Colorado State University EXTENSION

Vegetarian Diets

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Vegetarianism includes a variety of eating patterns that rely heavily on plant foods, while avoiding meat. While some vegetarians exclude all animal products from their diets (vegans), others simply limit the amount of animal products in their overall diet. Vegetarianism is growing in popularity in the United States, with an estimated 3.3% of American adults identifying as vegetarian in 2016, up from 2.3% in 2012. About 46% of vegetarians in the United States are vegan.

According to the Academy of Nutrition and Dietetics, well planned vegetarian diets can be healthful and nutritionally adequate throughout the lifecycle, while providing potential health benefits in prevention and treatment of chronic diseases. In fact, the 2015-2020 Dietary Guidelines for Americans, includes the vegetarian diet as one of its highlighted healthy eating patterns, demonstrating that vegetarian diets can successfully meet the Dietary Guidelines and its key recommendations.

Vegetarian diets have been associated with lower levels of obesity (body mass index), and reduced risk of cardiovascular disease, type 2 diabetes, hypertension, and certain types of cancer. Compared to non-vegetarians, vegetarians tend to consume fewer overall calories; a lower proportion of calories from fat (particularly saturated fat); and higher quantities of fruits, vegetables, whole grains, nuts, soy products, fiber, and phytochemicals. These dietary features help to produce lower LDL cholesterol levels, better serum glucose control, and reduce the risk of chronic disease in those who follow a vegetarian diet. Research also shows that vegetarian diets are more environmentally sustainable and use fewer natural resources than diets rich in animal products.

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Types of Vegetarian Diets

Vegetarians have different dietary practices, but most can be categorized into one of the following groups:

Vegans eat only plant foods; including fruits, vegetables, legumes (dried beans, peas, and lentils), grains, seeds and nuts.

Raw vegans eat only plant foods; including vegetables, fruit, nuts and seeds, legumes (dried beans, peas, and lentils), and sprouted grains. The amount of uncooked food varies from 75% to 100%.

Lacto vegetarians eat plant foods as well as dairy products, such as milk and cheese.

Lacto-ovo vegetarians eat plant foods, dairy products and eggs. Most vegetarians in the U.S. fit into this category.

Key Nutrients of a Vegetarian Diet

Because of the variability in vegetarian diets, it is important for individuals to become familiar with their individual nutritional needs

Quick Facts

- Following a vegetarian diet can be a healthful way to eat.
- Vegetarians are categorized by which animal foods are restricted in the diet.
- Nutritional requirements are the same for vegetarians and nonvegetarians but some nutrients require special attention.

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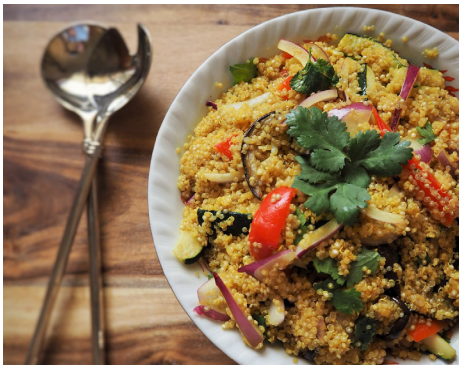

and potential dietary deficiencies. People following a vegetarian diet generally receive adequate amounts of most nutrients. However, the following nutrients may be lacking so it is important to assure adequate amounts of these nutrients in the diet.

Protein

Protein is needed for growth and maintenance of body tissues. It also is necessary for enzymes, hormones, antibodies and milk production in women who are breastfeeding. Plant sources of protein can provide adequate amounts of essential and nonessential amino acids, if they are reasonably varied and caloric intake is sufficient to meet energy needs. Whole grains, legumes, vegetables, seeds and nuts all contain essential and nonessential amino acids. Textured vegetable proteins and meat analogues, such as tofu and tempeh (usually made from soybeans and fortified with amino acids) are good protein sources. Soy milk is also a good source of protein as it contains the same amount of protein per serving as cow's milk. An assortment of plant foods eaten over the course of a day can provide all essential amino acids; thus, complementary proteins do not need to be eaten at the same meal.

Omega-3 Fatty Acids

An increasing body of research shows the many benefits of omega-3 fatty acids. These fats may reduce the risk for cardiovascular disease, improve cognitive function and vision, and act as an anti-inflammatory agent in the body. The primary sources of omega-3 fatty acids in the diet are fish, organ meats, and DHA-enriched foods such as eggs. Based on these food sources, vegetarians may not get enough omega-3 fatty acids in their diet. However, evidence suggests the healthy individuals can meet their omega- 3 needs by consuming adequate amounts of omega-3 containing plant foods like flaxseed, chia seeds, hemp seeds, walnuts, canola oil and soy. Vegetarians can also choose from the increasing variety of DHA-enriched foods sold in the marketplace, such as some soy milks and breakfast bars. Finally, capsule supplements made from DHA-rich microalgae are available, but it is always important to consult a healthcare provider before taking a supplement.

Iron

Iron combines with protein to form hemoglobin, the substance in the blood that carries oxygen and carbon dioxide. An adequate intake of iron is necessary to prevent anemia. Many Americans, both meat-eaters and vegetarians, have a difficult time consuming enough iron.

While vegetarians generally consume as much, or slightly more iron than omnivores, vegetarians typically have lower iron stores than non-vegetarians. This is due to the fact that the iron in animal foods is more easily absorbed by the body than the iron in plant foods. The iron in plant foods may be less available to the body because of the high fiber content in plants. Fiber is not absorbed into the body and may tie up minerals, such as iron, so they, too, are not absorbed. For these reasons, vegetarians may be at a higher risk for developing iron deficiency. Because women need more iron than men they especially need to pay attention to iron.

Recent research has shown however, that some individuals can adapt to absorb plant based iron (non-heme iron) almost as effectively as animal based iron (heme iron). One study found that total iron absorption increased by almost 40% after 10 weeks of consuming a plant-based diet. Even so, the daily recommendation for iron intake is 1.8 times higher for vegetarians than those who eat meat.

Among plant foods, dark green leafy vegetables have the highest iron content. Dried fruits (such as raisins, apricots, peaches and prunes) also are high in iron. For maximum iron absorption, it is beneficial to eat plant sources of iron at the same meal as foods high in vitamin C (Brussels sprouts, strawberries, citrus fruits, broccoli, collard greens, mustard greens, cantaloupe or vitamin C-rich fruit juices). Vitamin C increases the availability of iron in the intestinal tract. When vitamin C and iron are eaten together, more iron is absorbed into the body.

Zinc

As with iron, zinc is a mineral that is present in plant foods but better absorbed from animal sources. As a result, some vegetarians have lower concentrations of zinc in the body than non-vegetarian diets, but most vegetarians still have levels within the normal range. True zinc deficiencies are rare in Western civilizations. Vegetarians can make sure they consume zinc by including foods such as soy products, legumes, grains, cheese and nuts. Like iron, zinc can be better absorbed when eaten in combination with vitamin C-rich foods.

Calcium

Calcium is needed for strong bones and teeth, for normal blood clotting and for normal muscle and nerve function. Most calcium in the American diet comes from milk and milk products. When these foods are avoided, calcium must come from other sources. Dark green

Table 1: Healthy Vegetarian Eating Pattern: Recommended Amounts of Food From Each Food Group

Daily Amount of Food From Each Group in Cup and Ounce Equivalents

	Healthy U.S.-Style Eating Pattern	Healthy Vegetarian Eating Pattern	What counts as a cup or ounce equivalent (c-eq or oz-eq)?
Fruit	2 c-eq	2 c-eq	1 cup-equivalent is:1 cup raw or cooked vegetable or fruit, 1 cup vegetable or fruit juice, 2 cups leafy salad greens, ½ cup dried fruit or vegetable.
Vegetables	2 ½ c-eq	2 ½ c-eq	
Dark green vegetables	1 ½ c-eq/week	1 ½ c-eq/week	
Red and orange vegetables	5 ½ c-eq/week	5 ½ c-eq/week	
Legumes (beans and peas)	1 ½ c-eq/week	1 ½ c-eq/week	
Starchy vegetables	5 c-eq/week	5 c-eq/week	
Other vegetables	4 c-eq/week	4 c-eq/week	
Grains	6 oz-eq	6 ½ oz-eq	1 ounce-equivalent is: ½ cup cooked rice, pasta, or cereal; 1 ounce dry pasta or rice; 1 medium (1 ounce) slice bread; 1 ounce of ready-to-eat cereal (about 1 cup of flaked cereal).
Whole grains	3 oz-eq	3 ½ oz-eq	
Refined grains	3 oz-eq	3 oz-eq	
Dairy	3 c-eq	3 c-eq	1 cup-equivalent is: 1 cup milk, yogurt, or fortified soymilk; 1½ ounces natural cheese such as cheddar cheese or 2 ounces of processed cheese.
Protein Foods	5 ½ oz-eq	3 ½ oz-eq	1 ounce-equivalent is: 1 ounce lean meat, poultry, or seafood; 1 egg; ¼ cup cooked beans or tofu; 1 Tbsp peanut butter; ½ ounce nuts or seeds.
Seafood	8 oz/wk		
Meat, poultry, eggs	26 oz/wk		
Nuts, seeds, soy products	5 oz/wk		
Eggs		3 oz-eq/wk	
Legumes (beans and peas)		6 oz-eq/wk	
Soy Products		8 oz-eq/wk	
Nuts & Seeds		7 oz-eq/wk	
Oils	27g	27g	

leafy vegetables are the plant foods that provide the most calcium.

Certain plant components, like oxalates, may inhibit the absorption of dietary calcium. Calcium from low-oxalate green vegetables (broccoli, turnip greens, bok choy, chinese cabbage, collards, kale) is absorbed as well as or better than calcium from cow's milk, at a rate close to 50%. In high-oxalate vegetables (spinach, beet greens, and Swiss chard), as low as 5% of the available calcium is absorbed. Fruit juices and plant milks fortified with calcium and calcium-set tofu are also good sources of calcium.

Calcium deficiency in vegetarians is rare, and there is little evidence to show that calcium intakes below the Dietary Reference Intake cause major health problems in vegetarians. U.S. recommendations for calcium are relatively high compared to those for populations that eat a more plant-based diet. High levels of animal protein increase urinary loss of calcium. U.S. recommendations are designed to compensate for this. Studies show that vegetarians absorb and retain more calcium from food than do non-vegetarians.

Vitamin D

Vitamin D is required to absorb calcium from the digestive tract and to incorporate calcium into bones and teeth. Few foods contain large amounts of vitamin D and the best sources–fortified milk, egg yolks and liver–are all of animal origin. Therefore, vegetarians, especially vegans, may not get enough.

Sunlight is another source of vitamin D. The body makes vitamin D from sunlight on the skin. People regularly exposed to sunlight can get enough vitamin D without having any come from food. However, sun exposure can be limited by several factors, including dark skin, pollution and northern latitudes. If sun exposure is limited and there are no animal products in the diet a vitamin D supplement is recommended.

Vitamin B-12

Vitamin B12 is needed for normal red blood cell formation and normal nerve function. The body needs only small amounts and can store it in large amounts. Therefore, a deficiency takes a long time to develop, maybe several years. Once a deficiency does develop, however, it results in irreversible nerve damage. Vegetarians need to pay special attention to this nutrient, as it is not found in common plant foods.

Vegetarians who consume dairy products and/or eggs daily should get enough vitamin B12 in their diets. Vegans, however, have little or no vitamin B12 in their diets and must obtain the vitamin through regular use of a vitamin B12 supplement or through food sources, such as, nori, spirulina, chlorella, algae, unfortified nutritional yeast, fermented foods (such as tempeh fermented with beneficial bacteria), commercial breakfast cereals, or fortified soy beverages.

Iodine

Iodine is as an essential component of the thyroid hormones thyroxine (T4) and triiodothyronine (T3), which regulate a number of biochemical reactions in the body. The primary food sources of iodine are sea vegetables, sea food, and dairy products, so plant-based diets are often low in iodine Vegans may be at risk for iodine deficiency, so they should make a point to include sea vegetables (such as kelp, nori, kombu, and wakame) and iodized salt in their diets. It is also important to note, that while iodized salt contains iodine, sea salt and kosher salt do not. Salty seasonings, such as tamari and soy sauce are generally not iodized either. Lacto-vegetarians can get iodine from dairy products, but iodine content in dairy foods varies considerably.

Some vegetables, such as soybeans, sweet potatoes and cruciferous vegetables such as broccoli and cabbage, are considered goitrogens, because they interfere with iodine absorption. These foods however, have not been associated with thyroid insufficiency in healthy individuals with adequate iodine intake.

Planning a Nutritious Vegetarian Diet

Vegetarians should follow the diet principles recommended in the Dietary Guidelines for Americans. Well-planned vegetarian diets can effectively meet these guidelines and be a health-supporting dietary option. The 2015-2020 Dietary Guidelines includes the Healthy Vegetarian Eating Pattern as one of three eating patterns, along with the Healthy U.S.-Style Eating Pattern and the Healthy Mediterranean-Style Eating Pattern, that can be adapted based on cultural and personal preferences to meet the Dietary Guidelines and its Key Recommendations. The recommendations, as outlined in Table 1, the Healthy U.S.-Style Eating Pattern and the Healthy Vegetarian Eating Pattern are similar for fruit, vegetables, grains and dairy. The overall amount of protein recommended is less for the Vegetarian Eating Pattern and the types of protein foods and amounts for each of these foods vary.

Vegetarian Protein Options

Beans and Peas

Dry beans and peas, as well as lentils, are considered legumes. Legumes are an excellent food to extend or replace meat. Legumes are low cost, high in nutritive value, and contribute iron, B vitamins, and fiber to the diet. Like most plant sources they are not a complete protein, meaning they do not contain all of the essential amino acids the body needs. When combined with a variety of other plant foods throughout the week, dried beans and peas can become valuable protein sources in the diet.

Dry beans: Rich in protein, iron, calcium, phosphorus and potassium. Many varieties of dry beans include black beans, garbanzo beans (also called chick peas), kidney beans, lima beans, navy beans and pinto beans.

Dry peas: Good sources of protein, iron, potassium and thiamin. They are green or yellow and can be purchased split or whole.

Lentils: Disc-shaped legumes similar in size to peas. They are rich in protein, iron, potassium, calcium and phosphorus.

Soy Products

Soy products include tofu, soymilk, tempeh and other products. All are derived from soybeans and are a rich source of plant-based protein. Protein in soybeans contains as much complete protein as meat and they are a good source of B vitamins and essential fatty acids, including some omega-3s. Soy foods are generally low in saturated fat and trans fat and are cholesterol free. They also contain isoflavones which may help lower the risk of some chronic diseases. The following are common soy products that you will find in the marketplace:

Soybean: A legume, which is an excellent, inexpensive source of protein and iron. Soybeans can be eaten in their whole form and, but are also used to make a number of vegetarian substitutions for meat, dairy, and eggs.

Soy cheese: A cheese-like product made from soybeans. Soy cheeses come in most of the same varieties as dairy cheeses, such as parmesan, mozzarella and cheddar. However, some soy cheeses are not vegan as they contain the animal protein casein.

Soymilk: A milk-like product made from soybeans, with the same amount of protein and less fat than cow's milk. Not all soymilks are vegan as some contain the animal protein casein.

Tempeh: Made from fermented soybeans, tempeh is a replacement for meat.

Textured Vegetable Protein: Commonly used as a substitute for ground beef; TVP is derived from soy flour.

Tofu: Made from curdled soymilk and pressed into blocks. It is a replacement for meat, eggs and cheese and can be eaten fresh or cooked in many different ways. Tofu is an excellent source of protein. Types and uses of tofu:

- Extra-firm tofu: frying, roasting, grilling or marinating
- Firm tofu: stir-frying, boiling or to use as filling
- Soft tofu: pureeing
- Silken tofu: pureeing, simmering, egg substitution, used in vegan desserts and smoothies

Nuts and Seeds

Nuts are one of the best plant sources of protein. They are rich in fiber, folic acid, potassium, antioxidants (vitamin E and selenium) and phytochemicals as well. Nuts are high in monounsaturated and polyunsaturated fatty acids, including omega 3 fatty acids. Seeds have a similar nutrient profile to nuts, thus they're considered interchangeable with nuts. Because nuts and seeds are high in fat, portions should be limited.

Tree nuts: Includes almonds, Brazil nuts, cashews, hazelnuts, macadamias, pecans, pine nuts, pistachios and walnuts.

Seeds: Includes pumpkin, sesame, sunflower, and flaxseed. Seeds have a similar nutrient profile to nuts.

Nut butters: Peanut butter is the most popular but other nuts and seeds make healthful butters: sunflower, almond, hazelnut and soy.

Summary

A vegetarian diet can be a healthy way to eat. The key is to consume a variety of foods in the right amounts to meet your energy and nutrient needs. For vegetarians, it is important to:

- Be conscious of protein-rich foods. Your protein can easily be met by eating a variety of plant foods, such as beans, peas, soy products, nuts, and seeds.
- Eat a variety of fruits and vegetables to provide a wide range of nutrients.
- Include whole grains and other fiber rich foods.
- Get enough omega-3 fatty acids, calcium, and vitamin B12.

Well planned vegetarian diets can be healthful, nutritionally adequate, and may provide health benefits in prevention and treatment of chronic diseases during all phases of the lifecycle.

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