tends to increase with age and 65% of Americans age 60 or above have hypertension. But Kenyans eating a low-sodium diet around whole plant foods had normal blood pressure

Sodium

- Evolutionarily, we ate plant-based diets consisting of 500mg of sodium a day
- Now, average daily consumption is 3,500mg, and the AHA recommends 1,500mg
- Sodium raises blood pressure
  - Double-blind randomized trials show that salt increases blood pressure
  - A single meal increases blood pressure over the next 3 hours, and decreases endothelial function within 30 minutes
- Cutting sodium lowers blood pressure
  - Dietary changes alone reversed malignant hypertension (240/150) down to 105/80
- Mechanism could be free radicals
  - In Doppler flowmetry, sodium reduces blood flow, but vitamin C blocks the sodium effect
  - Sodium suppresses antioxidant enzyme called superoxide dismutase
- Dietary sources of sodium
  - ¼ of salt comes from processed foods
  - For kids, major source of sodium is pizza; for ages 20-50, chicken; for ages 50+, bread
  - Why so much salt in food? Partly preservation, but also adding sodium to meat increases water retention, increasing weight sold. Also, saltier food tastes better than unsalty food, so competition with other products increases sodium across the board

How to Reduce Sodium Intake

- Adjust your taste buds back to normalcy
  - Cut sodium, fat, and sugar for a few weeks, and your taste buds will revert to normal. Food will taste more flavorful, and you will actively dislike aggressively salty and fatty foods
- Don’t add salt at the table
• Don’t add salt when cooking
• Stop eating out so much
• Avoid processed foods
• Buy foods with fewer mg of sodium than there are g in the serving size, or calorie count (eg <100mg sodium for 100g of servings or 100 calories)

Diet for Hypertension

• Whole grains
  o Three portions of whole grains a day reduce risk of heart attack and stroke as effectively as high blood pressure medications (without side effects)
  o Have to be whole grains - refined grains like white rice increase risk of diabetes
• Vegetarian diets
  o Rural Kenya and China people (with a low-sodium plant-based diet) show ideal blood pressures throughout all age, unlike Westerners who increase blood pressure with age
  o The more plant-based foods you eat, the lower your hypertension rates. Flexitarians show 23% reduced risk of hypertension; vegans show 75% reduced risk.
  o Even controlling for weight, vegetarians show better blood pressure
• Flaxseed
  o A few tablespoons a day may be more effective than exercise
  o Double-blind, placebo-controlled, randomized trial showed BP drop from 158/82 to 143/75, compared to no change in control. Multiples more effective than medications!
• Hibiscus
  o 3 cups of hibiscus tea a day dropped blood pressure by 6 points over control
  o #1 antioxidant content of beverages, above green tea
  o Precautions: it’s acidic, so rinse mouth after drinking; and because of high manganese content, don’t drink more than a quart a day
• Nitrates
  o Nitric oxide dilates blood vessels and lowers blood pressure. Created by NO synthase from nitrates. Free radicals consume NO and disrupt NO synthase
  o High-antioxidant diet improves endothelial function (ability of vessels to relax and dilate)
  o Best foods for nitrates, in descending order: arugula, rhubarb, cilantro, butter leaf lettuce, mesclun greens, basil, beet greens, oak leaf lettuce, swiss chard, beets
  o Beet juice can lower blood pressure by 10 points within hours, and by similar amounts over weeks with daily consumption. It also seems to allow higher aerobic performance from less oxygen, allowing more time to exhaustion and longer breath-holding
• Wine with alcohol removed

Hypertension drugs

• Not as effective as diet in reducing blood pressure
Calcium-channel blockers drop 8/3 points, ACE inhibitors by 5/2 points, compared to 15/7 for flaxseed

- Lots of side effects
  - Diuretics -> electrolyte disturbances
  - Calcium-channel blockers (Norvasc, Cardizem) -> breast cancer risk
  - Beta blockers (Lopressor, Corgard) -> lethargy and impotence
  - ACE inhibitors (Vasotec, Altace) -> swelling
How Not to Die from Liver Diseases

60,000 Annual Deaths

Liver function

- All blood coming from intestines passes through liver first
- Liver metabolizes nutrients and deactivates toxins
- You can survive without a kidney, stomach, and gallbladder, but not liver

Liver diseases

- Diet-induced fatty liver disease
  - Most common cause of chronic liver disease, affecting 70 million people in US. Nearly all severely obese people have liver disease
  - Mechanism: Fat deposits in liver -> inflammation -> liver scarring -> liver failure
  - Another mechanism: cholesterol overload -> cholesterol crystallizes -> white blood cells try to eat cholesterol crystals and die -> inflammatory compounds leak out
  - One week of fast food-heavy diet can cause pathological liver function tests
  - One can of soda/day raises fatty liver disease by 45%
  - Animal fat and cholesterol are causative. Eating >14 chicken nuggets/day of meat has 3x rate of fatty liver disease compared to <7 nuggets/day
- Alcoholic liver disease
  - Excessive alcohol consumption (>2 drinks/day for males, >1 drink/day for females) causes fatty liver -> inflammation -> irreparable scarring
  - Heavy drinking can lead to fatty liver in 3 weeks, but in most people resolves 4-6 weeks after cessation
- Hepatitis
  - Hep A – foodborne through feces, preventable with vaccine
  - Hep B – bloodborne, transmitted sexually and maternally through birth. Also preventable with vaccine
  - Hep C – bloodborne, transmitted through needle sharing. No prevention. Leading cause of liver transplants
  - Hep D – only infects people with hep B, so prevent B and you won’t get D
  - Hep E – pigs may be primary reservoir. 11% of pig livers show Hep E virus. Pork consumption in countries correlates with liver disease. Highly risky for pregnancy, so cook pork well or avoid entirely

Preventing Liver Disease

- Most importantly, don’t be obese, eat less fat and cholesterol, don’t drink alcohol heavily, and don’t share needles
• Oatmeal
  o Double-blinded, randomized, placebo-controlled trial in overweight people showed oatmeal reduced liver inflammation and led to weight loss (seemed to not be controlled for weight loss)
  o Refined grains associated with increased risk of liver disease

• Cranberries
  o Beat out other common fruits in suppressing liver cancer cells in vitro
  o Extracts failed to match anticancer effects of whole cranberries
  o Best to eat fresh or frozen, not juiced or dried

• Coffee
  o In highest risk group, >2 cups of coffee/day showed less than half risk of chronic liver problems
  o Among smokers, >4 cups of coffee/day showed 92% lower risk of death from chronic liver disease
  o Mechanism: may reduce DNA damage, increase clearance of infected cells, slow scarring process

Is Alcohol Protective?

• Alcohol decreases mortality, but only for those in poorer health
• Drinking decreases heart disease, but increases cancer risk. Since heart disease is more common, this may be why alcohol is net protective
• **People who are reasonably healthy show no protective effect from alcohol.** Reasonably healthy = exercise 30 minutes a day, don’t smoke, and eat at least one daily serving of fruits/veg
How Not to Die from Blood Cancers

The range of diseases

- Leukemia: 52,000 diagnosed, 24,000 die
  - Bone marrow produces abnormal white blood cells, crowding out ability to produce red/white cells. Leads to anemia, infection, death
- Lymphoma: 70,000 diagnosed, 19,000 die
  - Proliferation of lymphocytes, white blood cells
  - Collect in lymph nodes and disrupt immunity
- Myeloma: 24,000 diagnosed, 11,000 die
  - Proliferation of plasma cells, antibody-secreting white blood cells
  - Displace bone marrow, make abnormal levels of antibodies that clog kidneys
  - Multiple myeloma happens when cancer is discovered in multiple bones
  - Particularly resistant to treatment; most do not survive beyond 5 years

Animal Viruses Causing Cancer

- Of all foods in EPIC study, poultry had greatest risk for blood cancers. Risk increases between 56 and 280 percent for every 50g of poultry consume daily. A chicken breast weighs 350 g.
- Thesis: poultry viruses cause cancer
  - Some other animal products like milk show no such cancer risk, ruling out dioxin toxin exposure
  - Eating well-done meat lowers risk of lymphoma compared to rare meat, even though it increases exposure to cooked meat carcinogen MeIQx
  - Farmers, slaughterhouse workers, butchers all show higher rates of blood cancers [see reference 42 for specific rates]
  - Growing up on poultry farm show almost 3x odds of blood cancer
  - Viruses include avian herpesvirus, avian leucosis virus, lymphoproliferative disease
  - Still no smoking gun yet on viruses directly causing cancer through infection and genetic mutation

Diet Decreasing Risk of Blood Cancers

- Greens
  - Plant-based diet reduces all cancer forms, lowering risk of blood cancer by half
  - Patients with lymphoma that eat 3+ vegetable servings/day show 42% improved survival rate. Green, leafy vegetables and citrus showed most protective
    - Not clear whether the diet reduced cancer effects or improved tolerance to chemotherapy
  - In healthy patients, 5+ servings of green, leafy vegetables per week showed half the odds of lymphoma
  - Sulforaphane in cruciferous vegetables kills cancer in vitro while ignoring healthy cells
Vitamin C and carotenoid in diet lowers lymphoma risk, but supplementing vitamin C doesn’t do anything
- High-dose supplements increase risk of death; may disrupt balance of antioxidants that network to reduce disease

Acai Berries
- Extract triggers apoptosis in cancer cell line in vitro, and increases activity of macrophages
- Better antioxidant bang for buck goes to purple cabbage, cinnamon, and cloves

Curcumin
- In randomized, double-blind, placebo-controlled study, reduced antibody levels in myeloma patients [see reference 32]
- In vitro stopped myeloma cell growth

Pet ownership
- Seems to lower lymphoma risk, plausibly by boosting immunity [see reference 58]
Kidney disease

- Kidneys filter 150 quarts of blood daily to make 1-2 quarts of urine
- Kidney malfunction leads to toxin accumulation, causing weakness, shortness of breath, confusion
- Kidney failure requires dialysis, but life expectancy of patient requiring dialysis is less than 3 years
- Only 41% of Americans have normal kidney function, compared to 52% 10 years ago
- Most people with kidney failure die from other causes like cardiovascular disease. Patients under 45 with kidney failure are 100x more likely to die from heart disease

Animal protein, animal fat, and cholesterol all implicated in declining kidney function

- Animal protein causes hyperfiltration, or increase in workload of kidney
  - Kidney filtration rate shoots up within hours of eating animal protein
  - Human evolved hyperfiltration capacity to handle sudden boosts in protein intake from an animal kill. Once in a while is OK. But now we’re overloading daily.
- Mechanism: animal products cause inflammation
  - Giving an anti-inflammatory drug along with animal protein shows no hyperfiltration response
- Mechanism: acid load
  - Meat protein increases acid load to kidneys. Animal protein tends to have higher levels of sulfur-containing amino acids like methionine
  - Worst offenders: fish (inc. tuna), pork, poultry, cheese, beef
  - Acid load requires ammonia production to balance pH. Chronic exposure to ammonia is toxic and degrades kidney function gradually over time
  - Sodium bicarbonate can lower acid load, but comes with excess sodium leading to more kidney damage

There is no such correlation with plant protein or plant fat

- Equivalent amount of plant protein causes no noticeable stress on kidneys
- Six-month, double-blind, randomized, placebo-controlled trial shows plant protein helps preserve function in diseased kidneys, vs dairy protein
- Plant foods are basic
  - Plant protein does not contain as much acidic amino acid
  - Plant-based diet can return acidic urine to neutral within a week
  - Best performers: vegetables, fruits, beans

Kidney stones
• 1 in 11 Americans are affected today
• Formed from crystallized calcium oxalates and uric acid
• Extra animal protein (1 can of tuna fish daily) increased risk of kidney stones by 250%
• Eating less meat and salt reduced kidney stone risk by 50%, compared to low-calcium diet decreasing by 25%
• Removing all meat reduces risk of uric acid crystallization by over 90% in 5 days
• Higher vegetable intake does not increase risk of stone formation, despite increase in oxalate dosing

Phosphorus

• Excess phosphorus increases risk of kidney failure, heart failure. Seems to damage blood vessels and hasten aging and bone loss
• Americans consume twice as much phosphorus as needed
• Source of phosphorus matters
  o Animal phosphorus comes in phosphate formed, readily absorbed
  o Plant phosphorus comes in phytate form, which is not readily absorbed
  o Similar to difference in absorption of animal heme iron vs plant non-heme iron
  o Phosphorus additives are the worst. Found in cola drinks and meat to enhance color and add water weight
• Avoid pyrophosphate and sodium triphosphate in foods

Nitrosamines

• The reaction is nitrates -> nitrites -> nitrosamines and nitrosamides
• Nitrosamines are carcinogens
• Tobacco use is a big risk factor for kidney cancer because of nitrosamines
  o Nitrosamines stick to walls and continue harming – so-called thirdhand smoke
• One hot dog has as many nitrosamines and nitrosamides as 4 cigarettes
• Reduce processed meat consumption to under 20g a day
• Nitrates and nitrites are precursors to nitrosamines
  o For nitrite free food, look at fine print – often says “except those naturally occurring in celery juice” which is fermented celery juice containing nitrites
• Amines and amides are necessary for nitrosamine production
  o Animal products contain amines and amides, thus creating nitrosamine in the stomach
  o Plant foods contain less, and they also contain vitamin C and other antioxidants blocking formation
  o Thus plant foods do not show increased risk for kidney cancer

Sugar and high-fructose corn syrup also cause increased blood pressure and uric acid levels
How Not to Die from Breast Cancer

230,000 diagnosed, 40,000 die

Risk Factors

- Alcohol
  - The metabolic product of alcohol, acetaldehyde, is the carcinogen
  - Even moderate drinking - one drink a day - shows a small increase in risk
  - Red wine is exempt from this effect, possibly because of compounds in the skin that suppress estrogen synthase

- Decreased melatonin
  - Melatonin regulates sleep and circadian rhythm and is secreted in the dark
  - Melatonin suppresses cancer growth
  - Blind women (who secrete melatonin constantly) shows half the odds of breast cancer
  - Night shifts show increased relative risk (1.14) for breast cancer
  - Higher vegetable intake increases melatonin levels; meat lowers melatonin

- Heterocyclic Amines
  - HCAs are produced when cooking meat at high temperatures
  - Well done meat eaters show 5x odds of breast cancer compared to rare eaters. Also higher risk of colon, esophagus, lung, pancreas, prostate, stomach
  - Mechanism: PhiP has estrogen-like effects, inducing breast-cancer cell growth

- Cholesterol
  - LDL may be used by cancer to synthesize estrogen or tumor membranes for cell growth
  - Women with total cholesterol >240 show 17% increased risk of breast cancer vs those with cholesterol <160

Reducing Risk

- Exercise
  - Five hours a week of vigorous aerobic exercise lowers estrogen/progesterone by 20%
  - Walking an hour a day shows reduced relative risk (0.91) when controlled for BMI

- Fiber
  - Premenopausal women who ate 6g of fiber/day had 62% lower odds of breast cancer vs those eating <4g/day
  - Every 20g fiber/day showed 15% lower risk of breast cancer
  - Getting up to a minimum of 25g/day may be required to show an effect. Average vegetarian may only get 20g/day

- Apples
  - Daily apple eaters show 24% lower odds of breast cancer (also ovarian, laryngeal, colorectal cancer)
  - Apples contain antioxidants in skin that seem to suppress breast cancer cell growth in vitro
  - Compounds in skin reactivate maspin (mammary serine protease inhibitor) which reduces cancer growth
• Cruciferous Vegetables
  o 250g each of broccoli and brussels sprouts per day reduced HCA levels in urine by around 22%
  o Mechanism: may improve liver function to detoxify HCAs
  o Sulforaphane suppresses ability to form tumors. To match *in vitro* levels, would need to eat ¼ cup of broccoli sprouts a day

• Flaxseeds
  o Contains lignans, phytoestrogens that dampen effects of human-made estrogen
  o 1 tbsp of flaxseeds can extend menstrual cycle by a day
  o 25g flaxseed muffin in cancer patients showed 31% increase in apoptosis, 71% reduction in C-erB2 (cancer aggressiveness)

• Soy
  o Women with breast cancer who ate most soy had reduced mortality (HR 0.85) and recurrence (HR 0.79)
  o Soy during childhood cuts later risk of breast cancer by half. Soy during adult reduces risk by 25%
  o Soy contains phytoestrogens, which stimulate the estrogen receptor less strongly and compete against estrogen for binding
  o Soy may reactivate BRCA genes through demethylation

• Misc Japanese Foods
  o Green tea consumption associated with 30% reduction in breast cancer risk
  o Mushrooms: >1/2 a mushroom per day shows 64% lower odds of breast cancer
How Not to Die from Suicidal Depression

7% of population suffers from at least one depressive episode each year; 41,000 die from suicide each year

Depression

- The definitive cause is unknown
- The monoamine theory suggests that depression arises from relative depletion of neurotransmitters like serotonin and dopamine
  - The enzyme monoamine oxidase breaks down monoamines; people with depression show higher levels of this enzyme
  - Tryptophan is an amino acid and precursor to serotonin. Depletion of tryptophan worsens mood

Diet affecting mood

- Disclaimer: confounds
  - Vegetarians are often reported to be happier than omnivores. However, it’s not clear the vegetarian diet is causative - it could be that happier people tend to seek out vegetarian diets.
  - The gold standard, as always, is a randomized placebo-controlled trial
- Arachidonic acid
  - Proinflammatory compound; produced naturally in our bodies, but enriched in animal products.
  - In multiple studies, omnivores that go onto a plant-based diet report significantly increased energy, better sleep, and general health.
  - Omnivores consume 9x more arachidonic acid than vegetarians
  - Highest sources: chicken, eggs, beef, pork, fish (but chicken and eggs are highest)
- Plants are natural monoamine oxidase inhibitors
  - Phytonutrients from plant foods like apples, berries, onions, spices naturally inhibit MAO
- Tryptophan
  - If tryptophan is important to produce serotonin, why not eat more of it?
    - Tryptophan supplements led to deaths in 1980s and subsequent bans
    - High-protein meals fail to increase tryptophan, possibly because other amino acids compete for absorption in gut or across blood-brain barrier
  - Carb ingestion improves mood and lowers depression
    - Possibly by shunting nontryptophan amino acids from bloodstream into muscles, allowing tryptophan more access into brain
  - Seeds like sesame, sunflower, pumpkin have high tryptophan-protein ratios
- Saffron
  - Worked as well as Prozac for depression
  - Smelling diluted saffron improves anxiety for 20 minutes
- Coffee
  - Suicide risk drops with increases in coffee dose
    - 6 cup daily drinkers were 80% less likely to commit suicide
  - Adding sugar to coffee negates positive effects on mood
- Aspartame
Experiment showed high-aspartame diet shows more depression and irritability and lower cognitive function

- Exercise
  - Interventionsal study showed exercise was equivalent to Zoloft for relieving depression in 50+ year olds

- Antioxidants and folate
  - Free radicals and oxidative stress cause tissue damage
  - Higher levels of carotenoids reduce damage
    - Lycopene from tomatoes has highest antioxidant activity
    - Daily eaters of tomatoes have half odds of depression
  - Antioxidant supplements do not seem protective, while whole foods do
How Not to Die from Prostate Cancer

Prostate function and disease

- Prostate surrounds the urethra and secretes the fluid part of semen
- Half of men over 80 have prostate cancer, but most die with the disease
- 28,000 die annually from prostate cancer

Dietary risks for prostate cancer

- Milk and hormones
  - High intake of dairy products increases total prostate cancer risk with a relative risk of 1.07
  - Overall, each daily glass of milk showed higher rates of premature death (hazard ratio of 1.15), heart disease, and cancer in women.
    - 3 or more classes of milk a day show mortality hazard ratio of 1.93!
  - Women who drink milk have 5x rate of twin births
  - Japanese men have 25x increase in prostate cancer risk after World War II. Also associated with 7x, 9x, and 20x increase in egg, meat, and dairy consumption respectively
  - Cow’s milk stimulates human prostate cancer cells in vitro by 30%
  - Culprit could be D-galactose, which induces premature aging in lab animals and causes acute symptoms in patients with galactosemia, possibly from oxidative stress
- Eggs and choline
  - Men eating 2.5+ eggs/week show 81% increased risk of dying from prostate cancer
  - Culprit could be choline, which is converted into trimethylamine toxin
  - Overall men eating poultry showed 4x risk of prostate cancer progression (like metastasis) which could be due to cooked-meat carcinogens like HCAs
- Meat and IGF-1
  - IGF-1 (insulin-like growth factor 1) stimulates cell production. Useful for growth as a child, but less helpful in adulthood
    - Laron syndrome is caused by inability to produce IGF-1. Patients almost never get cancer
  - IGF-1 is triggered by animal protein consumption
    - After 11 days of avoiding animal protein, IGF-1 levels drop by 20%, IGF-1 binding protein levels increase by 50%
  - Increase in animal protein consumption of 3% associated with 15% increased risk of bladder cancer
  - Vegetarians who include eggs and dairy in diets don’t achieve significant reduction in IGF-1

Dietary reductions in prostate cancer risk

- Vegetarian diet
- *In vitro*, blood from standard diet slowed down prostate cancer cell growth by 9%. Blood from men placed on plant-based diet for a year **reduce growth by 70%**.
- Cruciferous vegetables especially helpful, cutting cancer progression by over 50%
- Increase in plant protein intake of 2% associated with 23% decreased cancer risk
- Can reverse prostate cancer
  - PSA levels with plant-based diet decrease, while levels increase in control group
- Exercise vs Diet
  - Exercise is helpful, but not as helpful as plant-based diet
    - 3 groups: control sedentary, exercise-only (15 years exercising for an hour each day, 5x a week), and plant-diet-and-moderate-exercise (14 years of plant-based diet, and moderate exercise like daily walk)
  - *In vitro*, blood from control group killed 1-2% of cancer cells. Blood from exercise group killed 20x more cells. Blood from plant-diet group killed 40x more cells.
- Flaxseed
  - Lignans are phytoestrogens shown to slow prostate cancer cell growth *in vitro*. Especially concentrated in flaxseeds
  - Prostate cancer patients eating 3 tablespoons/day of flaxseed after a month show lower proliferation rate
  - Also reduces relief for benign prostatic hyperplasia comparable to drugs like Flomax
How Not to Die from Parkinson’s Disease

25,000 people die from Parkinson’s every year

Mechanism of Disease

- Dopaminergic neurons in your substantia nigra control movement
- In Parkinson’s these cells die off. 70% of the cells could be dead before symptoms appear
- Head trauma increases risk (think Muhammad Ali)
  - So wear helmets, and don’t play football or box

Toxic pollutants accumulate in meat

- Chemicals flow into oceans and into feed, and get concentrated in meat
- Long longevity
  - Half-life of mercury = 2 months. Of dioxins, PCBs, and DDT, can be 10 years
  - Breast milk has higher concentrations of pollutants in first pregnancy vs subsequent ones, suggesting toxins could accumulate over decades and be extruded through milk
  - Children are more at risk of arsenic, pesticide dieldrin, dioxins, and DDE (DDT by-product)
- Top sources
  - Arsenic: poultry, tuna
  - Lead: dairy
  - Mercury: seafood
  - DDT: fish
  - PCB: fish and fish oil
  - Hexachlorobenzen: dairy and meat
  - Dioxins: butter, eggs, processed meat
- How toxins get into meat despite banning
  - Toxins appear in rain and water and enter plants at a low level. Then severely concentrated in cows and other plant eaters
  - Animal feed sometimes consists of animal trimmings itself. So toxins accumulate in generations of agricultural cannibalistic animals, then in us at the top of the food chain
    - [Ideally comparing grass-feed animals to animal-fed meat will show differences in toxicity]
  - Link to Parkinson’s
    - Parkinson’s brains show elevated levels of pesticides, PCBs. The higher level of pollutants, the more damage seen in the substantia nigra
    - Risk of Parkinson’s may increase 17% for every daily cup of milk [ref 66]
      - May not necessarily be toxins, since seems tied closer to lactose than to milk fat, and to milk than to butter. Could be galactose
      - May also lower uric acid, a brain antioxidant
    - Eating more than 0.5 egg/day associated with 2x-3x higher odds for cancers of mouth, colon, bladder, prostate, breast. Possibly because of dioxins
• Cause direct damage to protein folding: pesticides are able to trigger accumulation of alpha synuclein proteins *in vitro*
  o Constipation is associated with Parkinson’s
    • Could be because Parkinson’s causes lack of thirst and decreases intake
    • Alternatively, could be that the longer feces stay in bowel, the longer time to absorb chemicals from diet

**Protective factors**

• Nicotine
  o Smoking has repeatedly been associated with lower Parkinson’s risk
  o Highest non-tobacco sources of nicotine are in bell peppers, then tomatoes and minorly in potatoes. Pepper eating is associated with lower risk of Parkinson’s

• Plant-based diet
  o People who eat dairy-free, plant-based diets show lower levels of PCBs associated with Parkinson’s
  o Mercury in hair of plant-based diet eaters were up to 10x lower than those who ate fish
  o Removes 98% of dioxin intake

• Berries and flavonoids
  o Flavonoids inhibited alpha synuclein deposits from accumulating *in vitro*
  o Population study showed berry eating does lower risk of Parkinson’s [117]

• Coffee and caffeine
  o Coffee consumption associated with 1/3 lower risk of Parkinson’s
  o Caffeine seems to be main effector – tea is protective, decaf is not
  o Giving caffeine amount of 2 cups of coffee/day improved movement symptoms in 3 weeks
How Not to Die from Iatrogenic Causes

Deaths from treatment

- 106,000 deaths from side effects from medications
- 7,000 deaths from wrong medication
- 20,000 from hospital errors
- 99,000 from hospital-acquired infections
- 12,000 from unnecessary surgery complications
- 199,000 from drug side effects

Risks and reductions

- Medical error
  - Residents used to have 36-hour shifts until shortened. All-nighters increase serious errors by 36%, diagnostic errors by 5x
- Radiation
  - Many causes of radiation
    - Single CT scan for baby girl could cause cancer at rate of 1/150
    - Chest CT has same cancer risk as 700 cigarettes
    - Angiogram could cause cancer in 1/270 women
    - A cross-country flight could cause as much radiation as chest x-ray from cosmic radiation [ref 31]
  - Reduce radiation damage through antioxidants in foods like spinach and kale. Vitamin C and E supplements don’t seem to help
  - Hiroshima and Nagasaki survivors show that plant-rich diets cut cancer risk by 36%
  - Ginger, garlic, turmeric, goji berries, mint leaves, lemon may also be protective
- Diet instead of drugs
  - Patients routinely overestimate the power of drugs to treat disease
    - Believe statins are 20x more effective than they actually are. Real benefit of preventing heart attack is <5% over a period of 5 years
  - In comparison, plant-based diet may reduce risk by 60% over 4 years
  - Patients who overtrust drugs may be less likely to adopt lifestyle changes
- Aspirin
  - Salicylic acid is a blood thinner by inhibiting pro-coagulant enzyme; suppresses proinflammatory prostaglandins
  - Not generally recommended for people who haven’t had first heart attack because of side effects
  - Fruit and vegetable contain salicylic acid – levels of people on plant-based diets are comparable to those on low-dose aspirin
    - Cumin, chili powder, paprika, turmeric highest concentration of salicylic acid. India has very low rates of colon cancer, which is the most sensitive to aspirin
    - Organic produce seems to have less salicylic acid, possibly because it’s used as a defense mechanism against bugs
• But fruit and veg may cause fewer side effects, because salicylic acid comes packaged with other gut-protective nutrients

• Colonoscopies
  o Starting at age 50, should get a colonoscopy per decade, have stool tested for blood each year, or have sigmoidoscopy every 5 years
    ▪ Effectiveness of 3 arms is unknown until results come out
    ▪ But doctors generally over-prescribe colonoscopies because it bills the most
  o Serious complications for colonoscopies happen in 1/350 cases, like perforations and bleeding
  o Eating peppermint oil capsules reduces strength of colon contractions
Part 2: What to Eat

Introduction

More reasons for eating veg and fruit

• Think of your diet everyday as a bank account of 2000 calories you can spend everyday. Eating one 800 calorie hamburger displaces eating 7 sweet potatoes or 26 cups of broccoli
• Is eating healthily expensive?
  o On a calories-per-dollar basis, junk food and fat are the cheapest
  o But on a nutrients-per-dollar basis, vegetables offer 6x more nutrition compared to processed food
  o Meat costs 3x more than vegetables but deliver 16x less nutrition. Thus meat is 48x more expensive on a nutrient basis than vegetables
• Increasing fruit and veg spending by 50 cents/day can decrease mortality by 10%.
• Dietary guidelines are often influenced by industry
  o When promoting products, they can use specific food groups (“eat more veg and fruits”)
  o When discouraging products, they switch to biochemical components (“eat less saturated and trans fats,” vs “eat less meat and junk food”), likely to appease agricultural groups

Diet by Traffic Light

• Michael Greger suggests considering food by a traffic light system:
  • Green: Unprocessed plant foods
    o Unprocessed means nothing bad added, nothing good taken away
    o Tomato juice may be healthier than whole fruit; cocoa powder is processed to remove saturated fat
    o You can eat unlimited amounts of these
  • Yellow: Processed plant foods, Unprocessed animal foods
    o Processed means something bad is added or something good is taken away
    o Almond milk is worse than eating pure almonds
    o Ideally you’d replace yellow foods with green foods
  • Red: Ultra-processed plant foods, Processed animal foods
    o Eat sparingly; you might run a red light once in a while, but you won’t make a habit of it
    o OK if this helps you eat more green foods (like bacon bits or hot sauce)

How to succeed in plant-based diets

• Don’t worry about 100% into plant-based diet immediately
  o Don’t feel like you have to give up things you love, like never eating pizza again
  o Instead, make wise choices day to day. Have pizza once a month instead of once every 3 days. Aim for 80% and succeeding instead of 100% and failing
• Remove decision fatigue from your diet
  o Willpower depletes throughout the day with decisions. When your willpower is low, your inhibition is low, and you make worse decisions
  o Adopt strict rules like “never cook with oil” or “eat only whole grains” so you won’t have to make the choice
  o Remove junk food cues from your house so you don’t adopt a habit of snacking
• Replace your typical meals with healthier alternatives
  o Most families rotate through same 8-9 meals
  o Step 1: Add health to plant-based meals
    ▪ Turn spaghetti and pasta sauce into whole-grain pasta with veg
  o Step 2: Adapt 3 meals to plant-based meals
    ▪ Beef chili to bean chili
  o Step 3: Discover new healthy options
• Consider it an experiment first, not a lifetime change
  o Commit to a plant-based diet for 3 weeks. Easier than a lifetime change
  o Your health may improve so much that you won’t want to go back

Dr Greger’s Daily Dozen

• Beans [ ] [ ] [ ]
• Berries [ ]
• Other Fruits [ ] [ ] [ ]
• Cruciferous Vegetables [ ]
• Greens [ ] [ ]
• Other Vegetables [ ] [ ]
• Flaxseeds [ ]
• Nuts [ ]
• Spices [ ]
• Whole Grains [ ] [ ] [ ]
• Beverages [ ] [ ] [ ] [ ] [ ]
• Exercise [ ]
Beans

Daily recommendations

- 3 servings per day
- Serving sizes
  - ¼ cup of hummus or bean dip
  - ½ cup cooked beans, tofu, tempeh
  - 1 cup of fresh peas, sprouted lentils
- What to eat
  - Black beans, black-eyed peas, butter beans, cannellini/garbanzo beans, chickpeas, edamame, kidney beans, lentils (beluga, French, red), miso, navy beans, peas, pinto beans, small red beans, tempeh

Benefits and Recommendations

- Nutrients: protein, iron, zinc, fiber, folate, potassium
- Canned beans are as nutritious as boiled beans, except for salt
- Beans drop LDL and total cholesterol
- 8% reduction in premature death for every 20g increase in daily legume intake

Specific Choices

- Soy
  - Half of nutrients are lost when converted into tofu or soy milk
  - For tofu, choose ones made with calcium
  - Tempeh or miso are whole soy foods that are preferable
    - Don’t boil miso since it has probiotics
    - Despite its salt, miso may have protective effects that cancel out risk of stomach cancer and hypertension
  - Lentils
    - Lentil effect – when eaten, blunts sugar spike of foods eaten hours later. Compounds relax stomach and slow rate of sugar absorption
    - When sprouted, antioxidants double
  - Black beans
    - Have more phenolic phytonutrients than egeneration
Berries

**Daily recommendations**

- 1 serving per day
- Serving sizes
  - ½ cup fresh or frozen
  - ¼ cup dried
- What to eat
  - Acai berries, barberries, blackberries, blueberries, cherries, concord grapes, granberries, goji berries, kumquats, mulberries, raspberries, strawberries

**Benefits and Recommendations**

- 10x more antioxidants than other fruits and vegetables by density
- Flavonoid intake associated with [lower risk of fatal cardiovascular disease](#) (RR: 0.82, top vs bottom quintile)
- Protection against cancer
- Immune system boost (1.5 cups/day of blueberries for 6 weeks doubled natural killer counts in athletes after intense exercise, when normally it drops by half)
- Protection for brain (women who ate one serving of blueberries and two servings of strawberries a week had slower rates of cognitive decline, by as much as 2.5 years)
- Fructose in fruit is less harmful than pure added fructose
  - Fiber, antioxidants, and phytonutrients may cancel out harmful fructose effects (eg slower absorption)
  - Small trial found that feeding a diet including 20 servings of fruit per day had no effect on weight, BP, or triglycerides, but lowered LDL by 38 points
- Frozen berries are roughly the same in nutrition or about 20% less nutritious in antioxidant activity, but tend to last longer and are cheaper
  - Jams lose majority of nutrient though
- Avoid these and anti-inflammatory drugs during 3rd trimester of pregnancy

**Specific Choices**

- Blackberries
  - Highest antioxidant density at 650 units, vs blueberries at 380, raspberries at 350, strawberries at 310, mangoes at 110, apples at 60
- Cherries
  - Can reduce inflammation, useful for gout
- Goji Berries
  - Highest concentration of melatonin, 3rd highest antioxidant capacity of common dried fruit
  - Zeaxanthin content helps protect against macular degeneration
- Black Currants
  - Improves computer eye strain – may be due to anthocyanins
Other Fruits

Daily recommendations

- 3 servings per day
- Serving sizes
  - 1 medium-sized fruit
  - 1 cup cut-up fruit
  - ¼ cup dried fruit
- What to eat
  - Apples, dried apricots, avocados, bananas, cantaloupe, clementines, dates, dried figs, grapefruit, honeydew, kiwi, lemons, limes, lychees, mangos, nectarines, oranges, papaya, passion fruit, peaches, pears, pineapple, plums, pomegranates, prunes, tangerines, watermelon

Benefits and Recommendations

- Diet low in fruits found to be second leading dietary factor for global disease burden in DALYs
- Associated with lower cardiovascular disease and type 2 diabetes
- Are fruits and nuts fattening?
  - In experiment, one group was told to eat two fruit-and-nut bars daily. Despite the extra 340 calories from the bars, they didn’t gain weight after two months.
  - Fruits and nuts are satiating and offset calories elsewhere, while delivering better nutrients than common processed foods

Specific Choices

- Olives
  - An anti-recommendation: avoid eating high-sodium olives
  - Olive oil has most of nutrition removed, so try cooking without oil
- Watermelon
  - Seeds have respectable antioxidant levels
  - Citrulline is useful for erectile dysfunction
- Apples
  - Eating a dozen dried apple rings a day drops LDL 16% in 3 months
- Grapefruit
  - Can suppress liver enzymes that metabolize drugs
Cruciferous Vegetables

Daily recommendations

- 1 serving per day
- Serving sizes
  - ½ cup chopped
  - ¼ cup Brussels or broccoli sprouts
  - 1 tablespoon horseradish
- What to eat
  - Arugula, bok choy, broccoli, Brussels sprouts, cabbage, cauliflower, collard greens, horseradish, kale, mustard greens, radishes, turnip greens, watercress

Benefits and Recommendations

- Sulforaphane is thought to be main beneficial component
  - Protective against DNA mutations and ability to form tumors
  - Protects brain, eyesight, immunity
  - May help with autism
- Sulforaphane requires enzyme myrosinase to be produced
  - Raw foods suppress cancer cell growth *in vitro*, but not cooked
  - Michael Greger suggests a “hack and hold” technique – chop and wait forty minutes while sulforaphane is produced
  - Frozen cruciferous vegetables lose much of antiproliferative effect because tyrosinase is destroyed before packaging. Powdered mustard seeds have tyrosinase and increase sulforaphane production
- Supplementing sulforaphane seems ineffective
  - *Bioavailability is >8x better* when eating broccoli sprouts vs supplements containing the same amount of precursor chemical
- Too much sulforaphane could cause DNA damage
  - Equivalent of 4+ cups of broccoli sprouts

Specific Choices

- Red cabbage
  - More antioxidants per dollar than other foods
- Broccoli sprouts
  - When grown yourself, very cheap source of sulforaphane
Greens

Daily recommendations

- 2 servings per day
- Serving sizes
  - 1 cup raw
  - ½ cup cooked
- What to eat
  - Arugula, beet greens, collard greens, kale, mesclun mix, mustard greens, sorrel, spinach, swiss chard, turnip greens

Benefits and Recommendations

- **Decreases cancer risk**
- **1 serving/d increase associated with 4% lower risk for coronary heart disease**
  - Vitamin C-rich foods contributed most
- **Relative risk of 0.69 for ischemic stroke for highest quintile vs lowest quintile fruit and veg intake**
- Chlorophyll blocks carcinogen activity, possibly by regenerating coenzyme Q10
- Eat with fat
  - Fat-soluble compounds like beta-carotene, lutein, vitamin K, zeaxanthin are better absorbed when paired with fat
- Warning: Greens contain vitamin K. If taking warfarin or blood-thinners, can nullify the drug

Specific Choices

- Kale
  - Green is best, **had greater antiproliferative effects in vitro**
- Method of preparation – fresh is better
  - Fresh kale showed much **better antiproliferative effects** than frozen and heated-in-bag kale (in some assays, cooked kale showed no antiproliferation while fresh did)
  - Boiling broccoli **removes 50% of glucosinolates**; steaming doesn’t change significantly
- Vinegar
  - (Not a green, but included in the chapter)
  - In type 2 diabetics, 2 tbsp of apple cider vinegar at bedtime **reduces fasting sugar by 6% compared to 0.7% in control**
  - Acetic acid may lead to improved nitric oxide production
- Avoid alfalfa sprouts
  - **Salmonella** outbreaks seem most common in alfalfa sprouts
Other Vegetables

Daily recommendations

- 2 servings per day
- Serving sizes
  - 1 cup raw leafy vegetables
  - ½ cup raw or cooked nonleafy vegetables
  - ½ cup vegetable juice
  - ¼ cup dried mushrooms
- What to eat
  - Artichokes, asparagus, beets, bell peppers, carrots, corn, garlic, mushrooms (button, oyster, Portobello, shiitake), okra, onions, peas, purple potatoes, pumpkin, seaweed, squash, sweet potatoes, tomatoes, zucchini

Benefits and Recommendations

- Diversify your vegetables
  - Different vegetables have different phytonutrients and different benefits to the body
    - Cabbage, cauliflower, broccoli, Brussels sprouts lower risk of colon cancer on middle and right side
    - Carrots, pumpkins, apples lower risk on left side
    - *In vitro*, radishes do nothing to stop pancreatic cell growth, but do stop stomach cancer
  - Studies might underestimate effect of plant foods because people tend to concentrate eating typical fruits – apples, bananas, grapes
  - Variety of intake was better predictor of decreased inflammation than absolute quantity
- Improved attractiveness
  - Carotenoids from yellow/red vegetables deposit in skin and make face rating more attractive
  - Intake of green/yellow vegetables associated with decreased facial wrinkling in Japanese women (controlling for age, smoking, BMI, sun exposure; could still be confounded with wealth)
- Promoting vegetable eating
  - Call vegetable dishes exotic names, like “traditional Cajun red beans and rice” rather than “red beans with rice”
  - Or “Tiny Tasty Tree Tops” for broccoli doubles vegetable eating for kids
- Cooking method
  - Raw generally has the most nutrients available
  - But cooking can compensate if it makes you eat more
  - Varies with vegetable
    - Steaming destroys 10% vitamin C in broccoli
    - Cooking carrots increases vitamin A, and cooking tomatoes increases lycopene
    - Boiling, pressure-cooking reduce antioxidant capacity by 20-50% depending on vegetable
    - Microwaving reduces on average by 5%, but some vegetables decrease by 50%, and some actually increase activity (carrot, celery, green bean)
    - Artichokes, beets, onions aren’t affected by cooking method
- Carrots and celery gain in antioxidants with cooking
  - Vegetable wash with 5% acetic acid (vinegar) or 10% saltwater
  - Organic food?
    - Organic fruits and vegetables do not produce higher serum levels of vitamins or nutrients
    - Pesticide contamination risk was 30% lower in organic foods, but still under allowed limits. People tend to far overestimate the risks of pesticides, equating pesticide risk to motor vehicle driving. (I was not able to find estimates of what the real number was)
    - [Allen addition: the EWG has the dirty dozen and clean 15 lists for pesticide exposure. Worst = strawberries, apples, peaches, celery, grapes, spinach. Best = avocados, corn, pineapples, cabbage, peas, onions]

Specific Choices

- Tomato
  - Yellow fluid surrounding seeds has anti-platelet compounds
  - Choose whole, crushed, diced tomato products instead of sauce or puree
- Mushrooms
  - Ergothioneine is an intramitochondrial antioxidant
  - Our cells have a specific ergothioneine transporter; humans don’t synthesize it
  - Oyster mushrooms have 1000 units of ergothioneine, 9x more than black beans
  - Best to cook or eat frozen mushrooms because of agaritine toxin
  - Morel mushrooms have higher levels of toxins; Greger recommends not eating this
- Sweet potatoes
  - Phenolics and antioxidants are at highest levels when raw. Boiling decreases by ~10%, roasting by 20-30%
- Spinach
  - Top in vitro antiproliferative action against breast, brain, kidney, lung, pancreatic, prostate, stomach cancer
- Other antiproliferative vegetables
  - Brussels sprouts, cabbage, kale
  - Garlic, green onions, leek
Flaxseeds

Daily recommendations

- 1 serving per day
- Serving sizes
  - 1 tablespoon ground
- What to eat
  - Golden or brown flaxseeds

Benefits and Recommendations

- Contains lignans and omega-3 fatty acids
- Double-blind, placebo-controlled, randomized trial showed BP drop from 158/82 to 143/75 for tablespoons of flaxseed a day, compared to no change in control.
- Prostate cancer patients eating 3 tablespoons/day of flaxseed after a month show lower proliferation rate
- Best to blend flaxseeds. Should last at least 4 months at room temperature

Nuts and Seeds

Daily recommendations

- 1 servings per day
- Serving sizes
  - ¼ cup nuts or seeds
  - 2 tablespoons nut or seed butter
- What to eat
  - Almonds, Brazil nuts, cashews, chia seeds, hazelnuts, hemp seeds, macadamia nuts, pecans, pistachios, pumpkin seeds, sesame seeds, sunflower seeds, walnuts

Benefits and Recommendations

- ¼ cup of nuts daily may lead to lifespan extension of 2 years+
- Nuts have high caloric density, but studies show adding nuts to diet cause lower weight gain than control. Where do the calories go?
  - 70% of nut calories displace other foods
  - 10% of calories are not absorbed by gut
  - 20% may come from nuts boosting metabolism

Specific Choices

- Walnuts
- Have the highest antioxidant and omega-3 levels and suppress cancer proliferation in vitro
- **PREDIMED study** showed Mediterranean diet with nuts reduced stroke risk by 50% and **39% lower all-cause mortality risk**, while olive oil did not reduce all-cause mortality.

- **Peanuts**
  - Women at high risk for heart disease who eat nuts or peanut butter daily halve risk of heart attack compared to non-eaters

- **Pistachios**
  - Erectile dysfunction is early sign of vascular disease and can predict heart disease
    - **40 over 40 rule**: 40% of men over age 40 have erectile dysfunction
  - 3 to 4 handfuls of pistachios a day for 3 weeks show improvement of erectile function by 50%
  - Can also improve female lifespan from Nurses’ Health Study
Herbs and Spices

Daily recommendations

- 1 servings per day
- Serving sizes
  - ¼ teaspoon turmeric
  - + any other you enjoy
- What to eat
  - Allspice, barberries, basil, bay leaves, cardamom, chili powder, cilantro, cinnamon, cloves, coriander, cumin, curry powder, dill, fenugreek, garlic, ginger, horseradish, lemongrass, marjoram, mustard powder, nutmeg, oregano, smoked paprika, parsley, pepper, peppermint, rosemary, saffron, sage, thyme, turmeric, vanilla

Benefits and Recommendations

- Spices have high antioxidant density
- Too much of a good thing
  - Poppy seeds contain opium, can overdose – safe dose below 1 teaspoon for 10lbs of body weight
  - Nutmeg can create amphetamine-like compounds – safe dose below 2-3 tsp
  - Cassia cinnamon contains coumarin, which may be toxic to liver – safe dose below teaspoon

Specific Choices

- Turmeric
  - Curcumin appears to be the dominant active ingredient
  - Shown to reduce lung disease, brain disease, cancers, rheumatoid arthritis, osteoarthritis, ulcerative colitis
  - 1/8 teaspoon of turmeric daily reduces free radical damage and DNA breakage by 50% in extracted blood cells
  - Black pepper piperine inhibits drug metabolism in liver and increases bioavailability of turmeric
  - Cooked turmeric seems to offer better DNA protection, raw turmeric better anti-inflammatory effects
  - What about curcumin supplements?
    - Turmeric appeared to have twice the effect of curcumin in inhibiting cancer cell growth in vitro
    - Curcumin-free turmeric has similar effects as turmeric, so other compounds may be contributory
    - Also should worry about overdosing on curcumin
  - Don’t take turmeric if you have gallstones (pumps gallbladder and causes pain) or if you’re prone to kidney stones (turmeric contains oxalates; <1 teaspoon daily of turmeric)
• Fenugreek
  o Found to improve 1 rep max lifts for leg press and bench press, by about 100% (for leg press placebo improved 48kg, fenugreek group improved 84kg)
  o Causes armpits to smell like maple syrup
• Cilantro
  o Reduces inflammation levels in arthritis patients and reduces uric-acid levels
• Cayenne pepper
  o Might be useful for cluster headaches and irritable bowel syndrome because it depletes pain neurotransmitter (substance P)
• Ginger
  o Randomized controlled trial showed 1/8 tsp of ginger worked as well as sumatriptan for migraines
  o 1/8 tsp a day, 3x a day reduced menstrual cramp pain from an 8 (on a 10-point scale) to a 3 over 2 months.
  o Counters vomiting and motion sickness
  o During pregnancy, maximum amount recommended is 20g
• Peppermint
  o Most antioxidant-dense common herb
• Oregano and marjoram
  o Antioxidant, reduces chromosome damage from radioactive iodine by 70% in vitro
• Cloves
  o Most antioxidant-dense common spice
• Amla
  o Most antioxidant-dense uncommon spice, at 261.5 units compared to 9.24 for blueberries
  o Powdered dried Indian gooseberry fruit spice
• Spice mixes
  o Spice mix, when applied to high-fat chicken meal, doubled antioxidant presence in bloodstream and reduced triglycerides in blood by 30%
• Liquid smoke
  o Smoke compounds are carcinogenic but are fat-soluble, so don’t reside in spices or liquid smoke
Whole Grains

Daily recommendations

- 3 servings per day
- Serving sizes
  - ½ cup hot cereal or cooked grains, pasta
  - 1 cup cold cereal
  - 1 tortilla or slice of bread
  - ½ bagel or English muffin
  - 3 cups popcorn
- What to eat
  - Barley, brown rice, buckwheat, millet, oats, popcorn, quinoa, rye, teff, whole-wheat pasta, wild rice

Benefits and Recommendations

- From Nurses’ Health Study, 5th quintile of whole grain intake led to hazard ratio of 0.91 for total mortality and 0.85 for cardiovascular mortality, compared to 1st
- Whole grains reduce risk of heart disease, type 2 diabetes, obesity, stroke
- Reduces inflammation across a panel of markers (CRP, interleukins, TNF-a, etc)
- Five-to-One rule
  - Ratio of grams of carbohydrates to dietary fiber should be 5 or less
  - When grains are processed into flour, digested more rapidly and increases glycemic index

Specific Choices

- Gluten
  - Outside of celiac disease, is gluten sensitivity real? Two randomized controlled trials show most people who claim to feel better on gluten-free diet feel worse on a no-gluten placebo. Exposure to gluten can induce feelings of depression.
  - But some people showed wheat sensitivity, which is correlated to sensitivity to other foods like eggs and milk. If you remove these from the diet and challenge with gluten, there’s no effect. So going on a healthier diet may be the reason gluten-free diets work.
  - About 2% of population may have celiac disease or wheat allergies. For the other 98%, there is no evidence that gluten-free diet has benefits, and may negatively affect gut flora
- Pigmented grains
  - Pigmented rice (red, purple) may have antioxidant benefits over brown rice
- Oats
  - Contain avenanthramides, anti-inflammatory
  - Suppresses inflammation for skin rashes
Beverages

Daily recommendations

- 5 servings per day
- Serving sizes
  - One glass
- What to eat
  - Black tea, chai tea, chamomile tea, coffee, earl grey tea, green tea, hibiscus tea, hot chocolate, jasmine tea, lemon balm tea, matcha tea, oolong tea, peppermint tea, rooibos tea, water, white tea

Benefits and Recommendations

- Liquid benefits overall
  - 8 glasses a day recommendation seems to originate from 1921 paper measuring urine and sweat output
  - New recommendation is 10-15 cups of water a day for men, 8-11 for women, including foods. Net of food, translates to 6-11 cups for men and 4-7 for women
  - Low liquid intake associated with heart disease, kidney disease, UTIs, etc. But unclear whether low drinking is associated with other unhealthy behaviors like lack of exercise and poor diet
  - Each extra daily cup of fluid reduced risk of bladder cancer by 7%
  - Adventist Health Study shows 5+ glasses of water a day had half risk of heart disease, compared to <2 glasses
  - Dehydration causes lower cognitive function and depressed mood
  - 2/3 of children might be in state of mild dehydration!

Specific Choices

- Coffee
  - Overall, 3% lower risk of premature death for each cup of coffee
  - NIH-AARP study showed 6+ cups/day had 10-15% lower mortality rate for over-55 people. Below age of 55, coffee increased risk of death
  - Benefits for liver disease, mood, and Parkinson’s
  - Improves energy, alertness, and cognitive performance
  - Drawbacks
    - Does induce acid reflux; decaf has less of this effect
    - Coffee may increase cholesterol when not filtered out, caused by fat-soluble cafestol
- Tea
  - Reduces risk of cancer, diabetes, and tooth loss; lowers cholesterol, blood pressure, body fat, allergic symptoms
  - Promotes alpha brainwaves (alert, focused, calm)
  - White tea has more antioxidants than green tea if you add lemon, as some phytonutrients are activated at lower pH
  - Cold-steeping tea (2 hours in the fridge) reduces caffeine content and may improve antioxidant activity (by around 20%)
- Topical green tea can clear genital warts
- Green-tea extract pills have caused liver toxicity
- Overdose causes fluorosis problems
  - Safe limit: 20 bags of black tea, 30 of green tea, or 80 of white tea
- Sweeteners
  - Greger approves blackstrap molasses and date sugar as green-light foods
  - Erythritol is absorbed so doesn’t cause laxative effect of sorbitol/xylitol; hasn’t been implicated in disorders like hypertension or headaches like other low-calorie sweeteners
  - Artificial sweeteners may cause excess calorie consumption in a few ways
    - Consciously knowing that you’re consuming fewer calories makes you compensate
    - Subconsciously, sweet sensation could trigger body to want to eat more, since in the past this meant you were around blueberry bushes; but it doesn’t trigger satiation responses since calories aren’t absorbed
    - Maintaining cravings for sweet things
- Hibiscus
  - Highest antioxidant content among beverages, at 6.99 units compared to 2.11 for jasmine tea, 1.21 for black tea
  - 3 cups of hibiscus tea a day dropped blood pressure by 6 points over control
  - Acidic, so rinse mouth after drinking
Exercise

Daily recommendations

- 1 serving per day
- Serving sizes
  - 90 minutes of moderate-intensity activity
  - 40 minutes of vigorous activity
- What to eat
  - Moderate-intensity = cycling, hiking, housework, ice skating, shoveling snow, walking briskly (4 mph), yard work, yoga
  - Vigorous = basketball, jogging, rock climbing, running, vigorous swimming, tennis, weightlifting

Benefits and Recommendations

- Eating is still the principal cause of obesity
  - People may actually be increasing physical activity over time, but foods are more calorically dense now that more than compensate
  - Not eating a set of calories is usually much easier than exercising away the calories
  - Diet is the #1 risk factor for decreasing lifespan, responsible for 26% of deaths and 14% disability-adjusted life years compared to tobacco smoking at 22% and 12%
  - 1% of national BMI could reduce 2 million cases of diabetes, 1.5 million cases of heart disease, 127,000 cases of cancer

Specific Choices

- Not sitting
  - Every extra hour spent watching TV per day associated with 11% increased risk of death
  - Men who sit for >6 hours per day have 20% higher death rate compared to men sitting <3 hours; for women, it’s 40%. Even among people who exercise daily for an hour
  - Possible mechanism: endothelial dysfunction – blood vessels don’t signal to arteries to relax in response to increased blood flow
  - Walking 300 minutes/week reduces mortality by 14%; 150 minutes/week reduces mortality by 7%; 60 minutes/week reduces mortality by 3%
  - Options
    - Switch to standing desk – extra 30,000 calories burned per year
    - Have walking/stand-up meetings instead of sit-downs
    - Take short breaks of 1 minute to walk or climb stairs
    - Turmeric can improve endothelial function as well as 1 hour/day of exercise
  - Reduce muscle soreness and oxidative stress from exercise
    - Reduce lactic acid with bioflavonoids from citrus
    - Reduce inflammation with anthocyanin flavonoids in berries
    - Whole-food antioxidants reduce DNA damage from exercise, whereas vitamin C supplements promote even more oxidative stress
Conclusion

- Modern foods are optimized to develop unhealthy eating habits
  - Our primate brains have evolved to have natural drives for food, water, sex
  - Modern industries exploit and amplify this in ways we don’t consciously perceive. Processing of foods takes them into an unnaturally addictive state by decreasing dopamine sensitivity and raising the barrier for enjoyment.
  - Natural coca leaves have not been shown to be addictive over millennia, but do become addictive when processed into cocaine
  - Similarly, ice cream gives such an intense dopamine response (to both sugar and fat) that it deadens response to natural foods like fruits. Then, you naturally try to seek a greater dopamine high than what ice cream provides
  - Eating normal whole foods can return dopamine sensitivity to normal levels

Supplements

- Vitamin B12
  - Dosing
    - Under 65: 2,500 mcg of cyanocobalamin once a week, or 250 mcg a day
    - Over 65: up to 1,000 mcg daily
  - B12 is made only by microbes, and is present in meat but not plants
  - Deficiency can lead to paralysis, psychosis, blindness

- Vitamin D
  - Dosing
    - One 2,000 IU vitamin D3 daily
  - Above 40 degrees latitude, through November through February no vitamin D may be produced

- Iodine
  - Dosing
    - 150 mcg daily
  - Green-light: Seaweed has iodine; two sheets of nori
  - Yellow-light: seafood and dairy milk
  - Red-light: iodized salt

- Omega-3s
  - Dosing
    - 250 mg omega-3s
  - Algae oil or yeast products are best
  - Avoid fish oil
    - Contains PCBs, mercury, pollutants
    - Mercury from seafood can cause cognitive performance drop