SUPPLEMENT

Plant-Based Diets for Reversing Disease and Saving the Planet: Past, Present, and Future

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ABSTRACT

The relative contributions of meat and plants to the native human diet, and human adaptation to these dietary constituents, are a matter of debate among paleoanthropologists. Indisputable, however, is the imprint of both on the anatomy and physiology of *Homo sapiens*: our species is constitutionally omnivorous. That means we have choices to make. At present, we are making mostly bad ones, with poor diets of highly processed plant and animal foods alike leading contributors to chronic disease, premature death, and environmental degradation. The evidence is strong, consistent, and compelling that a diet of predominantly, or even exclusively, whole plant foods can promote health, selectively treat and reverse disease, and confer comparable benefit to the planet. Omnivores have dietary choices, but the choices of nearly 8 billion hungry *Homo sapiens* on a small imperiled planet have narrowed. The future of food, for the sake of people and planet alike, is plant centric. *Adv Nutr* 2019;10:S304–S307.

Keywords: reversal of chronic disease, plant-based diets, plant-centric diet, whole plant foods

"The past is history; the future is a mystery; the present is a gift." (Bill Keane)

"The best way to predict the future is to create it." (Peter Drucker)

Diet Past: Of Adaptations and Interpretations

Human beings are constitutionally omnivorous. This is evident not merely from prevailing dietary proclivities, but from far more substantive considerations of anatomy and physiology (1). Obligate herbivores cannot digest meat, but we can. Obligate carnivores cannot digest plants, but we can. We are omnivorous.

As a result, perspectives on the role of plant foods in the optimal feeding of *Homo sapiens* are subject to wide variation. Paleoanthropologists have long referred to Stone Age (and prior) humans as hunter-gatherers. In recent years, the perspective that gathering, and plant food consumption, may have prevailed has led others to flip that order to "gatherer-hunters." More often now, the term "forager" is used to encompass both (2, 3).

The relevance of adaptation to dietary requirements is beyond dispute (4). All animals best thrive on the foods they are adapted to eat. There is no reason to think *Homo sapiens* departs from this rule of nature. But defining the bounds of human adaptation is challenging. Our closest cousins, chimpanzees, consume a plant-predominant diet, but do eat some meat. Our cousins one step further removed, gorillas, are all but exclusive plant eaters, with a little room in their diets for insects. In the direct human lineage, *Homo erectus* hunted, but the earlier australopithecines did not. What "humans" are adapted to eat may depend on just when one chooses to start the clock (5).

Even then, there are potential controversies. Proponents of the "paleo" diet routinely argue for the exclusion of grains, for instance, but there is archeological evidence to support grain ingestion by humans some 150,000 y ago—nearly 100,000 y before the dawn of agriculture (6). At the other end of the spectrum is evidence of modern adaptation, such as a study suggesting genetic adaption to a plant-predominant diet in a population with a long tradition of the same (7).

Even the quantitative contributions of plant foods to human sustenance can be interpreted variably. Those wishing to emphasize the importance of meat in human evolution are apt to reference calories (8). Because of the low energy density

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of many plant foods, however, their dietary prominence may be better represented by volume (9).

By any metric, there is much to suggest that humans are adapted to plant-predominant diets, and that such diets foster human vitality. But we are left to concede that much about the past is less than perfectly clear, and prone to dispute. What is beyond dispute is that we are omnivores, and thus have choices. The present demonstrates the high cost of bad choices; and the future provides clear opportunity for better ones.

Diet Present: All Knowledge, No Power

The present state of prevailing dietary practices, plant based or otherwise, in the United States and increasing swathes of the world, may be summed up in one word: calamitous. The modern, animal-food-centric, highly processed diet is devastating to planetary and public health alike (10, 11). In the most recent accounting, diet is the number one root cause of premature death and antecedent chronic disease in the United States (12).

This is not for lack of warning. At a minimum, the alarm has been sounding for a quarter century, since McGinnis and Foege published their seminal paper "Actual causes of death in the United States" in *JAMA* in 1993 (13). That provocative paper enumerated the modifiable causes of premature death in the United States, and attributed 80% to just 3 factors: tobacco, poor diet, and lack of physical activity. Those findings were reaffirmed when the analysis was repeated a decade later (14). The reanalysis showed the gap between bad use of fingers (i.e., holding cigarettes) as the then number one cause of premature death, and the combination of bad use of feet (i.e., lack of physical activity) and forks (i.e., poor dietary patterns) as number two, to have narrowed for one good reason and one bad. The good reason was less, albeit still too much, smoking. The bad was further deterioration of diet and activity patterns, and worsening epidemics of obesity and diabetes to show for it.

In the years since diet went from the number two to the ostensibly number one cause of premature death, the peer-reviewed literature has percussed with an unending sequence of publications reaffirming the same basic proposition with remarkable quantitative consistency: a ~80% variance in the risk of major chronic disease and premature death in tandem with a short list of lifestyle factors, diet salient among them. This calculus pertains to both sides of the same currency. Just as poor diet and related practices can conspire mightily against health, the salutary alternatives are arguably the most potent medicine known (15) for health promotion, disease prevention, and perhaps disease treatment as well (16).

The basic theme of optimal eating, subject to variation though it may be, appears to pertain to humans more or less universally. Human variation figures in the burgeoning preoccupation with personalizing nutrition. However advantageous the fine-tuning of personalization may prove to be, evidence to date points to a limited role (17). Rather, the basic theme of a health-promoting diet seems to have species-wide implications for our kind (18), as is true for every other kind of animal.

Over recent decades, the role of diet in our medical destinies has been clarified and amplified. Studies have indicated the potential for diet (and lifestyle) interventions to treat coronary disease, ameliorate insulin resistance, normalize high blood pressure, reverse diabetes, and more (18). Some 2400 y after Hippocrates, there are indeed randomized controlled trials supporting the proposition of letting "food be thy medicine."

It is, as well, an arbiter of our fate at the most foundational levels of our physiology. We entered the genomic age thinking that DNA was destiny. We know now, in what we might deem the epigenetic age, that far more frequently, dinner is destiny. The evidence is clear that diet and lifestyle can alter gene expression (19), overcome high genetic risk (20), and even change the very architecture of our chromosomes (21).

But the present is a place where knowledge and power seemingly refuse to cohabitate. We know that "food, not too much, mostly plants" defines well the crucial, common attribute of all good diets (22), but do little with that information. Instead, we debate nutrient scapegoats and silver bullets, and devise new ways of eating badly for a population seemingly committed to exploring them all. Arguments in favor of plant-predominant (and plant-exclusive) diets do nothing to obviate "bad" plant foods. In a culture where eating less salami has meant eating more Snackwells (i.e., low-fat junk food), such bad foods prevail. They prevail quite profitably for the many industries—from Big Food to Big Pharma—exploiting the toxic status quo.

At present, bickering (or the semblance of it) among academics and exaggerations by media obscure the realities of global consensus (23), and common ground (24) fertile to the proposition of plant-predominant diets. Despite years of attention and opposition, Farm Bill subsidies in the United States continue to favor giant agribusinesses over average Americans busy acquiring lifestyle-related chronic diseases (25). A food supply in which "junk" is a food group, willfully engineered to maximize eating for profit (26), is tolerated with no obvious outrage by either parents or health professionals. Waiting for silver bullets, we let a pernicious truth hide in plain sight, squandering the potential to eliminate some 80% of chronic disease and premature death, and at the same time devastating our aquifers, our climate, our economy, and the great treasure of this planet's biodiversity (27). Instead of effectively combating the costly calamity of our prevailing diet, we look on as it is exported to undermine the health of people and places around the globe for the sake of short-term corporate profits (28, 29).

Diet Future: Back, and Forth

As I write this, there is a pop culture fascination with the "ketogenic" diet. This is, in effect, the Atkins diet (or any of its prior designations) under a new label, and apt to suffer the same fate in time: loss of seductive luster. But, for the moment, seductive it is, based in part on claims that it can both treat obesity and reverse disease (30).

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Here, then, is a precautionary note about a focus on "disease reversal" as the primary argument for plant-predominant, truly salutary diets. Not everything that can "reverse" a disease in the short term is a good idea in the long run. Substituting cocaine for food will reverse type 2 diabetes as reliably as ketosis. So, too, would a bout of cholera. High blood pressure and elevated lipids fall with any of many health crises, from cancer to tuberculosis. Reversing disease is a good thing, but only in the context of replacing it with sustainable health. The only dietary theme known to do that and foster the prospect of the real "prize"—more years in life, more life in years—is wholesome foods, mostly plants, in any time-honored, sensible assembly (18). Why the fascination with disease reversal by means that might not be, and probably aren't, good for long-term health, when means that are work as well? Presumably something related to the perpetual allure of the new and shiny, of magic and false promises, and the many industries that peddle such deceptions.

However compelling the arguments for plant-predominant (and plant-exclusive) diets for human health, the environmental arguments are even more so (31). A population of nearly 8 billion hungry *Homo sapiens* is, quite simply, running out of choices.

As constitutional omnivores, we specialize in dietary choices. We have choices for our sources of dietary fat. The evidence suggests that the more of it we get from nuts and seeds, olives and avocadoes, and fish and seafood in lieu of any other meats, the lower our rates of all-cause mortality (32). We have choices for our sources of protein. The evidence suggests that the more of it we get from plant rather than animal foods, the lower our rates of all-cause mortality (33).

When we were few, and scattered, and foraging, we had the native choices of omnivores. The animals we hunted were wild, active, free to roam, and sustained on a native diet of wild plants. For the current human population to "forage" accordingly would require 15 times the surface area of our planet (34). On this planet, the only way to satisfy the carnivorous inclinations of humans at scale is with methods of mass production that adulterate the composition of that meat, impose horrific abuses on our fellow creatures, undermine public health, and devastate the planet.

What we should be eating, then, for disease reversal and health promotion, for the sake of people and planet alike, is clear enough. Welcomed by some, clearly inconvenient to others, the truth is that we should all be eating plant-predominant diets. The "what" of future eating is not in question. The questions are all about "how" we get there from here.

There are promising signs. There is the advent of meatless meat to satisfy the Stone Age appetites of digital-age humans, absent the ethical abuses and with reduced environmental costs (35). There are increasingly empowering digital delivery systems conveying the skills required to rely on diet and lifestyle as medicine. There are thoughtful innovations in food production around the globe (36), and a growing focus on sustainability (37). There is a burgeoning interest in cooking in medical education, and a growing focus on public and planetary health in culinary education (38). There are conveniences in the offing, born of technological innovation (39).

There is the prospect of entirely new tools to empower individual dietary change for the sake of personal health and planetary protection (40); the compelling example of culture-wide change (41); and new commitments to making better choices more readily available to all (42). There is a global consensus among content experts in support of such trends (23), and the promise of that chorus maturing into a signal routinely audible above the fractious, background din.

These are encouraging signs, and there are many more—but they are all merely elements in the comprehensive and transformational change the public and planetary health imperatives of our time demand. The full expanse of the requisite response ranges across policy and practice, education and innovation, advocacy and entrepreneurialism, culture and communication, education and economics. Our relationship with food, for good or for ill, reverberates through every aspect of culture (43–45).

Looking back, we can acknowledge we are the descendants of omnivores with dietary choices. Looking around, we must concede the terrible costs of bad choices, and that those choices have narrowed. Looking ahead invites us to translate what we know about diet for the health of people and planet alike into what we do. We should waste no time predicting the future of food; we must, with urgency, create it.

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References

1. Armelagos GJ. Brain evolution, the determinates of food choice, and the omnivore's dilemma. Crit Rev Food Sci Nutr 2014;54(10):1330–41.
2. Ember CR. 2014. Hunter-gatherers. In: Ember CReditor. Explaining human culture. Human relations area files [Internet]. Available from: http://hraf.yale.edu/ehc/summaries/hunter-gatherers [cited 13 June, 2018].
3. Turner BL, Thompson AL. Beyond the paleolithic prescription: incorporating diversity and flexibility in the study of human diet evolution. Nutr Rev 2013;71(8):501–10.
4. Konner M, Eaton SB. Paleolithic nutrition: twenty five years later. Nutr Clin Pract 2010;25(6):594–602.
5. Wrangham R. The evolution of human nutrition. Curr Biol 2013;23(9):R354–5.
6. Mercader J. Mozambican grass seed consumption during the middle stone age. Science 2009;326(5960):1680–3.
7. Kothapalli KS, Ye K, Gadgil MS, Carlson SE, O'Brien KO, Zhang JY, Park HG, Ojukwu K, Zou J, Hyon SS, et al. Positive selection on a regulatory insertion-deletion polymorphism in FADS2 influences apparent endogenous synthesis of arachidonic acid. Mol Biol Evol 2016;33(7):1726–39.
8. Cordain L, Miller JB, Eaton SB, Mann N, Holt SH, Speth JD. Plant-animal subsistence ratios and macronutrient energy estimations in worldwide hunter-gatherer diets. Am J Clin Nutr 2000;71(3):682–92.

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9. Melamed Y, Kislev ME, Geffen E, Lev-Yadun S, Goren-Inbar N. The plant component of an Acheulian diet at Gesher Benot Ya'aqov, Israel. Proc Natl Acad Sci U S A 2016;113(51):14674–9.
10. Johnston JL, Fanzo JC, Cogill B. Understanding sustainable diets: a descriptive analysis of the determinants and processes that influence diets and their impact on health, food security, and environmental sustainability. Adv Nutr 2014;5(4):418–29.
11. Springmann M, Godfray HC, Rayner M, Scarborough P. Analysis and valuation of the health and climate change co-benefits of dietary change. Proc Natl Acad Sci U S A 2016;113(15):4146–51.
12. Micha R, Peñalvo JL, Cudhea F, Imamura F, Rehm CD, Mozaffarian D. Association between dietary factors and mortality from heart disease, stroke, and type 2 diabetes in the United States. JAMA 2017;317(9):912–24.
13. Mokdad AH, Ballestros K, Echko M, Glenn S, Olsen HE, Mullany E, Lee A, Khan AR, Ahmadi A, Ferrari AJ, et al. US Burden of Disease Collaborators. The state of US health, 1990–2016: burden of diseases, injuries, and risk factors among US states. JAMA 2018;319(14):1444–72.
14. McGinnis JM, Foege WH. Actual causes of death in the United States. JAMA 1993;270(18):2207–12.
15. Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. JAMA 2004;291(10):1238–45.
16. Ford ES, Bergmann MM, Kröger J, Schienkiewitz A, Weikert C, Boeing H. Healthy living is the best revenge: findings from the European Prospective Investigation into Cancer and Nutrition-Potsdam study. Arch Intern Med 2009;169(15):1355–62.
17. Katz DL. Lifestyle is the medicine, culture is the spoon. The covariance of proposition and preposition. Am J Lifestyle Med 2014:8:301–5.
18. Dinu M, Abbate R, Gensini GF, Casini A, Sofi F. Vegetarian, vegan diets and multiple health outcomes: a systematic review with meta-analysis of observational studies. Crit Rev Food Sci Nutr 2017;57(17):3640–9.
19. Gardner CD, Trepanowski JF, Del Gobbo LC, Hauser ME, Rigdon J, Ioannidis JPA, Desai M, King AC. Effect of low-fat vs low-carbohydrate diet on 12-month weight loss in overweight adults and the association with genotype pattern or insulin secretion: the DIETFITS randomized clinical trial. JAMA 2018;319(7):667–79.
20. Katz DL, Meller S. Can we say what diet is best for health? Annu Rev Public Health 2014;35:83–103.
21. Ornish D, Magbanua MJ, Weidner G, Weinberg V, Kemp C, Green C, Mattie MD, Marlin R, Simko J, Shinohara K, et al. Changes in prostate gene expression in men undergoing an intensive nutrition and lifestyle intervention. Proc Natl Acad Sci U S A 2008;105(24):8369–74.
22. Khera AV, Emdin CA, Drake I, Natarajan P, Bick AG, Cook NR, Chasman DI, Baber U, Mehran R, Rader DJ, et al. Genetic risk, adherence to a healthy lifestyle, and coronary disease. N Engl J Med 2016;375(24):2349–58.
23. Ornish D, Lin J, Chan JM, Epel E, Kemp C, Weidner G, Marlin R, Frenda SJ, Magbanua MJ, Daubenmier J, et al. Effect of comprehensive lifestyle changes on telomerase activity and telomere length in men with biopsy-proven low-risk prostate cancer: 5-year follow-up of a descriptive pilot study. Lancet Oncol 2013;14(11):1112–20.
24. Katz DL, Hu F. Knowing what to eat, refusing to swallow it. *Huffington Post* 2 July, 2014.
25. The True Health Initiative. A global consensus on lifestyle as medicine. 2015 [Internet]. Available from: www.truehealthinitiative.org [cited 13 June, 2018].
26. Oldways. Oldways common ground, 2015 [Internet]. Available from: https://oldwayspt.org/programs/oldways-common-ground/oldways-common-ground [cited 13 June, 2018].
27. Bittman M, Pollan M, Salvador R, de Schutter O. How a national food policy could save millions of American lives. [Internet]. *Washington Post* 7 November, 2014. Available from: https://www.washingtonpost.com/opinions/how-a-national-food-policy-could-save-millions-of-american-lives/2014/11/07/89c55e16-637f-11e4-836c-83bc4f26eb67_story.html?utm_term=.93828018c5a5 [cited 13 June, 2018].
28. Moss M. The extraordinary science of addictive junk food. [Internet]. *New York Times Magazine* 20 February, 2013. Available from: https://www.nytimes.com/2013/02/24/magazine/the-extraordinary-science-of-junk-food.html. [cited 13 June, 2018].
29. Ripple WJ, Wolf C, Newsome TM, Galetti M, Alamgir M, Crist E, Mahmoud MI, Laurance WF; 15,364 scientist signatories from 184 countries. World scientists' warning to humanity: a second notice. BioScience 2017;67(12):1026–8.
30. Jacobs A, Richtel M. How big business got Brazil hooked on junk food. [Internet]. *New York Times* 16 September, 2017. Available from: https://www.nytimes.com/interactive/2017/09/16/health/brazil-obesity-nestle.html [cited 13 June, 2018].
31. Ochs R. Mediterranean diet has disappeared, says WHO. [Internet]. *European Scientist* 25 May, 2018. 2018. Available from: https://www.europeanscientist.com/en/public-health/mediterranean-diet-has-disappeared-says-who/ [cited 13 June, 2018].
32. Abbasi J. Interest in the ketogenic diet grows for weight loss and type 2 diabetes. JAMA 2018;319(3):215–7.
33. The conversation: meat is a complex health issue but a simple climate one: the world needs to eat less of it [Internet]. 5 July, 2015. Available from: https://theconversation.com/meat-is-a-complex-health-issue-but-a-simple-climate-one-the-world-needs-to-eat-less-of-it-44006 [cited 13 June, 2018].
34. Wang DD, Li Y, Chiuve SE, Stampfer MJ, Manson JE, Rimm EB, Willett WC, Hu FB. Association of specific dietary fats with total and cause-specific mortality. JAMA Intern Med 2016;176(8):1134–45.
35. Song M, Fung TT, Hu FB, Willett WC, Longo VD, Chan AT, Giovannucci EL. Association of animal and plant protein intake with all-cause and cause-specific mortality. JAMA Intern Med 2016;176(10):1453–63.
36. Katz DL. Paleo for a shrinking planet? *Huffington Post* [Internet]. 19 February, 2015. Available from: https://www.huffingtonpost.com/david-katz-md/paleo-for-a-shrinking-pla_b_6712936.html [cited 13 June, 2018].
37. Beyond Meat. Eat what you love [Internet]. Available from: http://beyondmeat.com/ [cited 13 June, 2018].
38. FoodTank. The think tank for food [Internet]. Available from: https://foodtank.com/ [cited 13 June, 2018].
39. EAT forum. Young innovators are changing the food system [Internet]. Available from: https://eatforum.org/ [cited 13 June, 2018].
40. Menus of change. Culinary Institute of America [Internet]. Available from: http://www.menusofchange.org/ [cited 13 June, 2018].
41. Brava. Faster, giving you time back [Internet]. Available from: http://www.brava.com/ [cited 13 June, 2018].
42. Diet Quality Photo Navigation. How can we determine a dietary pattern in under a minute [Internet]. Available from: https://www.dqpn.io/ [cited 13 June, 2018].
43. Katz DL. Obesity…be dammed! What it will take to turn the tide. Harvard Health Policy Rev 2006;7:135–51.
44. Katz DL. Perspective: obesity is not a disease. Nature 2014;508(7496):S57.
45. Katz DL, Bittman M. (Foreword). *The truth about food: why pandas eat bamboo, and people get bamboozled*. Amazon White Glove Publishing. 2018.

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