CME credits available for this article — see page 88.

ORIGINAL RESEARCH & CONTRIBUTIONS

Special Report

Nutritional Update for Physicians: Plant-Based Diets

Philip J Tuso, MD; Mohamed H Ismail, MD; Benjamin P Ha, MD; Carole Bartolotto, MA, RD

Perm J 2013 Spring;17(2):61-66

http://dx.doi.org/10.7812/TPP/12-085

Abstract

The objective of this article is to present to physicians an update on plant-based diets. Concerns about the rising cost of health care are being voiced nationwide, even as unhealthy lifestyles are contributing to the spread of obesity, diabetes, and cardiovascular disease. For these reasons, physicians looking for cost-effective interventions to improve health outcomes are becoming more involved in helping their patients adopt healthier lifestyles. Healthy eating may be best achieved with a plant-based diet, which we define as a regimen that encourages whole, plant-based foods and discourages meats, dairy products, and eggs as well as all refined and processed foods. We present a case study as an example of the potential health benefits of such a diet. Research shows that plant-based diets are cost-effective, low-risk interventions that may lower body mass index, blood pressure, HbA_{1C}, and cholesterol levels. They may also reduce the number of medications needed to treat chronic diseases and lower ischemic heart disease mortality rates. Physicians should consider recommending a plant-based diet to all their patients, especially those with high blood pressure, diabetes, cardiovascular disease, or obesity.

Introduction

In the HBO documentary *The Weight of the Nation,* it was noted that if you "go with the flow" in the US, you will eventually become obese.[1] In 2011, Witters reported that in some areas of the country, the rate of obesity is 39% and is increasing at a rate of 5% per year.[2] Risks of obesity, diabetes, hypertension, and cardiovascular disease, along with their ensuing complications (eg, behavioral health and quality-of-life problems) often go hand-in-hand and are strongly linked to lifestyle, especially dietary choices.[3] Of all the diets recommended over the last few decades to turn the tide of these chronic illnesses, the best but perhaps least common may be those that are plant based.

Despite the strong body of evidence favoring plant-based diets, including studies showing a willingness of the general public to embrace them,[4] many physicians are not stressing the importance of plant-based diets as a first-line treatment for chronic illnesses. This could be because of a lack of awareness of these diets or a lack of patient education resources.

National dietary guidelines for active living and healthful eating are available at www.ChooseMyPlate.gov.[5] A typical healthful plate of food is 1/2 plant foods (nonstarchy vegetables and fruits), 1/4 whole grains or unprocessed starchy food, and 1/4 lean protein.

The goal of this article is to review the evidence supporting plant-based diets and to provide a guideline for presenting them to patients. We start with a case study and conclude with a review of the literature.

Case Study

A 63-year-old man with a history of hypertension presented to his primary care physician with complaints of fatigue, nausea, and muscle cramps. The result of a random blood glucose test was 524 mg/dL, and HbA_{1C} was 11.1%. Type 2 diabetes was diagnosed. His total cholesterol was 283 mg/dL, blood pressure was 132/66 mmHg, and body mass index (BMI) was 25 kg/m^2. He was taking lisinopril, 40 mg daily; hydrochlorothiazide, 50 mg daily; amlodipine, 5 mg daily; and atorvastatin, 20 mg daily. He was prescribed metformin, 1000 mg twice daily; glipizide, 5 mg daily; and 10 units of neutral protamine Hagedom insulin at bedtime. His physician also prescribed a low-sodium, plant-based diet that excluded all animal products and refined sugars and limited bread, rice, potatoes, and tortillas to a single daily serving. He was advised to consume unlimited nonstarchy vegetables, legumes, and beans, in addition to up to 2 ounces of nuts and seeds daily. He was also asked to begin exercising 15 minutes twice a day.

The patient was seen monthly in his primary care clinic. Over a 16-week period, significant improvement in biometric outcome measures was observed. He was completely weaned off of amlodipine, hydrochlorothiazide, glipizide, and neutral protamine Hagedorn insulin. Follow-up blood pressure remained below 125/60 mmHg, HbA_{1C} improved to 6.3%, and total cholesterol improved to 138 mg/dL. Lisinopril was gradually decreased to 5 mg daily and his diabetes is controlled with metformin alone, 1000 mg twice daily.

Definitions of Plant-Based Diets

The presented case is a dramatic example of the effect a plant-based diet can have on biometric outcomes like blood pressure, diabetes, and lipid profile. The reduction in HbA_{1C} from 11.1% to 6.3% in 3 months is much better than would be expected with monotherapy with metformin[6] or daily exercise.[7] The improvement in blood pressure observed over a 4-month period with few medications is also rarely encountered in clinical practice and is likely related to a low-sodium diet and the avoidance of red meat. Because the patient was not obese and did not

Philip J Tuso, MD, is the Regional Co-Lead for the Complete Care Program of the Southern California Permanente Medical Group and the National Physician Lead for the Care Management Institute's Total Health Program. E-mail: phillip.j.tuso@kp.org. **Mohamed H Ismail, MD,** is a Physician at the Riverside Medical Center in CA. E-mail: mohamed.h.ismail@kp.org. **Benjamin P Ha, MD,** is the Associate Area Medical Director for Family Medicine at the Bakersfield Medical Center in CA. E-mail: benjamin.p.ha@kp.org. **Carole Bartolotto, MA, RD,** is a Senior Consultant for Regional Health Education for the Southern California Permanente Medical Group. E-mail: carole.a.bartolotto@kp.org.

have significant weight loss with the diet, the dramatic improvements appear to be related to the quality of his new diet.

A healthy, plant-based diet aims to maximize consumption of nutrient-dense plant foods while minimizing processed foods, oils, and animal foods (including dairy products and eggs). It encourages lots of vegetables (cooked or raw), fruits, beans, peas, lentils, soybeans, seeds, and nuts (in smaller amounts) and is generally low fat.[8,9] Leading proponents in the field have varying opinions as to what comprises the optimal plant-based diet. Ornish et al recommends allowing animal products such as egg whites and skim milk in small amounts for reversal of disease.[10,11]

Esselstyn, who directs the cardiovascular prevention and reversal program at the Cleveland Clinic Wellness Institute, recommends completely avoiding all animal-based products as well as soybeans and nuts, particularly if severe coronary artery disease is present.[12]

Despite these smaller differences, there is evidence that a broadly defined plant-based diet has significant health benefits. It should be noted that the term *plant-based* is sometimes used interchangeably with *vegetarian* or *vegan*. Vegetarian or vegan diets adopted for ethical or religious reasons may or may not be healthy. It is thus important to know the specific definitions of related diets and to ascertain the details of a patient's diet rather than making assumptions about how healthy it is. The following is a brief summary of typical diets that restrict animal products. A key distinction is that although most of these diets are defined by what they exclude, the plant-based diet is defined by what it includes.

Vegan (or total vegetarian): Excludes all animal products, especially meat, seafood, poultry, eggs, and dairy products. Does not require consumption of whole foods or restrict fat or refined sugar.

Raw food, vegan: Same exclusions as veganism as well as the exclusion of all foods cooked at temperatures greater than 118°F.

Lacto-vegetarian: Excludes eggs, meat, seafood, and poultry and includes milk products.

Ovo-vegetarian: Excludes meat, seafood, poultry, and dairy products and includes eggs.

Lacto-ovo vegetarian: Excludes meat, seafood, and poultry and includes eggs and dairy products.

Mediterranean: Similar to whole-foods, plant-based diet but allows small amounts of chicken, dairy products, eggs, and red meat once or twice per month. Fish and olive oil are encouraged. Fat is not restricted.

Whole-foods, plant-based, low-fat: Encourages plant foods in their whole form, especially vegetables, fruits, legumes, and seeds and nuts (in smaller amounts). For maximal health benefits this diet limits animal products. Total fat is generally restricted.

Benefits of Plant-Based Diets

The goal of our diet should be to improve our health. In this section, we will review the literature for key articles that demonstrate the benefits of plant-based diets. Our review consists of existing studies that include vegan, vegetarian, and Mediterranean diets.

Obesity

In 2006, after reviewing data from 87 published studies, authors Berkow and Barnard[13] reported in *Nutrition Reviews* that a vegan or vegetarian diet is highly effective for weight loss. They also found that vegetarian populations have lower rates of heart disease, high blood pressure, diabetes, and obesity. In addition, their review suggests that weight loss in vegetarians is not dependent on exercise and occurs at a rate of approximately 1 pound per week. The authors further stated that a vegan diet caused more calories to be burned after meals, in contrast to nonvegan diets which may cause fewer calories to be burned because food is being stored as fat.[13]

Farmer et al[14] suggest that vegetarian diets may be better for weight management and may be more nutritious than diets that include meat. In their study, they showed that vegetarians were slimmer than their meat-eating counterparts. Vegetarians were also found to consume more magnesium, potassium, iron, thiamin, riboflavin, folate, and vitamins and less total fat. The authors conclude that vegetarian diets are nutrient dense and can be recommended for weight management without compromising diet quality.[14]

In 2009, Wang and Beysoun[15] analyzed the nationally representative data collected in the 1999-2004 National Health and Nutrition Examination Survey. The aim of their study was to analyze the associations between meat consumption and obesity. Using linear and logistic regression analyses, they showed that there was a positive association between meat consumption and obesity.[15]

The Oxford component of the European Prospective Investigation into Cancer and Nutrition assessed changes in weight and BMI over a five-year period in meat-eating, fish-eating, vegetarian, and vegan men and women in the United Kingdom. During the five years of the study, mean annual weight gain was lowest among individuals who had changed to a diet containing fewer animal foods. The study also reported a significant difference in age-adjusted BMI, with the meat eaters having the highest BMI and vegans the lowest.[16] Similar results were reported by the Adventist Health Study.[17]

According to Sabaté and Wien,[18] "Epidemiologic studies indicate that vegetarian diets are associated with a lower BMI and a lower prevalence of obesity in adults and children. A meta-analysis of adult vegetarian diet studies estimated a reduced weight difference of 7.6 kg for men and 3.3 kg for women, which resulted in a 2-point lower BMI. Similarly, compared with nonvegetarians, vegetarian children are leaner, and their BMI difference becomes greater during adolescence. Studies exploring the risk of overweight and food groups and dietary patterns indicate that a plant-based diet seems to be a sensible approach for the prevention of obesity in children. Plant-based diets are low in energy density and high in complex carbohydrate, fiber, and water, which may increase satiety and resting energy expenditure."[18] The authors conclude that plant-based dietary patterns should be encouraged for optimal health.

Diabetes

Plant-based diets may offer an advantage over those that are not plant based with respect to prevention and management of diabetes. The Adventist Health Studies found that vegetarians have approximately half the risk of developing diabetes as nonvegetarians.[19] In 2008,

Vang et al[20] reported that nonvegetarians were 74% more likely to develop diabetes over a 17-year period than vegetarians. In 2009, a study involving more than 60,000 men and women found that the prevalence of diabetes in individuals on a vegan diet was 2.9%, compared with 7.6% in the nonvegetarians.[17] A low-fat, plant-based diet with no or little meat may help prevent and treat diabetes, possibly by improving insulin sensitivity and decreasing insulin resistance.

Barnard et al[21] reported in 2006 the results of a randomized clinical trial comparing a low-fat vegan diet with a diet based on the American Diabetes Association guidelines. People on the low-fat vegan diet reduced their HbA_{1C} levels by 1.23 points, compared with 0.38 points for the people on the American Diabetes Association diet. In addition, 43% of people on the low-fat vegan diet were able to reduce their medication, compared with 26% of those on the American Diabetes Association diet.[18]

Heart Disease

In the Lifestyle Heart Trial, Ornish[10] found that 82% of patients with diagnosed heart disease who followed his program had some level of regression of atherosclerosis. Comprehensive lifestyle changes appear to be the catalyst that brought about this regression of even severe coronary atherosclerosis after only 1 year. In his plant-based regimen, 10% of calories came from fat, 15% to 20% from protein, and 70% to 75% from carbohydrate, and cholesterol was restricted to 5 mg per day.

Interestingly, 53% of the control group had progression of atherosclerosis. After 5 years, stenosis in the experimental group decreased from 37.8% to 34.7% (a 7.9% relative improvement). The control group experienced a progression of stenosis from 46.1% to 57.9% (a 27.7% relative worsening). Low-density lipoprotein had decreased 40% at 1 year and was maintained at 20% less than baseline after 5 years. These reductions are similar to results achieved with lipid-lowering medications.[10,11]

In the Lyon Diet Heart Study, a prospective, randomized, secondary prevention trial, de Lorgeril found that the intervention group (at 27 months) experienced a 73% decrease in coronary events and a 70% decrease in all-cause mortality. The intervention group's Mediterranean-style diet included more plant foods, vegetables, fruits, and fish than meat. Butter and cream were replaced with canola oil margarine. Canola oil and olive oil were the only fats recommended.[22]

In 1998, a collaborative analysis using original data from 5 prospective studies was reviewed and reported in the journal *Public Health Nutrition*. It compared ischemic heart disease-specific death rate ratios of vegetarians and nonvegetarians. The vegetarians had a 24% reduction in ischemic heart disease death rates compared with nonvegetarians.[23] The lower risk of ischemic heart disease may be related to lower cholesterol levels in individuals who consume less meat.[24]

Although vegetarian diets are associated with lower risk of several chronic diseases, different types of vegetarians may not experience the same effects on health. The key is to focus on eating a healthy diet, not simply a vegan or vegetarian diet.[25]

High Blood Pressure

In 2010, the Dietary Guidelines Advisory Committee performed a literature review to identify articles examining the effect of dietary patterns on blood pressure in adults. Vegetarian diets were associated with lower systolic blood pressure and lower diastolic blood pressure.[26] One randomized crossover trial found that a Japanese diet (low sodium and plant based) significantly reduced systolic blood pressure.[27]

Mortality

The Dietary Guidelines Advisory Committee also performed a 2010 literature review to determine the effect of plant-based diets on stroke, cardiovascular disease, and total mortality in adults. They found that plant-based diets were associated with a reduced risk of cardiovascular disease and mortality compared with non-plant-based diets.[26]

The benefit of plant-based diets on mortality may be primarily caused by decreased consumption of red meat.[28] Several studies have documented the benefits of avoiding excessive consumption of red meat, which is associated with an increased risk of all-cause mortality and an increased risk of cardiovascular mortality.[29] Low meat intake has been associated with longevity.[30]

In 2012, Huang et al[31] performed a meta-analysis to investigate cardiovascular disease mortality among vegetarians and nonvegetarians. They only included studies that reported relative risks and corresponding 95% confidence intervals. Seven studies with a combined total of 124,706 participants were analyzed. Vegetarians had 29% lower ischemic heart disease mortality than nonvegetarians.[31]

Health Concerns About Plant-Based Diets

Protein

Generally, patients on a plant-based diet are not at risk for protein deficiency. Proteins are made up of amino acids, some of which, called essential amino acids, cannot be synthesized by the body and must be obtained from food. Essential amino acids are found in meat, dairy products, and eggs, as well as many plant-based foods, such as quinoa.[32] Essential amino acids can also be obtained by eating certain combinations of plant-based foods. Examples include brown rice with beans, and hummus with whole wheat pita. Therefore, a well-balanced, plant-based diet will provide adequate amounts of essential amino acids and prevent protein deficiency.[33]

Soybeans and foods made from soybeans are good sources of protein and may help lower levels of low-density lipoprotein in the blood[34] and reduce the risk of hip fractures[35] and some cancers.

Vegetarian diets were associated with lower systolic and diastolic blood pressure …

A study in the *Journal of the American Medical Association*[36] reported that women with breast cancer who regularly consumed soy products had a 32% lower risk of breast cancer recurrence and a 29% decreased risk of death, compared with women who consumed little or no soy.[36] An analysis of 14 studies, published in the *American Journal of Clinical Nutrition,* showed that increased intake of soy resulted in a 26% reduction in prostate cancer risk.[37]

Because of concerns over the estrogenic nature of soy products, women with a history of breast cancer should

discuss soy foods with their oncologists. Also, overly processed, soy-based meat substitutes are often high in isolated soy proteins and other ingredients that may not be as healthy as less processed soy products (ie, tofu, tempeh, and soy milk).

Iron

Plant-based diets contain iron, but the iron in plants has a lower bioavailability than the iron in meat. Plant-based foods that are rich in iron include kidney beans, black beans, soybeans, spinach, raisins, cashews, oatmeal, cabbage, and tomato juice.[38] Iron stores may be lower in individuals who follow a plant-based diet and consume little or no animal products. However, the American Dietetic Association states that iron-deficiency anemia is rare even in individuals who follow a plant-based diet.[39]

Vitamin B_{12}

Vitamin B_{12} is needed for blood formation and cell division. Vitamin B_{12} deficiency is a very serious problem and can lead to macrocytic anemia and irreversible nerve damage. Vitamin B_{12} is produced by bacteria, not plants or animals. Individuals who follow a plant-based diet that includes no animal products may be vulnerable to B_{12} deficiency[40] and need to supplement their diet with vitamin B_{12} or foods fortified with vitamin B_{12}.[41]

Calcium and Vitamin D

Calcium intake can be adequate in a well-balanced, carefully planned, plant-based diet. People who do not eat plants that contain high amounts of calcium may be at risk for impaired bone mineralization and fractures. However, studies have shown that fracture risk was similar for vegetarians and nonvegetarians. The key to bone health is adequate calcium intake, which appears to be irrespective of dietary preferences.[42] Some significant sources of calcium include tofu, mustard and turnip greens, bok choy, and kale. Spinach and some other plants contain calcium that, although abundant, is bound to oxalate and therefore is poorly absorbed.[43]

Vitamin D deficiency is common in the general population. Plant-based products such as soy milk and cereal grains may be fortified to provide an adequate source of Vitamin D.[44] Supplements are recommended for those who are at risk for low bone mineral density and for those found to be deficient in vitamin D.

Fatty Acids

Essential fatty acids are fatty acids that humans must ingest for good health because our bodies do not synthesize them. Only two such essential fatty acids are known: linoleic acid (an omega-6 fatty acid) and alpha-linolenic acid (an omega-3 fatty acid). Three other fatty acids are only conditionally essential: palmitoleic acid (a monounsaturated fatty acid), lauric acid (a saturated fatty acid), and gamma-linolenic acid (an omega-6 fatty acid). Deficiency in essential fatty acids may manifest as skin, hair, and nail abnormalities.[45]

The fatty acids that vegans are most likely to be deficient in are the omega-3 fats (n-3 fats). Consumptions of the plant version of omega-3 fats, alpha-linolenic acid, are also low in vegans. Adequate intake of n-3 fats is associated with a reduced incidence of heart disease and stroke. Foods that are good sources of n-3 fats should be emphasized. They include ground flax seeds, flax oil, walnuts, and canola oil.[46]

Conclusion

A healthy, plant-based diet requires planning, reading labels, and discipline. The recommendations for patients who want to follow a plant-based diet may include eating a variety of fruits and vegetables that may include beans, legumes, seeds, nuts, and whole grains and avoiding or limiting animal products, added fats, oils, and refined, processed carbohydrates. The major benefits for patients who decide to start a plant-based diet are the possibility of reducing the number of medications they take to treat a variety of chronic conditions, lower body weight, decreased risk of cancer, and a reduction in their risk of death from ischemic heart disease.

A plant-based diet is not an all-or-nothing program, but a way of life that is tailored to each individual. It may be especially beneficial for those with obesity, Type 2 diabetes, high blood pressure, lipid disorders, or cardiovascular disease. The benefits realized will be relative to the level of adherence and the amount of animal products consumed. Strict forms of plant-based diets with little or no animal products may be needed for individuals with inoperable or severe coronary artery disease. Low-sodium, plant-based diets may be prescribed for individuals with high blood pressure or a family history of coronary artery disease or stroke. A patient with obesity and diabetes will benefit from a plant-based diet that includes a moderate amount of fruits and vegetables and minimal low-fat animal products. Severe obesity may require counseling and initial management with a low-calorie diet or very-low-calorie diet and the supervision of a physician's team. Patients with kidney disease may need a plant-based diet with special restrictions, for example fruits and vegetables that are high in potassium and phosphorus. Finally, patients with thyroid disease will need to be careful when consuming plants that are mild goitrogens, like soy, raw cruciferous vegetables, sweet potatoes, and corn. These patients should be informed that cooking these vegetables inactivates the goitrogens.

Physicians should advocate that it is time to get away from terms like *vegan* and *vegetarian* and start talking about eating healthy, whole, plant-based foods (primarily fruits and vegetables) and minimizing consumption of meat, eggs, and dairy products. Physicians should be informed about these concepts so they can teach them to staff and patients.

A registered dietitian should be part of the health care team that designs a plant-based diet for patients with chronic disease, especially if multiple medications are involved. Depending on the underlying conditions, patients with chronic disease who take multiple medications need close monitoring of low blood sugar levels, low blood pressure, or rapid weight loss. If these occur, the physician may need to adjust medications. In some cases, such as the one presented here, the need for certain medications can be eliminated altogether. Although the risk of deficiencies may be low, health care teams need to be aware that a motivated patient on a strict plant-based diet may need monitoring for deficiencies of certain nutrients, as outlined above.

The purpose of this article is to help physicians understand the potential ben-

efits of a plant-based diet, to the end of working together to create a societal shift toward plant-based nutrition. There is at least moderate-quality evidence from the literature that plant-based diets are associated with significant weight loss and a reduced risk of cardiovascular disease and mortality compared with diets that are not plant based. These data suggest that plant-based diets may be a practical solution to prevent and treat chronic diseases.

Further research is needed to find ways to make plant-based diets the new normal for our patients and employees. We cannot cure chronic diseases, but we may be able to prevent and control them by changing how we eat. With education and monitoring for adherence, we can improve health outcomes. Patterns of families and other colleagues who may be reluctant to support the efforts of individuals who are trying to change are a challenge to be overcome.

We should invite our colleagues, patients, and their families to a shared decision-making process with the goal of adopting a plant-based diet and a regular exercise program. We should invite health care teams to complete a course on healthy eating and active living. We should encourage staff to be knowledgeable about plant-based nutrition. Finally, we should encourage performance-driven measurable outcomes, which may include:

1. the percentage of physicians who have completed a course on nutrition that includes a discussion of the benefits of a plant-based diet and exercise;
2. the percentage of our hospitals, cafeterias, and physicians' meeting facilities that serve meals that are consistent with a plant-based diet;
3. the percentage of patients on a physician panel who are obese and who have completed a course on weight management and nutrition that emphasizes a plant-based diet; and
4. the percentage of patients in a physician panel with high blood pressure, diabetes, high cholesterol, or cardiovascular disease who completed a course on nutrition that emphasizes a plant-based diet.

Too often, physicians ignore the potential benefits of good nutrition and quickly prescribe medications instead of giving patients a chance to correct their disease through healthy eating and active living. If we are to slow down the obesity epidemic and reduce the complications of chronic disease, we must consider changing our culture's mind-set from "live to eat" to "eat to live." The future of health care will involve an evolution toward a paradigm where the prevention and treatment of disease is centered, not on a pill or surgical procedure, but on another serving of fruits and vegetables. ❖

Disclosure statement

The author(s) have no conflicts of interest to disclose.

Acknowledgment

Kathleen Louden, ELS, of Louden Health Communications provided editorial assistance.

References

1. HBO Documentary Films; Institute of Medicine of the National Academies; Centers for Disease Control and Prevention; National Institutes of Health; Michael and Susan Dell Foundation; Kaiser Permanente. The weight of the nation [documentary]. New York, NY: Home Box Office, Inc; 2012. Available from: http://theweightofthenation.hbo.com/?cmpid=ABC1213.
2. Witters D. More than 15% obese in nearly all US metro areas [monograph on the Internet]. Washington, DC: Gallup Wellbeing; 2012 Mar 7 [cited 2012 Oct 6]. Available from: www.gallup.com/poll/153143/Obese-Nearly-Metro-Areas.aspx.
3. US Department of Health and Human Services. The surgeon general's call to action to prevent and decrease overweight and obesity [monograph on the Internet]. Rockville, MD: US Department of Health and Human Services, Public Health Service, Office of the Surgeon General; 2001 [cited 22 Jan 2013]. Available from: www.surgeongeneral.gov/library/calls/obesity/index.html.
4. Lea EJ, Crawford D, Worsley A. Public views of the benefits and barriers to the consumption of a plant-based diet. Eur J Clin Nutr 2006 Jul;60(7):828-37. DOI: http://dx.doi.org/10.1038/sj.ejcn.1602387
5. ChooseMyPlate.gov [homepage on the Internet]. Alexandria, VA: US Department of Agriculture, Center for Nutrition Policy and Promotion; [cited 2013 Jan 31]. Available from: www.choosemyplate.gov/.
6. Ito H, Ishida H, Takeuchi Y, et al. Long-term effects of metformin on blood glucose control in non-obese patients with type 2 diabetes mellitus. Nutr Metab (Lond) 2010 Nov 12;7:83. DOI: http://dx.doi.org/10.1186/1743-7075-7-83
7. Sigal RJ, Kenny GP, Boulé NG, et al. Effects of aerobic training, resistance training, or both on glycemic control in type 2 diabetes: a randomized trial. Ann Intern Med 2007 Sep 18;147(6):357-69.
8. Blaney D, Diehl H. The optimal diet: the official CHIP cookbook. Hagerstown, MD: Autumn House Publishing; 2009 Jan 1.
9. McDougall, JA, McDougall M. (1997). The new McDougall cookbook: 300 delicious ultra-low-fat recipes. New York, NY: Plume; 1997 Jan 1.
10. Ornish D, Brown SE, Scherwitz LW, et al. Can lifestyle changes reverse coronary heart disease? The Lifestyle Heart Trial. Lancet 1990 Jul 21;336(8708):129-33. DOI: http://dx.doi.org/10.1016/0140-6736(90)91656-U
11. Ornish D, Scherwitz LW, Billings JH, et al. Intensive lifestyle changes for reversal of coronary heart disease. JAMA 1998 Dec 16;280(23):2001-7. DOI: http://dx.doi.org/10.1001/jama.280.23.2001
12. Esselstyn CB Jr. Prevent and reverse heart disease: q & a with Caldwell B Esselstyn, Jr, MD [monograph on the Internet]. Lyndhurst, OH: Prevent and Reverse Heart Disease; [cited 2012 Oct 6]. Available from: www.heartattackproof.com/qanda.htm.
13. Berkow SE, Barnard N. Vegetarian diets and weight status. Nutr Rev 2006 Apr;64(4):175-88. DOI: http://dx.doi.org/10.1111/j.1753-4887.2006.tb00200.x
14. Farmer B, Larson BT, Fulgoni VL 3rd, Rainville AJ, Liepa GU. A vegetarian dietary pattern as a nutrient-dense approach to weight management: an analysis of the national health and nutrition examination survey 1999-2004. J Am Diet Assoc 2011 Jun;111(6):819-27. DOI: http://dx.doi.org/10.1016/j.jada.2011.03.012
15. Wang Y, Beydoun MA. Meat consumption is associated with obesity and central obesity among US adults. Int J Obes (Lond) 2009 Jun;33(6):621-8. DOI: http://dx.doi.org/10.1038/ijo.2009.45
16. Rosell M, Appleby P, Spencer E, Key T. Weight gain over 5 years in 21,966 meat-eating, fish-eating, vegetarian, and vegan men and women in EPIC-Oxford. Int J Obes (Lond) 2006 Sep;30(9):1389-96. DOI: http://dx.doi.org/10.1038/sj.ijo.0803305
17. Tonstad S, Butler T, Yan R, Fraser GE. Type of vegetarian diet, body weight, and prevalence of type 2 diabetes. Diabetes Care 2009 May;32(5):791-6. DOI: http://dx.doi.org/10.2337/dc08-1886
18. Sabaté J, Wien M. Vegetarian diets and childhood obesity prevention. Am J Clin Nutr 2010 May;91(5):1525S-1529S. DOI: http://dx.doi.org/10.3945/ajcn.2010.28701F
19. Snowdon DA, Phillips RL. Does a vegetarian diet reduce the occurrence of diabetes? Am J Public Health 1985 May;75(5):507-12. DOI: http://dx.doi.org/10.2105/AJPH.75.5.507
20. Vang A, Singh PN, Lee JW, Haddad EH, Brinegar CH. Meats, processed meats, obesity, weight gain and occurrence of diabetes among adults: findings from Adventist Health Studies. Ann Nutr Metab 2008;52(2):96-104. DOI: http://dx.doi.org/10.1159/000121365
21. Barnard ND, Cohen J, Jenkins DJ, et al. A low-fat vegan diet improves glycemic control and cardiovascular risk factors in a randomized clinical trial in individuals with type 2 diabetes. Diabetes Care 2006 Aug;29(8):1777-83. DOI: http://dx.doi.org/10.2337/dc06-0606
22. de Lorgeril M, Salen P, Martin JL, Monjaud I, Delaye J, Mamelle N. Mediterranean diet, traditional risk factors, and the rate of cardiovascular complications after myocardial infarction: final report of the Lyon Diet Heart Study. Circulation 1999 Feb;99(6):779-85. DOI: http://dx.doi.org/10.1161/01.CIR.99.6.779
23. Key TJ, Fraser GE, Thorogood M, et al. Mortality in vegetarians and non-vegetarians: a collaborative analysis of 8300 deaths among 76,000 men and women in five prospective studies.

Public Health Nutr 1998 Mar;1(1):33-41. DOI: http://dx.doi.org/10.1079/PHN19980006

24. Appleby PN, Thorogood M, McPherson K, Mann JI. Associations between plasma lipid concentrations and dietary, lifestyle and physical factors in the Oxford Vegetarian Study. J Hum Nutr Diet 1995 Oct;8(5):305-14. DOI: http://dx.doi.org/10.1111/j.1365-277X.1995.tb00324.x
25. Fraser GE. Vegetarian diets: what do we know of their effects on common chronic diseases? Am J Clin Nutr 2009;89(5):1607S-1612S. DOI: http://dx.doi.org/10.3945/ajcn.2009.26736K Erratum in: Am J Clin Nutr 2009 Jul;90(1):248. DOI: http://dx.doi.org/10.3945/ajcn.2009.27933
26. Report of the Dietary Guidelines Advisory Committee on the dietary guidelines for Americans, 2010: to the Secretary of Agriculture and the Secretary of Health and Human Services. Washington, DC: Agriculture Research Service, US Department of Agriculture, US Department of Health and Human Services; 2010 May.
27. Takahashi Y, Sasaki S, Okubo S, Hayashi M, Tsugane S. Blood pressure change in a free-living population-based dietary modification study in Japan. J Hypertens. 2006 Mar;24(3):451-8. DOI: http://dx.doi.org/10.1097/01.hjh.0000209980.36359.16
28. Singh PN, Sabaté J, Fraser GE. Does low meat consumption increase life expectancy in humans? Am J Clin Nutr 2003 Sep;78(3 Suppl):526S-532S.
29. Campbell TC, Campbell TM II. The China study: the most comprehensive study of nutrition ever conducted and the startling implications for diet, weight loss and long-term health. Dallas, TX: BenBella Books; 2006 May 11.
30. Sinha R, Cross AJ, Graubard BI, Leitzmann MF, Schatzkin A. Meat intake and mortality: a prospective study of over half a million people. Arch Intern Med 2009 Mar 23;169(6):562-71. DOI: http://dx.doi.org/10.1001/archinternmed.2009.6
31. Huang T, Yang B, Zheng J, Li G, Wahlqvist ML, Li D. Cardiovascular disease mortality and cancer incidence in vegetarians: a meta-analysis and systematic review. Ann Nutr Metab 2012;60(4):233-40. DOI: http://dx.doi.org/10.1159/000337301
32. Nutritiondata.self.com [web page on the Internet]. Soybeans, mature seeds, raw. New York, NY: Condé Nast; 2012 [cited 2012 Oct 6]. Available from: http://nutritiondata.self.com/facts/legumes-and-legume-products/4375/2.
33. Young VR, Pellett PL. Plant proteins in relation to human protein and amino acid nutrition. Am J Clin Nutr 1994 May;59(5 Suppl):1203S-1212S.
34. Pipe EA, Gobert CP, Capes SE, Darlington GA, Lampe JW, Duncan AM. Soy protein reduces serum LDL cholesterol and the LDL cholesterol: HDL cholesterol and apolipoprotein B: apolipoprotein A-I ratios in adults with type 2 diabetes. J Nutr 2009 Sep;139(9):1700-6. DOI: http://dx.doi.org/10.3945/jn.109.109595
35. Koh WP, Wu AH, Wang R, et al. Gender-specific associations between soy and risk of hip fracture in the Singapore Chinese Health Study. Am J Epidemiol 2009 Oct 1;170(7):901-9. DOI: http://dx.doi.org/10.1093/aje/kwp220
36. Shu XO, Zheng Y, Cai H, et al. Soy food intake and breast cancer survival. JAMA 2009 Dec 9;302(22):2437-43. DOI: http://dx.doi.org/10.1001/jama.2009.1783
37. Yan L, Spitznagel EL. Soy consumption and prostate cancer risk in men: a revisit of a meta-analysis. Am J Clin Nutr 2009 Apr;89(4):1155-63. DOI: http://dx.doi.org/10.3945/ajcn.2008.27029
38. Waldmann A, Koschizke JW, Leitzmann C, Hahn A. Dietary iron intake and iron status of German female vegans: results of the German vegan study. Ann Nutr Metab 2004;48(2):103-8. DOI: http://dx.doi.org/10.1159/000077045
39. Craig WJ, Mangels AR; American Dietetic Association. Position of the American Dietetic Association: vegetarian diets. J Am Diet Assoc 2009 Jul;109(7):1266-82. DOI: http://dx.doi.org/10.1016/j.jada.2009.05.027
40. Donaldson MS. Metabolic vitamin B12 status 1on a mostly raw vegan diet with follow-up using tablets, nutritional yeast, or probiotic supplements. Ann Nutr Metab 2000;44 (5-6):229-34. DOI: http://dx.doi.org/10.1159/000046689
41. Dietary supplement fact sheet: vitamin B12 [monograph on the Internet]. Bethesda, MD: National Institutes of Health, Office of Dietary Supplements; 2011 Jun 24 [cited 2013 Jan 31. Available from: http://ods.od.nih.gov/factsheets/VitaminB12-HealthProfessional/.
42. Appleby P, Roddam A, Allen N, Key T. Comparative fracture risk in vegetarians and non-vegetarians in EPIC-Oxford. Eur J Clin Nutr 2007 Dec;61(12):1400-6. DOI: http://dx.doi.org/10.1038/sj.ejcn.1602659
43. Weaver CM, Plawecki KL. Dietary calcium: adequacy of a vegetarian diet. Am J Clin Nutr 1994 May;59(5 Suppl):1238S-1241S.
44. Dietary supplement fact sheet: vitamin D [monograph on the Internet]. Bethesda, MD: National Institutes of Health, Office of Dietary Supplements; 2011 Jun 24 [cited 2013 Jan 31. Available from: http://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/.
45. Rosell MS, Lloyd-Wright Z, Appleby PN, Sanders TA, Allen NE, Key TJ. Long-chain n-3 polyunsaturated fatty acids in plasma in British meat-eating, vegetarian, and vegan men. Am J Clin Nutr 2005 Aug;82(2):327-34.
46. Davis BC, Kris-Etherton PM. Achieving optimal essential fatty acid status in vegetarians: current knowledge and practical implications. Am J Clin Nutr 2003 Sep;78(3 Suppl):640S-646S.

Medicine

Let food be thy medicine and medicine be thy food.

— Hippocrates, c 460-370 BCE, ancient Greek physician in the Age of Pericles known as the father of modern medicine