

# Plant-Based Diets: A Physician's Guide

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## ABSTRACT

Because of the ever-increasing body of evidence in support of the health advantages of plant-based nutrition, there is a need for guidance on implementing its practice. This article provides physicians and other health care practitioners an overview of the myriad benefits of a plant-based diet as well as details on how best to achieve a well-balanced, nutrient-dense meal plan. It also defines notable nutrient sources, describes how to get started, and offers suggestions on how health care practitioners can encourage their patients to achieve goals, adhere to the plan, and experience success.

## SUMMARY OF HEALTH BENEFITS

Plant-based nutrition has exploded in popularity, and many advantages have been well documented over the past several decades.<sup>1</sup> Not only is there a broad expansion of the research database supporting the myriad benefits of plant-based diets, but also health care practitioners are seeing awe-inspiring results with their patients across multiple unique subspecialties. Plant-based diets have been associated with lowering overall and ischemic heart disease mortality<sup>2</sup>; supporting sustainable weight management<sup>3</sup>; reducing medication needs<sup>4,6</sup>; lowering the risk for most chronic diseases<sup>7,8</sup>; decreasing the incidence and severity of high-risk conditions, including obesity,<sup>9</sup> hypertension,<sup>10</sup> hyperlipidemia,<sup>11</sup> and hyperglycemia;<sup>11</sup> and even possibly reversing advanced coronary artery disease<sup>12,13</sup> and type 2 diabetes.<sup>6</sup>

The reason for these outcomes is twofold. First, there are inherent benefits to eating a wide variety of health-promoting plants. Second, there is additional benefit from crowding out—and thereby avoiding—the injurious constituents found in animal products, including the following:

- **Saturated fats:** Saturated fats are a group of fatty acids found primarily in animal products (but also in the plant kingdom—mostly in tropical oils, such as coconut and palm) that are well established in the literature as promoting cardiovascular disease (CVD).<sup>14,15</sup> The American Heart Association lowered its

recommendations<sup>15</sup> for a heart-healthy diet to include no more than 5% to 6% of total calories from saturated fat, which is just the amount found naturally in a vegan diet (one consisting of no animal products).

- **Dietary cholesterol:** Human bodies produce enough cholesterol for adequate functioning. Although evidence suggests that dietary cholesterol may only be a minor player in elevated serum cholesterol levels, high intakes are linked to increased susceptibility to low-density lipoprotein oxidation, both of which are associated with the promotion of CVD.<sup>16-18</sup> Dietary cholesterol is found almost exclusively in animal products.
- **Antibiotics:** The vast majority (70% to 80%) of antibiotics used<sup>19,20</sup> in the US are given to healthy livestock animals to avoid infections inherent in the types of environments in which they are kept. This is, therefore, the number one contributor to the increasingly virulent antibiotic-resistant infections of the type that sickened 2 million and killed 23,000 Americans in 2013.<sup>20</sup>
- **Insulin-like growth factor-1:** Insulin-like growth factor-1 is a hormone naturally found in animals, including humans. This hormone promotes growth. When insulin-like growth factor-1 is consumed, not only is the added exogenous dose itself taken in, but because the amino acid profile typical of animal protein stimulates the body's production of insulin-like

growth factor-1, more is generated endogenously.<sup>21</sup> Fostering growth as a full-grown adult can promote cancer proliferation.

- **Heme iron:** Although heme iron, found in animal products, is absorbed at a higher rate than nonheme iron, found in plant-based and fortified foods, absorption of nonheme iron can be increased by pairing plant-based protein sources with foods high in vitamin C.<sup>22</sup> Additionally, research suggests that excess iron is pro-oxidative<sup>23</sup> and may increase colorectal cancer risk<sup>24</sup> and promote atherosclerosis<sup>25</sup> and reduced insulin sensitivity.<sup>26</sup>
- **Chemical contaminants formed from high temperature cooking of cooked animal products:** When flesh is cooked, compounds called polycyclic aromatic hydrocarbons,<sup>27</sup> heterocyclic amines,<sup>28</sup> and advanced glycation end products<sup>29</sup> are formed. These compounds are carcinogenic, pro-inflammatory, pro-oxidative, and contributive to chronic disease.
- **Carnitine:** Carnitine, found primarily in meat, may be converted in the body by the gut bacteria to produce trimethylamine N-oxide (TMAO). High levels of trimethylamine n-oxide are associated with inflammation, atherosclerosis, heart attack, stroke, and death.<sup>30</sup>
- **N-Glycolylneuraminic acid (Neu5Gc):** This compound is found in meat and promotes chronic inflammation.<sup>31,32</sup> On the other hand, there are infinite advantages to the vast array of nutrients found in plant foods. Phytochemicals and fibers are the two categories of nutrients that are possibly the most health promoting and disease fighting. Plants are the only source of these nutrients; they are completely absent in animals. Plants contain thousands of phytochemicals,

such as carotenoids, glucosinolates, and flavonoids, which perform a multitude of beneficial functions, including:

- Antioxidation, neutralizing free radicals<sup>33</sup>
- Anti-inflammation<sup>34</sup>
- Cancer activity reduction via several mechanisms, including inhibiting tumor growth, detoxifying carcinogens, retarding cell growth, and preventing cancer formation<sup>35</sup>
- Immunity enhancement<sup>36</sup>
- Protection against certain diseases, such as osteoporosis, some cancers, CVD, macular degeneration, and cataracts<sup>37-39</sup>
- Optimization of serum cholesterol.<sup>40,41</sup>

Fibers found in whole plant foods powerfully support the gastrointestinal, cardiovascular, and immune systems through multiple mechanisms. Yet more than 90% of adults and children in the US do not get the minimum recommended dietary fiber.<sup>42</sup>

Thus, it can be advantageous for physicians to recommend and support plant-based eating to achieve optimal health outcomes and possibly minimize the need for procedures, medications, and other treatments. Aiming for lifestyle changes as primary prevention has been estimated to save upwards of 70% to 80% of health care costs because 75% of health care spending in the US goes to treat people with chronic conditions.<sup>43</sup> Offering this option and guiding patients through the logistics and their concerns about plant-based eating is a viable first line of therapy in the clinical setting. This article will delineate how best to achieve a well-balanced, nutrient-dense meal plan, define notable nutrient sources, describe how to get started, and offer suggestions on how physicians can encourage and work with their patients who are interested to maintain adherence and enjoy success.

## NOTABLE NUTRIENTS

Although nutrient deficiency is a primary concern for many people when considering plant-based eating, the Academy of Nutrition and Dietetics states<sup>44</sup> that “vegetarian diets, including total vegetarian or vegan diets, are healthful, nutritionally adequate, and may provide health benefits in the prevention and treatment of certain diseases.” The Academy’s position paper goes on to conclude that

**Table 1. Food group recommended servings per day**

Food group	Recommended servings per day
Vegetables, all types, including starchy	Ad libitum, with a variety of colors represented
Fruits, all types	2-4 servings (1 serving = 1 medium piece or 1/2 cup)
Whole grains (eg, quinoa, brown rice, oats)	6-11 servings (1 serving = 1/2 cup cooked or 1 slice whole grain bread)
Legumes (beans, peas, lentils, soy foods)	2-3 servings (1 serving = 1/2 cup cooked)
Leafy green vegetables (eg, kale, lettuce, broccoli)	At least 2-3 servings (1 serving = 1 cup raw or 1/2 cup cooked)
Nuts (eg, walnuts, almonds, pistachios)	1-2 ounces
Seeds (eg, chia, hemp, and flax seeds)	1-3 tablespoons
Fortified plant milks (eg, soy, almond, cashew)	Optional, 2-3 cups
Fresh herbs and spices	Optional, ad libitum

“well-planned vegetarian diets are appropriate for individuals during all stages of the life cycle, including pregnancy, lactation, infancy, childhood, and adolescence, and for athletes.” Because any type of meal plan should be approached with careful thought, it is helpful to note that plant-based diets, including calorie-restricted, weight-loss diets, have been found to be more nutritionally sound than typical dietary patterns.<sup>45</sup>

A well-balanced, plant-based diet is composed of vegetables, fruits, whole grains, legumes, herbs, spices, and a small amount of nuts and seeds. Half of the plate should consist of vegetables and fruits in accordance with the US Department of Agriculture, American Cancer Society, and American Heart Association, because they are filled with fiber, potassium, magnesium, iron, folate, and vitamins C and A—almost all of the nutrients that tend to run low in the American population, according to the Scientific Report of the 2015 Dietary Guidelines Advisory Committee.<sup>46</sup> Legumes are excellent sources of lysine (an amino acid that may fall short in a plant-based diet), fiber, calcium, iron, zinc, and selenium. It is ideal to consume one to one-and-a-half cups of legumes per day. Substantiating meals with whole grains aids with satiety, energy, and versatility in cuisine. Nuts are nutritional nuggets, brimming with essential fats, protein, fiber, vitamin E, and plant sterols, and have been shown to promote cardiovascular health<sup>47</sup> and protect against type 2 diabetes and obesity,<sup>48</sup> macular degeneration,<sup>49</sup> and cholelithiasis.<sup>50</sup> One oz to 2 oz (or 30 g to 60 g) of nuts per day is recommended.

Seeds, too, are special in that their essential fat ratios are well-balanced, and they contain multiple trace minerals and phytochemicals. One or 2 tablespoons per day will boost overall nutrition. Opting for whole food sources of fats, as opposed to extracted fats as found in oils, is optimal to decrease caloric density and increase nutrient and fiber consumption. Herbs and spices also contain phytochemicals and help make food delicious, varied, and exciting, and should be used according to preference. Food group recommended servings per day are shown in Table 1.

## PLANT-BASED MACRONUTRITION

All calories (kcal) come from some combination of carbohydrates (4 kcal/g), proteins (4 kcal/g), and fats (9 kcal/g). Alcohol also provides calories (7 kcal/g) but is not considered an essential nutrient. The ideal ratio of intake of these 3 macronutrients is highly controversial and debatable. There is plenty of evidence supporting health and weight management benefits of low-fat/high-carbohydrate diets, as seen in the traditional Okinawan diet<sup>51</sup> and in Dean Ornish, MD’s<sup>12</sup> and Caldwell Esselstyn, MD’s<sup>13</sup> reversal of advanced coronary artery disease and Neal Barnard, MD’s<sup>6</sup> reduction of glycemia in type 2 diabetes using a plant-based diet with 10% of calories from fat. Similarly, the Mediterranean<sup>52</sup> and many raw food<sup>53</sup> diets consisting of upwards of 36% or more of calories from fat show consistently positive health advantages. Thus, it appears that it is likely the quality of the diet that is responsible for health outcomes rather than the ratio of macronutrients.

### Carbohydrates

The Institute of Medicine's adequate intake of carbohydrates<sup>54</sup> is 130 g/d for everyone (except during pregnancy and lactation) beginning at age 1 year. Optimal sources of carbohydrates, such as wholesome vegetables, fruits, whole grains, and legumes, are high in fiber and nutrients. Refined carbohydrates from sugars, flours, and other processed foods can lead to malnourishment and promote illness.

### Protein

Adequate intake<sup>54</sup> of protein is based on weight and is estimated at 1.5 g/kg/d for infants, 1.1 g/kg/d for 1 to 3 year olds, 0.95 g/kg/d for 4 to 13 year olds, 0.85 g/kg/d for 14 to 18 year olds, 0.8 g/kg/d for adults, and 1.1 g/kg/d for pregnant (using prepregnancy weight) and lactating women. Protein is readily available throughout the plant kingdom, but those foods that are particularly rich in protein include legumes, nuts and nut butters, seeds and seed butters, soy foods, and intact whole grains.

### Fats

Fats—or fatty acids—are more complicated because there are several different chemical varieties based on level and type of saturation. Each category of fatty acid performs different functions and acts uniquely in the body.<sup>14</sup>

The essential fatty acids are polyunsaturated and include both omega-3 and omega-6 fatty acids. Omega-3 fats are found in their shorter chain form as alpha linolenic acid and are used as energy. They are also converted by the body to the longer-chain eicosapentaenoic acid (EPA) and then docosahexaenoic acid (DHA). Because this conversion process can be inefficient, some people may require a direct source of these longer-chain EPA and DHA in the form of a microalgae supplement. Alpha linolenic acid can be found in flaxseeds, hempseeds, chia seeds, leafy green vegetables (both terrestrial and marine), soybeans and soy products, walnuts, and wheat germ, as well as in their respective oils. A direct plant source of EPA and DHA is microalgae, through which fish acquire them. Plant sources may be superior because they do not contain the contaminants that fish contain, including heavy

metals, such as mercury, lead, and cadmium, as well as industrial pollutants.<sup>55</sup> Also, plant sources are more sustainable than fish sources.<sup>56</sup>

Monounsaturated fats are not essential but have been found to impart either a neutral or slightly beneficial effect on serum cholesterol levels, depending on which nutrient they are replacing. When swapped for saturated fats, trans fats, or refined carbohydrates, monounsaturated fats may lower low-density lipoprotein and raise high-density lipoprotein cholesterol. These fatty acids are found in olives, avocados, macadamia nuts, hazelnuts, pecans, peanuts, and their respective oils, as well as in canola, sunflower, and safflower oils.

Saturated fats, as mentioned above, are not essential in the diet and can promote CVD. They are found primarily in animal products but are available in some plant foods, mostly in tropical fats and oils, such as palm and coconut, and also in other high-fat foods, including avocados, olives, nuts, and seeds. If a vegan diet contains an average of 5% to 6% of kcals from saturated fat, which is what the American Heart Organization recommends for a heart-healthy diet, any added serving of animal products will significantly increase the total intake.

Trans fatty acids are laboratory-made via hydrogenation and are found in processed, fried, and fast foods. Although they were originally developed to be a healthy alternative to butter and lard, trans fatty acids were found to significantly increase CVD risk. In November 2013, the US Food and Drug Administration issued a notice that trans fatty acids were no longer considered safe<sup>57</sup> and is now trying to eliminate artificially produced trans fatty acids (there are small amounts found naturally in meat and dairy products) from the food supply. Be aware that a nutritional label can state a food product contains “0 g trans fats” even if it contains up to 0.5 g per serving. Thus, advise your patients to focus on the ingredient list on food products and to avoid anything with the words “partially hydrogenated.”

Dietary cholesterol is a sterol that is found primarily in animal products. Although cholesterol is required for the

production of hormones, vitamin D, and bile acids, the liver produces enough cholesterol on its own. Excessive intake of dietary cholesterol is associated with increased risk of CVD.

Phytosterols, which are similar to cholesterol, are plant-based sterols found in all plant foods (especially wheat germ, nuts, seeds, whole grains, legumes, and unrefined plant oils). Phytosterols reduce cholesterol absorption in the gut, thereby optimizing lipid profiles. Together with viscous fibers, soy proteins, and almonds, phytosterols have been found to be as effective as statins in some studies in lowering low-density lipoprotein cholesterol.<sup>5,58</sup>

It is crucial to note that all whole foods contain all three macronutrients. It is a pervasive misunderstanding to identify a food as a “carb,” “protein,” or “fat.” Instead, these are all nutrients within a complex of other myriad constituents that are beyond the oversimplification perpetuated by the media and trendy diet fads.

Ideally, a healthful diet is loaded with wholesome carbohydrates, moderate in fat, and temperate in protein. The emphasis must be on the quality of the totality of foods coming from whole plant sources as opposed to calculations and perfect ratios.

### PLANT-BASED MICRONUTRITION

All nutrients, with the exception of vitamin B<sub>12</sub> and possibly vitamin D, which is ideally sourced from the skin's exposure to the sun's ultraviolet rays, can be found in plants. They are also packaged together with thousands of powerful disease-fighting nutrients that work synergistically to support optimal health.<sup>59</sup>

#### Vitamin B<sub>12</sub>

Cobalamin, commonly referred to as vitamin B<sub>12</sub>, is the only nutrient not directly available from plants. This is because vitamin B<sub>12</sub> is synthesized by microorganisms, bacteria, fungi, and algae, but not by plants or animals. Animals consume these microorganisms along with their food, which is why this vitamin can be found in their meat, organs, and byproducts (eggs and dairy). Vitamin B<sub>12</sub> deficiency can lead to irreversible neurologic disorders, gastrointestinal problems,

and megaloblastic anemia. Among other populations, vegans who do not supplement with a reliable source of vitamin B<sub>12</sub> or breastfeeding infants of vegan mothers who are not consuming a regular reliable source of vitamin B<sub>12</sub> are at risk for deficiency.

The body can store vitamin B<sub>12</sub> for approximately three to five years, but after that, with no repletion or with inability to absorb, deficiency symptoms may present; deficiency may also be asymptomatic. Because of this lag time and because serum tests for B<sub>12</sub> levels can be skewed by other variables, irreversible damage may occur before a deficiency is caught.

In a vegan diet, vitamin B<sub>12</sub> can be found in fortified plant milks, cereals, or nutritional yeast. However, these are not dependable means of achieving B<sub>12</sub> requirements. Although there are claims that fermented foods, spirulina, chlorella, certain mushrooms, and sea vegetables, among other foods, can provide B<sub>12</sub>, the vitamin is not usually biologically active. These inactive forms act as B<sub>12</sub> analogues, attaching to B<sub>12</sub> receptors, preventing absorption of the functional version, and thereby promoting deficiency. The most reliable method of avoiding deficiency for vegans or anyone else at risk is to take a B<sub>12</sub> supplement.

Because the body can absorb only approximately 1.5 µg to 2.0 µg at a time, it is ideal to supplement with a dose greater than the Recommended Dietary Allowance (RDA) to ensure adequate intake. Plant-based nutrition experts recommend a total weekly dose of 2000 µg to 2500 µg. This can be split into daily doses or into 2 to 3 doses of 1000 µg each per week to help enhance absorption. Because vitamin B<sub>12</sub> is water soluble, toxicity is rare.

### Vitamin D

Vitamin D, or calciferol, is also known as the “sunshine vitamin” because it is the only nutrient that is acquired from the sun. Although vitamin D is classified as and treated like a fat-soluble vitamin, it is actually a prohormone produced in the skin upon exposure to ultraviolet B sun radiation and then activated by the liver and kidneys.

Although human bodies evolved to produce vitamin D via the sun, there

appears to be a worldwide epidemic of deficiency. Vitamin D is not widely available from the food supply. Sources of preformed vitamin D include fish liver oil, oily fish, liver, and in smaller doses, meat and egg yolk—foods that also contain high concentrations of saturated fat, cholesterol, and other less-than-ideal components. Vitamin D from sunshine and animal sources is in the form of cholecalciferol, or vitamin D<sub>3</sub>. A second form called ergocalciferol, or vitamin D<sub>2</sub>, is found in plant sources, mostly in ultraviolet B-irradiated mushrooms. However, a plant-derived version of D<sub>3</sub> made by lichen was recently discovered.<sup>60</sup> Dietary supplements may contain either D<sub>2</sub> or D<sub>3</sub>, both of which can be effective at optimizing blood levels.

More and more physicians are testing for serum levels of vitamin D using the 25-hydroxyvitamin D test. The Institute of Medicine concluded that adequate serum 25-hydroxyvitamin D levels are ≥ 50 nmol/L (≥ 20 ng/mL).<sup>61</sup>

If patients have suboptimal levels, emphasizing food sources (especially fortified plant milks) as well as supplements may be helpful. Dosing may be tricky because of variable responses in individuals and differences in types of vitamin D formulas. Of note, although both of the 2 forms of vitamin D—cholecalciferol (D<sub>3</sub>) and ergocalciferol (D<sub>2</sub>)—are effective at raising serum D levels in small doses (4000 IU or less), cholecalciferol (D<sub>3</sub>) is superior when using large boluses. Because the supplement industry is not regulated by the Food and Drug Administration, it is “buyer beware” in the supplement market. Thus, aim to find well-reputed companies. A few organizations, such as Consumer Lab, NSF International, and US Pharmacopeia, act as independent third parties and offer seals of approval after testing products for potency and contaminants. They do not, however, test for safety or efficacy.

### Calcium

Calcium, a macromineral, is the most abundant mineral in the human body. A mere 1% of the body's calcium circulates in the blood and tissues; 99% is stored in the bones and teeth. Calcium is a nutrient of concern for the general population with

respect to bone mineral optimization during the lifespan. However, because bone metabolism is multifactorial and complex, it is important to emphasize consumption of ample sources of calcium as well as vitamins K and B<sub>12</sub>, fluoride, magnesium, phosphorus, and potassium; to maintain serum vitamin D levels; and to ensure consistent exercise. Throughout the lifespan, dietary recommendations for adequate intake of calcium fluctuate.<sup>62</sup>

Excellent plant sources of calcium include leafy green vegetables—especially bok choy, broccoli, napa cabbage, collard greens, dandelion greens, kale, turnip greens, and watercress—as well as fortified plant milks, calcium-set tofu, dried figs, sesame seeds and tahini, tempeh, almonds and almond butter, oranges, sweet potatoes, and beans.

No matter how much calcium is consumed, the amount that is actually *absorbed* is more significant. Many variables affect calcium levels via absorption or excretion, including:

- Overall consumption determines how much is absorbed. Only about 500 mg can be absorbed at a time, and absorption decreases as calcium intake increases
- Age. Calcium absorption peaks in infants and children, as they are rapidly growing bone, and then progressively decreases with age
- Phytates, compounds found in whole grains, beans, seeds, nuts, and wheat bran, can bind with calcium as well as with other minerals and inhibit absorption. Soaking, sprouting, leavening, and fermenting improve absorption
- Oxalates are constituents found in some leafy green vegetables, such as spinach, Swiss chard, collard greens, parsley, leeks, and beet greens; berries; almonds; cashews; peanuts; soybeans; okra; quinoa; cocoa; tea; and chocolate. They may also somewhat inhibit absorption of calcium and other minerals, but some may still be absorbed. Emphasizing variety in the foods eaten on a regular basis encourages adequate absorption
- Serum vitamin D levels must be within optimum range in order for the body to absorb calcium.
- Excessive intake of sodium, protein, caffeine, and phosphorus (as from dark sodas) may enhance calcium excretion.<sup>62</sup>

## Iron

Ironically, iron is one of the most abundant metals on Earth and yet iron deficiency is one of the most common and widespread nutritional deficiencies. It is the most common deficiency in the world and is a public health problem in both industrialized and nonindustrialized countries.<sup>63</sup> It is particularly prevalent in women of childbearing age, pregnant women, infants, children, teenage girls, and anyone experiencing bleeding, such as people with ulcers, inflamed intestines caused by malabsorptive disorders, or heavy menstruation. Iron-deficiency anemia is no more common in vegetarians than in nonvegetarians.

Because plant-sourced iron is nonheme iron, which is susceptible to compounds that inhibit and enhance its absorption, the recommendation for vegans and vegetarians is to aim for slightly more iron than nonvegetarians. Fortunately, this is easy to do with the wide array of iron-rich food choices in the plant kingdom. Leafy greens and legumes are excellent sources of iron and a multitude of other nutrients, so it is advantageous to include these foods often. Other good choices include

soy products, dark chocolate, blackstrap molasses, sesame seeds, tahini, pumpkin seeds, sunflower seeds, raisins, prunes, and cashews.

Iron absorption may be diminished in the presence of phytates, tannic acids from tea, calcium in dairy, fiber, polyphenols in coffee and cocoa, and certain spices (eg, turmeric, coriander, chilies, and tamarind). To minimize this, separate iron-rich foods from these nutrients as much as possible. An example is to drink coffee or tea separately from meals or to mix up meal combinations. One of the best tips for optimizing iron absorption is to eat iron-rich foods in combination with foods high in vitamin C and organic acids. This improves solubility, thereby facilitating absorption. Examples of such optimizing food combinations are a green smoothie with leafy greens (iron) and fruit (vitamin C) or salad greens (iron) with tomatoes (vitamin C).

## Iodine

Dietary sources of the trace mineral iodine are unreliable and fluctuate geographically because of varying soil qualities. It is crucial for vegans to be mindful

of consuming a source of iodine to avoid thyroid issues. Sources of iodine include iodized salt and sea vegetables. However, it is important to note that iodine is not found in sea salts, gourmet salts, or other salty foods. One half-teaspoon of iodized salt provides the daily recommended 150- $\mu\text{g}$  dose. Also, iodine levels in sea vegetables fluctuate dramatically, with some (especially dulse and nori) containing safe amounts and others (such as kelp) harboring toxic doses. Hijiki, also spelled hiziki, should be avoided owing to its excessive arsenic levels. A preexisting iodine deficiency, a selenium deficiency, or high intake of goitrogens (antinutrients found in cruciferous vegetables, soy products, flaxseeds, millet, peanuts, peaches, pears, pine nuts, spinach, sweet potatoes, and strawberries) can interfere with iodine absorption. There is no need to avoid goitrogenic foods as long as iodine intake is sufficient. If a patient does not enjoy sea vegetables or is minimizing intake of salt, an iodine supplement may be warranted.

## Selenium

Selenium is a potent antioxidant that protects against cellular damage and also plays a role in thyroid hormone regulation, reproduction, and DNA synthesis. Brazil nuts are an especially rich source of selenium in the plant kingdom. Although selenium content varies depending on the source, an average ounce (approximately 6 to 8 nuts) can provide 777% of the RDA. When accessible, one Brazil nut a day is an ideal way of meeting selenium recommendations. Other plant sources include whole grains, legumes, vegetables, seeds, and other nuts.

## Zinc

Zinc supports immune function and wound healing; synthesis of protein and DNA; and growth and development throughout pregnancy, childhood, and adolescence. Because of the presence of phytates, bioavailability of zinc from plants is lower than from animal products. Zinc deficiency may be difficult to detect in blood tests but can show up clinically as delayed wound healing, growth retardation, hair loss, diminished immunity, suppressed appetite, taste

**Table 2. Sources of notable nutrients**

Nutrient	Food sources
Protein	legumes (beans, lentils, peas, peanuts), nuts, seeds, soy foods (tempeh, tofu)
Omega-3 fats	seeds (chia, hemp, flax), leafy green vegetables, microalgae, soybeans and soy foods, walnuts, wheat germ
Fiber	vegetables, fruits (berries, pears, papaya, dried fruits), avocado, legumes (beans, lentils, peas), nuts, seeds, whole grains
Calcium	low-oxalate leafy greens (broccoli, bok choy, cabbage, collard, dandelion, kale, watercress), calcium-set tofu, almonds, almond butter, fortified plant milks, sesame seeds, tahini, figs, blackstrap molasses
Iodine	sea vegetables (arame, dulse, nori, wakame), iodized salt
Iron	legumes (beans, lentils, peas, peanuts), leafy greens, soybeans and soy foods, quinoa, potatoes, dried fruit, dark chocolate, tahini, seeds (pumpkin, sesame, sunflower), sea vegetables (dulse, nori)
Zinc	legumes (beans, lentils, peas, peanuts), soy foods, nuts, seeds, oats
Choline	legumes (beans, lentils, peas, peanuts), bananas, broccoli, oats, oranges, quinoa, soy foods
Folate	leafy green vegetables, almonds, asparagus, avocado, beets, enriched grains (breads, pasta, rice), oranges, quinoa, nutritional yeast
Vitamin B <sub>12</sub>	fortified foods (nutritional yeast, plant milks), supplement (2500 $\mu\text{g}$ per week)
Vitamin C	fruits (especially berries, citrus, cantaloupe, kiwifruit, mango, papaya, pineapple), leafy green vegetables, potatoes, peas, bell peppers, chili peppers, tomatoes
Vitamin D	sun, fortified plant milks, supplement if deficient
Vitamin K	leafy green vegetables, sea vegetables, asparagus, avocado, broccoli, Brussels sprouts, cauliflower, lentils, peas, nattō (a traditional Japanese food made from soybeans fermented with <i>Bacillus subtilis</i> var <i>nattō</i> )

abnormalities, or skin or eye lesions. Consider advising patients to aim for 50% or greater than the RDA of zinc daily by including legumes, cashews and other nuts, seeds, soy products, and whole grains. Preparation methods such as soaking, sprouting, leavening, and fermenting will improve absorption. Table 2 provides a convenient chart highlighting excellent sources of notable nutrients.

### HELPING PATIENTS GET STARTED

To support patients to delve into this therapeutic nutrition plan to help them prevent or manage chronic disease and improve or maintain their state of health, it is crucial to provide optimistic, simple, and strategic guidance. See Sidebar: Six-Step Guide for Initiating and Maintaining a Nutrition Dialogue with Patients.

### GUIDE FOR INITIATING AND MAINTAINING A NUTRITION DIALOGUE WITH PATIENTS

1. During the first part of an office visit when interviewing patients regarding wellness behaviors (typically covering exercise and smoking), include questions about diet, such as the following:

- Do you eat at least 7 to 9 servings of vegetables and fruits every day?<sup>64</sup>

- How many times per week do you eat fried foods/red meat/processed meat/refined sugars?
- How often do you choose whole grains over refined grains?
- Do you eat at least a cup to a cup-and-a-half of legumes (beans, lentils, peas) per day?
- Do you include leafy green vegetables in your daily diet?

2. When discussing a patient's treatment plan, include diet as a viable option with positive effects (eg, improved gastrointestinal function, decreased risk for chronic diseases, and better outcomes for existing conditions).

3. Advocate simple suggestions to start off. Instead of overwhelming a patient with drastic renovations to their current way of eating, begin with a few changes that can be made within reason. Some examples include the following:

- Incorporate leafy green vegetables with at least two meals or snacks each day (enjoy a salad, add broccoli to pasta, try a green smoothie for breakfast or a snack).
- Start reducing intake of red and processed meat to once per week or less.
- Opt for whole grains over refined (eg, brown rice instead of white rice, whole grain pasta instead of white pasta, 100% whole grain or sprouted bread).

### Suggested Internet Nutrition Resources

[www.nlm.nih.gov](http://www.nlm.nih.gov)  
<https://ndb.nal.usda.gov>  
<http://vegetariannutrition.net>  
<http://nutritionfacts.org>  
[www.pcrm.org](http://www.pcrm.org)  
[www.brendadavisrd.com](http://www.brendadavisrd.com)  
[www.veganhealth.org](http://www.veganhealth.org)  
<http://plantbaseddietitian.com>  
[www.theveganrd.com](http://www.theveganrd.com)  
[www.vrg.org/nutrition/](http://www.vrg.org/nutrition/)  
<https://fnic.nal.usda.gov/lifecycle-nutrition/vegetarian-nutrition>  
[www.vegansociety.com](http://www.vegansociety.com)

### Label-Reading Protocol

- Ignore misleading marketing terminology on labels (eg, "excellent source of," "free of," "natural")
- Focus solely on ingredient list and ignore rest of packaging
- Strive to purchase foods with:
  - Only recognizable ingredients
  - Few total ingredients listed
  - Absence of artificial colors/flavorings/sweeteners, refined sugars, preservatives, stabilizers, thickeners, or any unrecognizable names

### Six-Step Guide for Initiating and Maintaining a Nutrition Dialogue with Patients

1. During the first part of an office visit when interviewing patients regarding wellness behaviors (typically covering exercise and smoking), include questions about diet.
2. When discussing a patient's treatment plan, include diet as a viable option with positive effects (eg, improved gastrointestinal function, decreased risk for chronic diseases, and better outcomes for existing conditions).
3. Advocate simple suggestions to start off. Instead of overwhelming a patient with drastic renovations to their current way of eating, begin with a few changes that can be made within reason.
4. Educate patients on both the risks associated with inadequate intake of produce and regular consumption of refined sugars and animal products as well as the advantages of emphasizing whole plant foods. Enlist all health care practitioners on the patient's team to be aware of diet modification goals. One way to simplify this is by charting progress and goals.
5. Offer patients educational support (see Sidebar: Suggested Educational Support). Information in the form of pamphlets, onsite nutrition counseling, in-house cooking classes, and articles on the Internet (see Sidebar: Suggested Internet Nutrition Resources) is ideal because there are multiple points of reference and communication for patients.
6. Maintain a plan for follow-up and continued encouragement. It is common for people to lose motivation, and to become frustrated over time, particularly if there is not a strong support system in place (see Sidebar: Tips for Patient Motivation). Engage patients by ensuring they are enrolled in classes, have family or friends participating alongside them, are connected to others in similar phases of transition, and have access to continued information, as designated above.<sup>55</sup>

- Enjoy 2 to 4 servings of fruit per day.
  - Include colorful vegetables with each meal.
  - Try making a plant-based meal and then an entire plant-based day by prioritizing previously loved plant-based dishes (eg, pasta primavera, bean and rice burrito, bean chili).
  - Aim to eat a rainbow every day (foods naturally red, orange, yellow, green, and blue/purple).
- For those patients eager to make more dramatic changes, encourage switching to eating a combination of vegetables, fruits, legumes, and whole grains, according to the recommendations above.
4. Educate patients on both the risks associated with inadequate intake of produce and regular consumption of refined sugars and animal products as well as the advantages of emphasizing whole plant foods. Enlist all health care practitioners on the patient's team to be aware of diet modification goals. One way to simplify this is by charting progress and goals.
  5. Offer patients educational support (see Sidebar: Suggested Educational Support). Information in the form of pamphlets, onsite nutrition counseling, in-house cooking classes, and articles on the Internet (see Sidebar: Suggested

Internet Nutrition Resources) is ideal because there are multiple points of reference and communication for patients.

It is also important to educate patients on the importance of reading labels (see Sidebar: Label-Reading Protocol).

6. Maintain a plan for follow-up and continued encouragement. It is common for people to lose motivation, and to become frustrated over time, particularly if there is not a strong support system in place (see Sidebar: Tips for Patient Motivation). Engage patients by ensuring they are enrolled in classes, have family or friends participating alongside them, are connected to others in similar phases of transition, and have access to continued information.<sup>65</sup>

### Suggested Educational Support

- Informational sheets, such as pamphlets and handouts, of meal options, recipes, nutrient sources (as in Table 2), sample meal plans, benefits of eating healthfully, additional resources, and advice based on the information in this guide will support the patient in pursuing plant-based eating at home.
- Individual nutrition counseling as prescribed by a physician provides encouragement, reinforces positive outcomes, and helps address needs and concerns.
- Cooking classes, available in many communities, led by plant-based chefs or registered dietitians are excellent tools for successful adaptation of healthy cooking patterns in the home. Demonstrations and interactive methods whereby participants are able to prepare food or at least taste samples and receive recipes to take home will inspire adherence.
- Articles on the Internet (see Sidebar: Internet Nutrition Resources) and other online resources (or even nutrition-specific Web sites) are opportunities to provide patients with ready-to-go information and perhaps a 24-hour interactive resource.

### Tips for Patient Motivation

- Focus on optimism. Encourage every positive choice because food is deeply personal and making significant changes is challenging for most people. Every bite matters.
- Encourage the conversation with patients who are interested. The single person most people trust for advice and recommendations on health, diet, and wellness is their physician. It is an honor and special occasion to be able to open up the dialogue from a place of caring and support and without judgment. Offer advice and an ear to help propel patients onto the path of long-term health.
- Make it fun. Recalculating diet is similar to learning a new language. Initially, a few new ingredients are discovered, which is like learning some new words. Then enjoyable recipes and meals become part of the repertoire, which is similar to learning some phrases in the new language. Finally, the knowledge base expands so greatly that it becomes second nature to choose and prepare plant-based meals, akin to speaking the language fluently. Health care practitioners are ideally situated to easily guide patients toward fluency and success in this new language.

### CONCLUSION

Ultimately, it is a win-win situation—for patients, and for health care practitioners—to have plant-based eating as a powerful tool in the toolbox. Pharmaceuticals are an important tool in a physician's armamentarium, particularly in treating acute illness, but lifestyle changes, eg diet, can be an important and powerful tool in treating chronic illness. To facilitate lower health care costs and likely better health outcomes, let food be medicine and the route of the future. ❖

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## Food Rules

Eat food.  
Not too much.  
Mostly plants.

— *Food Rules*, Michael Pollan, b 1955, American author, journalist, activist, and professor of journalism