

Nutrition and Health Info Sheet: Vegetarian Diets

For Health Professionals

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What is a vegetarian diet?

A vegetarian diet consists primarily of plant foods, but may include eggs (called ovo-vegetarian), dairy products (called lacto-vegetarian), or both eggs and dairy products (called lacto-ovo-vegetarian). The vegan diet, as well as a strict vegetarian diet recently coined as a fruitarian, completely exclude meat, fish, poultry, eggs, and dairy products.¹ There are many variations of these types of diets; some people follow a semi-vegetarian diet, which excludes red meat but includes small amounts of fish and poultry, and are commonly referred to as pescetarians.¹ Whether following a vegetarian or variation diet with small amounts of meat, plant-based diets that include ample fruits, vegetables, legumes, and whole grains are associated with helping to reduce risk of chronic diseases by minimizing the intake of saturated fat. Furthermore, the plant-based diet provides the dietary fiber and phytochemicals found only in plant sources.¹



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Are vegetarians at risk of being deficient in certain nutrients?

A well-planned and balanced vegetarian diet can provide sufficient amounts of essential nutrients. However, the more restrictive a vegetarian diet is, there can be greater risks for nutrient deficiency. For example, vegans eliminate all animal foods from their diet, and need to plan their meals by consuming a wide variety of nutrient-dense plant source foods. Vegetarians need to ensure that they consume enough of the following nutrients, which have been found to be low in non-meat-based diets.³

Protein

Vegetarian diets can supply adequate protein, provided that rich protein sources are included, such as beans and nuts, and higher-protein grains such as quinoa. Animal sources of protein are more easily digested than plant sources, so a vegan diet may have higher protein requirements than a diet that includes eggs or dairy products.⁴

Iron

Adequate iron intake depends on both the amount of dietary iron consumed and the amount available for absorption. Iron absorption rates vary depending on physiological need and on the presence of other dietary components. These components can either reduce iron absorption (as with phytates and oxalates) or enhance iron absorption (as with vitamin C). Non-heme iron, the only form of iron found in plants, is more sensitive to these influences than the heme iron found in animal products. Dried beans, fortified breads and cereals, spinach, chard, blackstrap molasses, bulgur, and dried fruit are good sources of non-heme iron. To improve iron absorption from these and other iron-rich plant foods, consume vitamin C-rich foods at the same meal.⁴

Calcium

For vegetarians who include dairy products in their diets, meeting calcium requirements is the same as for omnivores (individuals who eat plant and animal foods). Vegetarians and vegans who choose to avoid dairy products should take special care to consume adequate amounts of calcium from nondairy sources, such as collard greens, spinach, almonds, soybeans, and turnip greens, in addition to calcium-fortified orange juice, cereal, soymilk, rice milk, almond milk, and tofu. Unfortunately, substances such as oxalic acid, found in some vegetables, may reduce the body's absorption of calcium, so individuals choosing to avoid dairy products should be sure to consume a variety of calcium-rich foods.⁴



Zinc

Good plant sources of zinc include whole grains, nuts, and legumes; however, the zinc found in plant foods is not as well-absorbed as the zinc in meat because phytates in plants bind to zinc. Vegetarian children, especially vegans, are more vulnerable to zinc deficiency than adults, presumably because of the high zinc levels required for growth. Ample intake of legumes and whole grains may provide adequate zinc, but vegan children (and adults) should be aware of the possibility of zinc deficiency. Compared to vegans, vegetarians who eat eggs

and/or dairy products are less likely to be deficient in this mineral.⁴

Vitamin B₁₂

Because vitamin B₁₂ is found in all animal products, a dietary pattern that includes foods such as dairy products or eggs is likely to be sufficient in vitamin B₁₂. Plants do not provide active vitamin B₁₂, making it essential for vegans to include a reliable source of this vitamin in their diets. Although deficiency can take up to 3 years to develop, research has shown an association in vegetarians between low levels of vitamin B₁₂ and elevated levels of homocysteine. This is a marker of cardiovascular disease, which suggests that vegetarians should be careful to consume adequate amounts of this nutrient as well.⁵ Elderly vegetarians are especially prone to vitamin B₁₂ deficiency, because the body's ability to absorb this vitamin tends to decline with age. The active form of the vitamin (cyanocobalamin) is found in vitamin supplements and fortified foods, such as some commercial breakfast cereals, soy beverages, and certain brands of nutritional yeast. Be sure to check the label to determine whether these items contain vitamin B₁₂. Spirulina, seaweed, tempeh, and other fermented foods are not reliable sources of the vitamin, as the form of B₁₂ in these foods may be inactive. Women who are pregnant or breast-feeding should take supplemental Vitamin B₁₂, commonly found in prenatal vitamins, to protect the newborn from deficiency.⁶

Vitamin D

Synthesized by the body upon exposure to sunlight, many Americans today still do not meet their vitamin D requirements with sun exposure alone. Food sources of vitamin D include vitamin D-fortified dairy products, egg yolks, liver, and fatty fish. Vegans are, therefore, particularly susceptible to vitamin D deficiency and should take special care to consume foods fortified with vitamin D, such as some breakfast cereals and certain brands of soymilk. These individuals may also consider taking supplements that provide sufficient amounts of calcium. There are two different forms of vitamin D in supplements and fortified foods. Supplemental Vitamin D₂, also called ergocalciferol, is vegan and can be synthesized from the UV irradiation of yeast. Supplemental Vitamin D₃, also called cholecalciferol, is made by UV irradiation of sheep's wool. Vitamin D₂ and D₃ are metabolized in the liver and converted to their active forms in the kidneys.⁷ Research indicates that vitamin D receptors (VDR's) show more affinity towards vitamin D₃ under hydroxylation processes. Findings suggest that vitamin D₃ increases the serum 25(OH)D, or the marker that indicates vitamin D levels within the body. Dietary intake of both calcium and vitamin D₃ can be met with fortified foods or supplementation that are vegan-friendly.⁸

Omega-3 Fatty Acids

The optimal source for consuming omega-3 fatty acids is fish, however for vegans and many vegetarians, fish is not a part of the diet. The essential fat, alpha linolenic acid (ALA), can be found in both plant and animal foods (including nuts, seeds, plant oils, and fish), and its consumption has been associated with a reduced risk of cardiovascular disease. A study found that both vegans and



vegetarians, in comparison to omnivores, may consume inadequate amounts of omega-3 fatty acids (measured by omega-3 fatty acid levels in sphingolipids, phosphatidylcholine, phosphatidylserine, and phosphatidylethanolamine), thus suggesting a need for vegetarians to include rich sources of omega-3 fatty acids in their diets. The best plant sources of this fat are walnuts and ground flaxseeds (or flaxseed oil) which provide ALA. However, ALA is not efficiently converted to omega-3s found in fish, called EPA and DHA (eicosapentaenoic acid and docosahexaenoic acid, respectively). Pescetarians will likely consume sufficient EPA and DHA, but other vegetarians should consider an omega-3 supplement.⁹ While it is possible for vegetarians and vegans alike to consume adequate levels of omega-3 fatty acids in their diet, overall diet quality affects the concentration levels inside the body. In recent years, poor quality diets rich in *trans* fats, and low levels of minerals and vitamins, cause a reduction in omega-3 fatty acid synthesis. Furthermore, research indicates that omega-3 and omega-6 fatty acids consumed in the diet compete for enzymes to convert them to DHA and EPA in the body. Consuming high amounts of omega-6 fatty acids prevents adequate conversion of what little omega-3's a vegan or vegetarian consumes. Findings suggest that it cannot be concluded whether low levels of omega-3 in the body causes adverse health risks, however. More research in this area is currently underway, but algal oils for both vegans and vegetarians look promising.^{10,11}

How can vegetarians plan healthful meals?

The United States Department of Agriculture (USDA) 2015-2020 Dietary Guidelines, provides the following recommendations for planning vegetarian meals:⁴

- Build meals around protein sources that are naturally low in fat, such as beans, lentils, and rice. Avoid overloading meals with high-fat cheeses to replace the meat.
- Calcium-fortified, soy-based beverages can provide calcium in amounts similar to milk, which are usually low in saturated fats.
- Many foods that typically contain meat or poultry can be made vegetarian. Eliminating the meat can increase vegetable intake and reduce saturated fat intake.

Vegetarians can also turn to many ethnic cuisines, such as Indian, Middle Eastern, Hispanic, and Asian, for plant-based dishes that include protein in the form of beans, nuts, and higher-protein grains.

Vegetarian food recommendations have been developed and may serve as helpful tools for planning a healthy vegetarian diet. One



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example is shown in Table 1.¹² Another example, shown in Appendix 5 of the 2015-2020 USDA Dietary Guidelines is available online at <http://health.gov/dietaryguidelines/2015/guidelines/appendix-5/>.¹³

Table 1: Vegetarian Food Guide for Adults following a 2,000 calorie diet ¹²

Food Group	Daily Amounts	Examples of Serving Size Equivalents
Fruits	2 cups	1 cup equivalent of fruit: 1 medium fruit ½ cup diced or cooked fruit ¼ cup dried fruit ½ cup calcium-fortified fruit juice* 5 figs*
Grains Half of grains consumed should be whole grains	6 ½ oz-eq†	1 oz equivalent of grains: 1 slice bread 1 cup calcium-fortified ready-to-eat cereal * ½ cup cooked grain, pasta, or cereal ½ cup brown or white rice
Dairy	3 cups	1 cup equivalent of milk: 1 cup milk 1 cup yogurt 1 ½ oz natural cheese 2 oz processed cheese 1 cup calcium-fortified soymilk*
Protein Foods	3 ½ oz-eq	1 oz equivalent of protein foods: ¼ cup cooked beans, peas, or lentils* ¼ cup tofu* 1 egg 1 Tbsp nut or seed butter* 1 oz meat substitute ½ oz nuts*
Oils	6 tsp	1 tsp equivalent of oils: 1 tsp. soft margarine, mayonnaise, or oil
Vegetables	2 ½ cups	1 cup equivalent of vegetables: 1 cup raw or cooked vegetables 2 cups raw leafy greens 1 cup vegetable juice (calcium-fortified)*

Note: The information in this table is adapted from Appendix 5 – Healthy Vegetarian Eating Pattern of the 2015-2016 USDA Dietary Guidelines for Americans

*For those following vegan or ovo-vegetarian diets, the dairy group will be omitted. Foods marked with an * are high-calcium, non-dairy foods

†Ounce Equivalents (oz eq): Cup and ounce equivalents identify the amounts of foods from each food group with similar nutritional content ¹³

Does eating a vegetarian diet reduce the risk of diseases such as heart disease and cancer?

The appeal of vegetarian diets for many individuals lies in their potential health benefits. Research has shown that vegetarians have lower morbidity and mortality from a number of degenerative diseases, including cardiovascular disease and certain types of cancer.¹⁴ However, it has not yet been shown that it is the omission of meat *per se* that has caused these positive effects, as vegetarian diets often include an overall higher intake of fruits, vegetables, and fiber, and lower intake of total fat and saturated



fat, compared with typical omnivorous diets.¹⁵ It has also been difficult to separate the beneficial effects of a vegetarian diet from those effects of commonly related lifestyle differences, such as not smoking, regular physical activity, and moderate alcohol consumption.

Consuming a vegetarian diet, or even occasional meatless meals, can make it easier for an individual to meet the *2015-2020 Dietary Guidelines for Americans* recommendation to consume sufficient amounts of a variety of fruits and vegetables daily, or to meet the Dietary Approaches to Stop Hypertension (DASH) recommendation to consume 4–5 servings of nuts, seeds, and dried beans per week.¹⁶ Other organizations, such as the American Institute for Cancer Research,¹⁷ the American Heart Association,¹⁸ and the National Heart, Lung, and Blood Institute,¹⁹ also recommend consuming a diet high in fruits and vegetables. Due to their dependence upon fruits, vegetables, whole grains, legumes, nuts, and seeds, well-planned vegetarian diets are more likely to meet the current recommendations for dietary fiber intake. This, in turn, helps lower the risk for chronic disease by reducing LDL-cholesterol levels and by replacing foods high in saturated fat with foods rich in heart-healthy monounsaturated and polyunsaturated fats.

Are vegetarian diets safe for everyone?

As with any dietary pattern, accommodations must be made for the specific nutrient needs of infants, children, adolescents, pregnant and breast-feeding women, and the elderly. As long as a conscious effort is made to choose a variety of nutritionally adequate foods, vegetarians at any age can obtain sufficient energy and nutrients necessary for health.²⁰ Some studies,

however, suggest this may be difficult for children, who may not be able to consume sufficient food to meet nutrient needs from a vegetarian or vegan diet.^{21, 22} Table 2 contains dietary recommendations for vegetarian children.

Table 2: Dietary Recommendations for Children –Vegetarians

Food Group	Daily Recommendations for Vegetarian Children (Girls)* 18	Daily Recommendations for Vegetarian Children (Boys)** 18	Examples of Serving Size Equivalents
Fruit	1 ½ -2 cups	1 ½ - 2 cups	½ cup equivalent of fruit: ½ cup fresh, frozen, or canned fruit ¼ cup dried fruit 1 medium whole fruit ½ cup fruit juice
Grains	5-7 oz	5-9 oz	1 oz equivalent of grains: 1 slice bread ~ 1 cup dry cereal (depends on brand) ½ cup cooked rice, pasta, or cereal
Protein	4-6 oz	5-6 ½ oz	1 oz equivalent of protein: ¼ cup cooked dry beans, lentils, peas, 1 egg ½ oz nuts or seeds 1 Tbsp nut or seed butter
Dairy	3 cups	3 cups	1 cup equivalent of milk: 1 ½ oz natural cheese 2 oz processed cheese 1 cup milk 1 cup yogurt
Oils	2 tsp	2 tsp	1 tsp equivalent of oils: 1 tsp. soft margarine, mayonnaise, or oil
Vegetables	1 ½ - 3 cups	2- 3 ½ cups	½ cup equivalent of vegetables: ½ cup chopped raw or cooked vegetable 1 cup raw leafy vegetable ½ cup vegetable juice

Notes:

* For a 1,400-2,200-calorie diet depending on growth and activity level

**For a 1,600-2,600-calorie diet depending on growth and activity level

†For children 9–13 years of age. Additional foods can be chosen to meet energy needs.²³



Photo by: Keith Weller, Agricultural Research Service, USDA

Is it important to consume complementary foods (foods that contain different amounts of amino acids) in order to receive a sufficient quality of protein in the diet?

Yes, it is important to combine amino acid food sources because plant proteins other than soy are low in one or more of the essential amino acids. However, having adequate protein quality is easily accomplished by eating a variety of foods. Examples of vegetarian meals containing complementary foods are: peanut butter and whole wheat bread; beans and rice; meals containing tofu or tempeh; meals containing eggs; and meals containing dairy products. Furthermore, there is no need to be sure that every meal or snack has the complete list of essential amino acids; it suffices to eat them over the course of a day.⁴

What is a nutritionally adequate vegetarian diet?

To be nutritionally adequate, any dietary pattern—vegetarian or otherwise—should provide balance, variety, and moderation. Table 1 provides recommendations from the 2015-2020 Dietary Guidelines for Americans following a 2,000-calorie diet for adults (18 years of age and older) following a vegetarian diet. Suggested dietary patterns for children, adolescents, pregnant and lactating women,¹² and vegans²⁴ are available elsewhere (see references 12 and 24 for examples).

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