

Vegetarianism

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Executive Summary

- Survey results indicate that 2 to 7 percent of Americans regard themselves as vegetarians, but less than 1 percent completely exclude meat, poultry, fish, and shellfish from their diets. Even fewer Americans choose vegan diets that exclude all foods of animal origin.
- Some scientific studies indicate that vegetarians have lower risks of chronic diseases than do meat eaters. However, some of the apparent benefits of vegetarianism may be attributable to aspects of the vegetarian diet other than the absence of meat or to nondietary aspects of typical vegetarian lifestyles. It is not necessary to give up meat and become a vegetarian to enjoy the benefits of a healthy diet.
- Vegetarian diets that include dairy products are usually nutritionally adequate, as long as care is taken to include good sources of bioavailable iron and zinc in the diet.
- Diets completely devoid of animal products (vegan diets) may not be nutritionally adequate unless they are very carefully planned. Vegans should take supplements of vitamin B12 or eat soy products or cereals fortified with vitamin B12. They may also need supplements of vitamin D, iron, zinc, and calcium.
- Properly planned lacto- and lacto-ovo-vegetarian diets can conform to official dietary recommendations, including the Dietary Guidelines for Americans, the Food Guide Pyramid, and the Recommended Dietary Allowances.
- People with increased nutritional needs, such as infants, children, adolescents, pregnant or lactating women, and individuals with certain medical problems, may have difficulty meeting their nutritional needs on vegan diets. People who plan to follow such limited diets during times of increased nutritional needs should seek nutritional counseling from an informed physician or registered dietitian. Parents who follow unusual diets or lifestyles should realize that children are far more vulnerable than adults are to serious health damage from nutritional inadequacies and imbalances. Dietary restrictions that may be well tolerated by adults could cause lasting harm to an infant or young child.
- Health professionals, parents, and others who deal with young people should be aware that some teenage and college-age women who describe themselves as vegetarians may actually be practicing unhealthful forms of weight control or suffering from an eating disorder. These young women are at risk for serious health problems.
- Young people who become vegetarians for ethical or environmental reasons may also be placing their health at risk. Often, these young vegetarians lack the knowledge and motivation needed to plan healthful vegetarian meals.

Introduction

Many people are interested in vegetarianism, but some are unsure whether a vegetarian diet is healthful and appropriate for them. This report describes the views of health authorities on the acceptability of various types of vegetarian diets; reviews the scientific data on the possible health benefits of vegetarianism; explains how vegetarians can plan a nutritionally adequate diet; and evaluates the suitability of vegetarian diets for special population groups, such as children, adolescents, pregnant women, and the elderly.

All Vegetarians Are Not Alike

Broadly, a vegetarian is a person who abstains from eating red meat, poultry, and fish. Within this definition, there are a number of different eating patterns (see Table 1 at end of doc.). The distinction among different types of vegetarian eating patterns is important for health and nutrition. The potential benefits and potential risks of a lacto-ovo-vegetarian diet containing generous amounts of dairy products differ greatly from the potential benefits and risks of a vegan diet containing no animal products.

People choose vegetarian diets for a variety of reasons. According to vegetarian organizations, most American adults who decide to become vegetarians do so because they believe a vegetarian diet is more healthful. Smaller numbers choose vegetarianism primarily because of ethical or environmental concerns, religious beliefs, or economic considerations.*

Worldwide, the most common reason for vegetarianism or near-vegetarianism is economic. In many parts of the world, foods of animal origin cost so much that most people cannot afford to eat them regularly. Religious beliefs also play a larger role in vegetarianism in Asian societies than they do in the United States.

Vegetarianism in the United States

Data on the prevalence of vegetarianism in the United States are conflicting. A 1992 survey conducted by the market research firm Yankelovich, Clancy and Shulman and commissioned by

Vegetarian Times magazine indicated that 12.4 million Americans—about 7 percent of the total population—considered themselves to be vegetarians.³ However, a survey commissioned by the National Live Stock and Meat Board at about the same time found that 5 percent of the respondents classified themselves as “red meat avoiders” and only about 2 percent classified themselves as “vegetarians.”⁴

These surveys may overestimate the number of Americans who always exclude meat, poultry, fish, and shellfish from their diets. One reason why it is difficult to determine how many people are vegetarians is that people often do not remember or report their eating habits accurately. For example, when researchers analyzed the actual diets of the respondents to the National Live Stock and Meat Board survey, they found that fewer than 1 percent consumed no red meat and an even smaller percentage consumed no meat, poultry, or fish during the two-week study period.⁴

Women are more likely than men to become vegetarians: Among the self-described vegetarians in the 1992 *Vegetarian Times* survey, 68 percent were female.⁵ And vegetarianism is more common in some population subgroups than it is in the nation as a whole. For example, a large company that provides food for college dining halls estimates that up to 15 percent of college students request vegetarian meals.⁶ Among members of the Seventh-Day Adventist faith, which advocates lacto-ovo-vegetarianism, more than 50 percent eat meatless diets.⁷

Acceptability of Vegetarianism

Most health authorities have long agreed that a well-planned lacto- or lacto-ovo-vegetarian diet can be nutritious and healthful; in recent years there has also been a notable increase in official recognition of the acceptability of lacto- and lacto-ovo-vegetarianism, both by expert organizations and by government agencies. Authorities have continued to express concern about the dangers of restrictive or poorly planned vegetarian regimens, however.

Expert Views

For example, the American Academy of Pediatrics states: “Over the centuries many individuals and population groups have practiced vegetarian life-styles on a long-term basis without ill effect. In fact, some beneficial aspects of vegetarian diets are in accordance with new dietary guidelines. . . . Properly planned vegetarian diets provide adequate nutrient intake even for children but, as with

any dietary habit, numerous restrictions or ill-advised meal planning may result in diets that are dangerous.”⁸

Similarly, in a 1993 position statement, the American Dietetic Association expressed the view that “vegetarian diets are healthful and nutritionally adequate when appropriately planned” but noted that “in planning vegetarian diets of any type, one should choose a wide variety of foods and ensure that the caloric intake is adequate to meet energy needs.”⁹

Vegetarianism Is Consistent with Official Dietary Advice

In 1995, in the 4th edition of its *Dietary Guidelines for Americans*, the U.S. government acknowledged that vegetarianism is an acceptable practice (see “What the Dietary Guidelines Report Says About Vegetarianism” at end of doc.).¹⁰ Lacto- and lacto-ovo-vegetarianism are entirely consistent with all three sets of official U.S. dietary guidance—the Dietary Guidelines, the Recommended Dietary Allowances (RDAs), and the Food Guide Pyramid.

Vegetarians may have an easier time following some of the Dietary Guidelines than do meat eaters. Because they use plant-based foods for main dishes as well as side dishes, vegetarians have little difficulty consuming sufficient grains, vegetables, and fruits. Because they have eliminated one major source of fat—meat products—from their diets, vegetarians may be able to achieve a low-fat diet more easily than can omnivores (those who eat all types of food). (This doesn’t happen automatically, however; it depends on the individual’s food choices.) In addition, because plant foods usually have fewer calories per serving than do animal foods, vegetarians may find it easier to maintain or improve their weight without feeling deprived of adequate-bulk meals.

Vegetarian diets that include dairy products can also satisfy the recommendations of the Food Guide Pyramid . Vegetarians simply have fewer foods to choose from in the “meat, poultry, fish, dry beans, eggs, and nuts” group. Otherwise, the choices for lacto- or lacto-ovo-vegetarians are like those for nonvegetarians.

As long as some animal products or fortified foods are included as sources of vitamin B₁₂ and care is taken to include good sources of essential minerals, well-planned vegetarian diets can meet the Recommended Dietary Allowances for essential nutrients.

Are Vegetarian Diets Healthier?

Many people choose a vegetarian diet because they believe that vegetarianism is associated with good health. A substantial body of scientific literature supports this belief. Several large epidemiologic studies have indicated that vegetarians (primarily lacto- or lacto-ovo-vegetarians) have lower mortality rates and lower rates of chronic diseases than do meat eaters.¹¹⁻¹⁵ This doesn't mean, however, that meatless diets are uniquely advantageous.

Vegetarian diets often come closer to meeting official dietary guidelines than do typical omnivorous diets because vegetarian diets contain less fat, less saturated fat, and fewer calories while including more whole grains, more fruits, and more vegetables. It is not necessary to become a vegetarian, however, to conform to official guidelines. Eliminating meat from the diet can be one way to reduce saturated fat and increase the consumption of plant foods, but it is not the only way. People can also reduce their risks of chronic diseases by adopting omnivorous diets that meet current dietary recommendations. This means limiting quantities of high-fat foods; choosing lean red meat, skinless poultry, and low-fat or non-fat dairy products; and eating generous amounts of grains, fruits, and vegetables.

Diet Versus Lifestyle

Vegetarians may also be healthy for reasons not related to their dietary choices. Many vegetarians are health conscious; they exercise regularly, maintain a desirable body weight, don't smoke, don't abuse illegal drugs, and don't abuse alcohol.¹⁶ These lifestyle choices contribute to reducing health risks. Although most epidemiologists have attempted to take these factors into account in their analyses, it is possible that they did not control adequately for the effects of some or all nondietary factors.

People who choose vegetarianism may also differ from the rest of the population in other ways that influence health. For example, Western vegetarians tend to be of relatively high socioeconomic status. As a rule, affluent people are healthier than those living in poverty simply because of their better living conditions and greater access to medical care.

An authoritative review of vegetarianism and chronic diseases classified the evidence for various alleged health benefits of vegetarianism as either "strong," "good," "fair," or "poor."¹⁷ The evi-

dence that vegetarians are at lower risk for obesity, constipation, lung cancer, and alcoholism was found to be “strong.” The evidence that risks of hypertension (high blood pressure), coronary artery disease, type II (adult-onset) diabetes mellitus, and gallstones are lower among vegetarians was regarded as “good.” The data supporting a link between vegetarianism and reduced risks of breast and colon cancers, diverticular disease, osteoporosis, kidney stones, dental erosion, and dental caries were classified as “fair to poor.”

For some of these diseases it is likely that the vegetarian diet itself is the key protective factor. For example, the low incidence of constipation in vegetarians is almost certainly due to their high intake of foods rich in dietary fiber. For other diseases, however, lifestyle factors other than diet may be more relevant. For example, the low rate of lung cancer in vegetarians is attributable primarily to their extremely low rate of cigarette smoking.¹⁸ There are many risk factors for most chronic diseases; diet is only one of them.

Choosing a Healthful Vegetarian Diet

The mere fact that a diet is vegetarian does not guarantee that it is healthful. The keys to any healthy eating plan, vegetarian or otherwise, are moderation and variety.

For a healthful diet, vegetarians—like everyone else—should eat a variety of different types of nutritious foods; should limit their intake of high-calorie foods that make little positive nutritional contribution to the diet; should use the information given in the Nutrition Facts labels on food products; and should limit their overall intake of fat and calories.

Although vegetarian diets are usually low in total fat and saturated fat, this is not always the case. Lacto-ovo-vegetarians, in particular, need to realize that their diets are not automatically low in saturated fat and cholesterol. Like omnivores, lacto-ovo-vegetarians need to choose foods carefully to conform to current dietary recommendations.

Vegetarians who eat large amounts of fried foods, full-fat cheeses, whole milk, nuts, and/or commercial meat substitutes may consume more total fat and saturated fat than do some omnivores. Vegetarians eating large quantities of eggs may exceed current recommendations for cholesterol intake. A healthful lacto-ovo-vegetarian diet should emphasize low-fat rather than full-fat dairy products; should include eggs and nuts only in moderation; and should balance high-fat or high-cholesterol foods with lower-fat, lower-cholesterol choices.

Getting Enough Essential Nutrients

It is easiest to get enough of all the essential nutrients if you eat a wide variety of foods. People who exclude whole categories of foods from their diets also eliminate important sources of nutrients. Unless those people plan their diets carefully to include alternate sources of the missing nutrients, they may be at risk for nutritional deficiency. This risk is greatest for people with high nutritional needs, such as growing children.

Protein

Many people think that it would be difficult to get enough protein from a meatless diet. However, lacto- and lacto-ovo-vegetarians can get plenty of high-quality protein from eggs and dairy products. In addition, plant foods alone can supply adequate protein provided that the overall diet includes different types of plant foods and that the total amount of food is sufficient to meet energy (calorie) needs.^{3,7-9} Good plant sources of protein include soy products, other legumes, nuts, seeds, grains, and vegetables. Both the quality and the quantity of protein in soy products are particularly high in comparison with other plant proteins.¹⁹

Protein molecules are made up of building blocks called amino acids. Some of these amino acids can be synthesized in the human body, but others (called “essential” amino acids) must be supplied by the diet. Most proteins of animal origin provide ample amounts of all of the essential amino acids; for this reason they are often referred to as “complete” proteins. Plant proteins typically lack sufficient amounts of one or more of the essential amino acids and are therefore described as “incomplete.” Grains, for example, are relatively low in the essential amino acid lysine but high in methionine; legumes are low in methionine but high in lysine.

It was once believed that people who eat mostly plant foods need to compensate for the incomplete nature of plant proteins by eating protein sources with compensating strengths and weaknesses at each meal. Currently, however, nutrition experts believe that the conscious combining of complementary proteins is necessary only if total protein intake is low or if protein needs are very high (as they are during periods of rapid growth). But even in these high-need situations it is sufficient to consume a variety of different plant protein sources within the course of a day, rather than to make a special effort to do so at every meal.

Getting enough protein can be a problem for vegans who severely limit the variety of plant foods that they consume (e.g., vegans who follow fruitarian regimens). People following extremely restricted diets should seek nutritional guidance from a health professional—preferably one who practices on a sound, scientific basis and does not zealously advocate any specific dietary practice.

Minerals

Getting adequate amounts of essential minerals can be a problem for vegetarians for two reasons: Plant products contain less of several important minerals than do animal products, and the bioavailability of minerals from plant foods is often lower. (The term “bioavailability” refers to the amount of a nutrient that is actually absorbed from the digestive tract and utilized by the body.) Bioavailability depends on the chemical form of an element, the nature of the food that contains it, the composition of the total diet, and the health and nutritional status of the individual.²⁰

Foods of plant origin contain several components that decrease the bioavailability of minerals. These components include dietary fiber, phytate, and oxalate. Because vegetarian diets usually contain more of these substances than do omnivorous diets, the bioavailability of minerals from vegetarian diets is typically lower.

The nutrition labels on food products do not include information on bioavailability. Therefore, they may give an overly generous impression of the amounts of minerals that people can obtain from some plant foods.

The impact of bioavailability on mineral nutrition is difficult to assess. Despite differences in the bioavailability of minerals from different sources, the mineral nutrition of most adult lacto- and lacto-ovo-vegetarians appears to be adequate.²⁰ This may reflect the body’s ability to adjust to decreased availability by increasing absorption of the available mineral.²¹ This type of compensation is more effective in adults than in children. For this reason, children are more at risk for deficiencies of certain minerals—especially zinc—if the bioavailability of the minerals in their diets is poor.²⁰

Calcium

Milk and other dairy products are the main sources of dietary calcium in the U.S., accounting for about three fourths of the calcium in the national food supply.²² Typical servings of dairy products provide between 200 and 300 milligrams (mg) of calcium. The Food Guide Pyramid calls for two to

three servings from the “milk, yogurt, and cheese” group every day. These servings provide 400 to 900 mg/day of calcium and thus make a substantial contribution to meeting the calcium RDA, although they may not fully satisfy it, especially for young adults (The RDA is 800 mg/day for most adults and 1,200 mg/day for teenagers and young adults through age 24).

Lacto- or lacto-ovo-vegetarians who consume dairy products in the amounts recommended by the Food Guide Pyramid have no more difficulty meeting their calcium needs than do omnivores. Obtaining enough calcium from a dairy-free diet is far more difficult. Only a few nondairy foods are naturally rich in calcium, and some of these foods contain sufficient phytate or oxalate to interfere substantially with the absorption of the calcium. As the U.S. government report *Healthy People 2000* states, “with current food selection practices in the United States, use of dairy products constitutes the difference between inadequate and adequate intakes of calcium.”²³

Table 2 lists the calcium content of representative foods from the five major food groups. All foods in the “milk, yogurt, and cheese” group contain substantial amounts of calcium. In the other food groups, however, only a few foods are calcium rich. Good calcium sources for a vegan who does not want to use fortified foods or supplements are calcium-processed tofu, beans, leafy dark-green vegetables, and certain types of dried fruit. However, it is difficult to meet the RDA for calcium from these sources alone.²⁴ Therefore, it is prudent for vegetarians who do not eat dairy products to take a calcium supplement or consume calcium-fortified foods (such as calcium-fortified orange juice or calcium-fortified soy milk) daily in order to ensure an adequate calcium intake.

Some advocates of milk-free diets contend that vegans may not need to achieve the relatively high calcium intakes called for by the RDAs. They argue that high calcium intakes are needed only when intakes of protein are also high, as protein promotes the urinary excretion of calcium. These advocates also point out that bone health appears to be good in some societies where people follow traditional diets that are low in both protein and calcium. The effect of protein on calcium excretion may be smaller than previously believed, however; and the idea that non-Western vegetarians are free from osteoporosis may be wrong.

Some recent research suggests that osteoporosis may actually be quite common among people consuming low-protein, low-calcium diets. For example, in a recent study in Taiwan, it was found that Buddhist women who had followed vegan diets for long periods of time were at greatly

increased risk of low bone density.²⁵ In this population and in others like it, the effect of low protein intake may be more than offset by the presence in plant-based diets of high levels of substances that decrease calcium bioavailability, such as oxalates and phytates.²⁶

Until more research on calcium requirements is completed, it would be best for all vegetarians—including vegans—to make an effort to meet the RDA for calcium. Vegans should not count on their low-animal-protein diets to protect them from the bone loss that can result from inadequate calcium intake.

Iron

Iron deficiency is more common in the U.S than most other nutritional-deficiency diseases.²⁷ The most vulnerable people are those with the highest iron needs: infants and young children, adolescents, women of childbearing age, and pregnant women. Adult men rarely develop iron deficiency. The RDA for iron is 15 mg/day for women of childbearing age and teenage girls, 12 mg/day for teenage boys, and 10 mg/day for men, postmenopausal women, and preadolescent children.

Iron is present in foods in two forms—heme iron and non-heme iron. Heme iron (also called “organic iron”) is found only in meat, poultry, and fish. Non-heme iron (also called “inorganic iron”) is found in a wide variety of animal and plant foods. Between 15 and 35 percent of heme iron is absorbed from the gastrointestinal tract into the bloodstream.²⁸ Non-heme iron is less readily absorbed (between 2 and 20 percent), and its absorption is affected by the presence of other substances consumed at the same meal. Some substances, such as organic acids and vitamin C,^{28,29} enhance non-heme iron absorption; others, such as the phytates in whole grains²⁸ and the tannins in tea,³⁰ inhibit it.

Because vegetarian diets of all types contain fewer iron sources and no heme iron, vegetarians—especially women and children—should make a special effort to eat foods that are good sources of this mineral. Sources of iron include legumes (beans), whole-grain or enriched-grain products, dried fruits, potatoes eaten with the skin, leafy dark-green vegetables, some types of nuts and seeds, eggs, and iron-fortified breakfast cereals (see Table 3 at end of doc.).

Milk and other dairy products are low in iron. Lacto- and lacto-ovo-vegetarians should be careful not to overconsume dairy products at the expense of other foods that are richer in iron.

One simple way to maximize the absorption of non-heme iron is to eat a vitamin C-rich fruit or

vegetable at every meal. This advice fits easily into most lacto-ovo-vegetarian and vegan meal patterns. It may also be helpful to avoid drinking tea with meals. If calcium supplements are used, they should be taken between meals, as calcium can inhibit iron absorption.³¹

Iron supplements are a useful source of iron for some vegetarians, especially women. People who take iron supplements should be careful to store these products in a locked cabinet, out of the reach and sight of children. Iron-containing nutrient supplements are the leading cause of poisoning deaths among children under the age of 6 years in the United States.³²

Zinc

Zinc should be a nutrient of concern for vegetarians, and especially for vegans, because some of the best sources of this mineral are excluded from vegetarian diets. Meat—especially red meat—is a major source of bioavailable zinc; in the U.S. it provides 50 percent of total dietary zinc.³³ Table 4 lists the zinc content of a variety of commonly consumed animal-protein foods. As shown, beef is a major source, both because of its high zinc content and its frequent consumption in the United States.

The amounts of zinc in plant foods are smaller than in meats, and some plant foods contain substances such as phytate that reduce zinc absorption. Some research suggests that zinc deficiency in the U.S. may be increasing as people reduce their consumption of red meat and shift to a more grain-based diet.³⁴ Although severe zinc deficiency is uncommon among Western vegetarians,^{9,35} it would be prudent for all vegetarians to make sure that their diets include good sources of this mineral.

Zinc deficiency is not a trivial concern; its effects can include reduced growth, delayed sexual maturation in children, impotence in men, decreased immunity, skin disorders, and decreased neuropsychological performance. There is increasing recognition that zinc deficiency is a significant public health problem,³⁶ and that meatless diets may be associated with increased risk of zinc deficiency.³⁷⁻³⁹ Plant sources of zinc include soybean products, beans, lentils, nuts, seeds, and whole grains. Dairy products also provide zinc, and some commercial breakfast cereals are fortified with zinc. Table 5 lists good sources of zinc for vegetarians.

Consumption of excess zinc should be avoided because it can interfere with the absorption and metabolism of other minerals, especially iron and copper. Supplements of zinc in doses greater than

the Daily Value of 15 mg/day should not be taken except on the advice of a physician.

Vitamin D

Vitamin D is necessary for proper utilization of calcium in the human body. Unlike other vitamins, vitamin D is synthesized in the skin in response to sunlight. For people who spend time outdoors in sunny climates, especially those with light skin, sunlight alone will generate enough vitamin D and no dietary source of this vitamin is necessary. Dark-skinned people, people who live in cold climates or smoggy areas, and people who rarely go outdoors all need a dietary source of vitamin D, however.⁴⁰

Few foods are naturally rich in vitamin D. For most people in Western countries, fortified dairy products are the principal dietary source of this vitamin. Milk is the only major food product that is fortified with vitamin D. No staple plant foods are routinely fortified with this vitamin.⁴⁰

Even without adequate sunlight exposure, getting enough vitamin D is not a problem for lacto- or lacto-ovo-vegetarians who regularly drink vitamin D–fortified milk. Surveys show, however, that vitamin D intakes and blood vitamin D levels of vegans and others who do not consume vitamin D–fortified dairy products are sometimes undesirably low.^{41,42} Therefore, individuals who do not consume dairy products need to ensure that they get sufficient amounts of vitamin D from other sources, such as vitamin supplements or daily sunlight exposure. People who take vitamin D supplements should not exceed the Daily Value for the vitamin, except on the advice of a physician, as overdoses of vitamin D can have serious toxic effects.

Vitamin B₁₂

Vitamin B₁₂ is normally found only in foods of animal origin. It is present in plants only if they are heavily contaminated with certain bacteria that produce the vitamin.⁴³ In developing countries where standards of hygiene are low, people most likely meet their needs for vitamin B₁₂ by eating inadequately washed produce contaminated with bacteria from human or animal feces. Where sanitary practices are better, plant foods do not contain significant amounts of vitamin B₁₂.

Lacto- and lacto-ovo-vegetarians can obtain sufficient vitamin B₁₂ from eggs and/or dairy products.⁴⁴ Vegans need to get their vitamin B₁₂ from supplements or fortified foods. Some breakfast cereals and meat analogs are fortified with vitamin B₁₂, but most of the soy milk sold in the U.S. is

not.

Bacteria growing in the human colon can produce vitamin B₁₂. At one time it was thought that the vitamin B₁₂ produced in this way could meet the body's need for the vitamin; but current evidence indicates that vitamin B₁₂ is produced almost exclusively in the lower part of the intestinal tract, posterior to the intestinal site where the vitamin is absorbed into the bloodstream.⁴³ Practically all of the B₁₂ produced in this way is therefore not available to the body. The trace amounts produced above the absorption site add up to less than one percent of daily need.

Fermented soy products (such as tempeh), seaweed (nori or kelp), and algae (spirulina) were once believed to contain substantial amounts of vitamin B₁₂. However, most if not all of the "vitamin B₁₂" detected in these foods by laboratory assays actually consists of analogs of the vitamin that are not physiologically active.^{43,45} Some of these analogs may even block or interfere with vitamin B₁₂ metabolism.

The body can store substantial amounts of vitamin B₁₂, primarily in the liver. An adult who has previously eaten a diet containing plenty of animal products can store enough vitamin B₁₂ to meet his or her needs for years: Some people can live on unsupplemented vegan diets for 20 years or more before developing clinical symptoms of vitamin B₁₂ deficiency. Other people, however, especially those with low body stores of vitamin B₁₂ or with medical problems that interfere with the absorption or metabolism of vitamin B₁₂, may develop deficiency symptoms much more quickly.*

Vitamin B₁₂ deficiency can be extremely serious. It can cause severe anemia and irreversible damage to the nervous system. Because the length of time during which a person can safely go without a vitamin B₁₂ source varies greatly among individuals, and because plant foods and bacterial contaminants cannot be relied upon to provide this vitamin, all vegans should make sure that they have a reliable supplementary source of vitamin B₁₂.

Special Population Groups

As a general rule, well-planned lacto- or lacto-ovo-vegetarian diets are nutritionally adequate for all segments of the population, as long as an effort is made to ensure that good sources of iron and zinc are included in the diet. Vegan diets, however, may not be nutritionally adequate for people with high nutrient needs unless the diets are planned with great care and supplemented with

certain nutrients. Anyone planning to follow a vegan diet during growth, pregnancy, lactation, adolescence, chronic illness, or recovery from illness should seek guidance from a knowledgeable and unbiased health professional and should use supplements when necessary.

Experts differ on whether a vegan diet is appropriate for infants and children. Although the American Academy of Pediatrics and the American Dietetic Association have not specifically condemned the use of vegan diets during childhood, other experts recommend against the use of such restrictive dietary regimens.¹⁶

The Danger of Extremism

Although properly planned lacto- or lacto-ovo-vegetarian diets can meet a child's nutritional needs, parents need to be aware that there is real danger in applying extreme or unconventional dietary or health practices, such as vegan diets, to infants and children. The nutritional needs of growing children are far greater than those of adults. An adult may be able to live for a long time on a highly restrictive or poorly planned diet without doing any irreversible damage to his or her health. However, severe problems—such as growth retardation, impaired mental and physical development, symptoms of nutrient deficiency, and increased susceptibility to infection—can develop within weeks or months if a child is placed on a similarly inadequate diet.

There have been tragic cases in which parents who were attracted to “alternative” medical practices and philosophies have irreversibly damaged their children's health by feeding them inappropriate diets, relying on unproved health practices, and avoiding scientifically based medical care. Often, vegetarianism has been involved in such situations, usually in combination with other unconventional practices. In some instances, misguided parents have been so overconfident in their special dietary or health practices that they have failed to seek conventional medical care for their children even after health problems became evident. Instead, they continued the alternative practices in the belief that this would be the best way to improve the child's health. The result, in several reported cases, has been serious—even fatal—illness.⁴⁶

Parents who follow unusual diets or lifestyles should seek expert guidance—preferably from a health professional who does not share their particular ideology—before attempting to impose similar restrictions on their children. Because of children's great vulnerability to serious harm from nutritional imbalances as well as their total dependence on their parents' decisions and care, parents

need to be far more conservative about their children's diets and lifestyles than they are about their own.

Infants

During the first few months of life, an infant's diet should consist entirely of breast milk, iron-fortified infant formula, or some combination of the two. Small amounts of solid foods are introduced at age 4 to 6 months, but breast milk and/or formula remains the mainstay of the diet. Breast-fed infants who do not have regular exposure to sunlight should receive vitamin D supplements by age 4 to 6 months. Also, by this age all infants should have some reliable source of iron (iron-fortified infant formula, iron-fortified infant cereal, or an iron supplement).⁸

Infants from vegan families generally do well during the early months, when breast milk and/or formula comprises most of the diet. Families who follow vegan diets usually prefer to use a soy-based formula rather than a milk-based formula if the infant is not breast fed or if breast feeding is discontinued before the first birthday.

There are two major nutritional concerns, however, for infants from vegan families during the early months of life.

First, parents who formula feed should not substitute homemade mixtures or soy milk for commercial infant formula. Homemade formulas and soy products (other than soy-based infant formula) are nutritionally inferior to commercial infant formula.

Second, it is crucial for vegan mothers who breast feed their infants to take supplements of vitamin B₁₂ during lactation. If the mother doesn't get enough of this vitamin, her milk will be very low in vitamin B₁₂, and the infant may develop a vitamin B₁₂ deficiency. Infants breast fed by mothers on unsupplemented vegan diets often have biochemical abnormalities indicative of vitamin B₁₂ deficiency.⁴⁷⁻⁴⁹ Some infants breast fed by vegan mothers have developed severe clinical vitamin B₁₂ deficiency—with symptoms such as developmental regression, failure to thrive, coma, seizurelike movement disorders, and anemia.⁵⁰⁻⁵⁴ Permanent neurologic damage has occurred in some cases.^{50,51} The breast-fed infant of a vegan mother can develop vitamin B₁₂ deficiency even though the mother herself shows no deficiency symptoms. Evidently, a lactating woman can sometimes meet her own need for the vitamin from her body's stores, even when no vitamin B₁₂ is getting into her milk.

Young Children

Planning a vegan or near-vegan diet that will meet the needs of very young children is difficult, and the most important problem—the low caloric density of plant foods—is one that cannot be solved with supplement pills.

Toddlers have high needs for nutrients, but they don't have the capacity to consume large amounts of food. Many vegan dishes are very bulky; they are so low in calories and high in fiber that young children may not be able to eat enough of them to meet their needs for energy and nutrients.⁵⁵ Diets with excessive bulk and low caloric density can lead to impaired growth in children aged 5 years and under.^{8,56} Studies of children on vegan or nearly vegan diets have shown that growth retardation is greatest during the weaning period (i.e., the last months of the first year and the second year of life).⁴⁷

Parents who wish to feed their child a vegan or nearly vegan diet should work closely with a physician or registered dietitian to plan an adequate diet and to monitor the child for adverse effects. Some health professionals recommend that the parents put the child on a diet less restrictive than their own. For example, the parents could have the child drink milk along with otherwise-vegan meals, even though adult family members do not consume dairy products. For families who don't find this approach acceptable, other useful ideas include continuing breast feeding or the feeding of soy formula well beyond the first birthday; making fortified soy products an important part of the diet; including relatively high-calorie plant foods (such as nut butters, avocados, and dried fruits) in the child's meals; and giving the child supplements of calcium, vitamin D, zinc, iron, and vitamin B₁₂.

Older Children

Unlike very young children, older children on vegan diets generally do not have difficulty meeting their calorie needs, even if their diet is bulky. Other considerations, however, become important. Older children spend more time away from home and exercise more control over their own food choices; this may interfere with parents' dietary planning. As vegetarian children become older, they should learn some basic principles of food selection so that they can make wise food choices away from home.

Adolescents and Young Adults

Many young people are attracted to vegetarianism. In some instances, this eating pattern is an acceptable, healthful practice; in other situations, it poses a real threat to the young person's health.

Well-informed, well-balanced vegetarianism is not harmful to young people. With good planning, adolescents and young adults can meet all of their needs for nutrients on a lacto- or lacto-ovo-vegetarian diet (or an appropriately supplemented vegan diet).^{8,10} Young people who understand the principles of vegetarian meal planning and practice those principles sensibly (e.g., young Seventh-Day Adventists who follow the lacto-ovo-vegetarian diets on which they were raised) are not likely to encounter major nutrition-related health problems during high school and college.

Unfortunately, however, newly vegetarian adolescents and young adults often lack knowledge of nutrition and vegetarian meal planning. They may also have little motivation to learn how to practice vegetarianism in a healthful way. The priorities of newly vegetarian young people tend to be very different from those of older people attracted to a vegetarian lifestyle. Unlike their older counterparts, few young people have health in mind when they decide to stop eating meat.⁵⁷ Instead, they usually are motivated by concerns about the ethics of eating animal flesh or the environmental impact of animal agriculture. They may respond to these concerns by simply omitting meat (or all animal foods) from their diets without making the effort needed to plan healthful vegetarian meals.

Parents and professionals who work with young people need to be aware that animal-rights groups and environmental organizations that discourage meat consumption are active on college campuses and even at some high schools. These organizations are often very aggressive in presenting their messages, and some young people are strongly attracted by their emotional appeals. Young people go through developmental stages in which they are very vulnerable to ideology, and their strong feelings and limited life experience may lead them to make questionable choices.

Concerns about weight and physical appearance may also motivate young women to adopt undesirable forms of vegetarianism. Many young women are extremely preoccupied with their weight. Surveys show that nearly half of all teenage girls are trying to lose weight at any given time.⁵⁸ Even if a young woman knows that she is of normal weight, this may not prevent her from dieting. In one survey, more than one fourth of the girls who considered themselves to be at the right weight were still trying to lose weight!⁵⁹

The desire for thinness frequently leads young women to try unhealthy weight-loss methods. For example, one survey showed that more than half of the teenage girls who dieted used at least one potentially harmful method of weight control, such as fasting, the use of diet pills, inducing vomiting, or the abuse of laxatives.⁵⁸ Omission of entire food groups from the diet should also be regarded as an unhealthy weight-loss practice unless it is accompanied by careful planning to ensure adequate intakes of the nutrients ordinarily provided by those food groups.

Some health professionals who treat young women with eating disorders such as anorexia nervosa and bulimia report that they are seeing increasing numbers of young vegetarians who avoid eating meat because they fear that it will make them fat.⁶⁰ For some of these young women, vegetarianism may represent a “politically correct” way to rationalize an eating disorder. These young women may try to explain away bizarre eating practices such as eating mainly salads and vegetables on the grounds that they are practicing vegetarianism, when they are actually trying to severely limit their fat and calorie intake.

Good nutrition during the adolescent and young adult years is crucial for the achievement of full growth potential and optimal health, both during youth and in the decades to follow.⁵⁸ For young women, many of whom will become pregnant during their teens or twenties, good nutrition—even before conception—is also crucial to the health of their future children.

Parents, health professionals, educators, and others who work with young people should recognize that extremely restrictive vegetarianism may be a warning sign of serious problems in young people, especially women. Although all adolescents and young adults may benefit from nutritional and health guidance, it may be especially appropriate to target such guidance toward those who follow a restrictive vegetarian lifestyle.

Pregnant and Lactating Women

Well-planned lacto- or lacto-ovo-vegetarian diets can be adequate for pregnant and lactating women.¹⁰ Since nutritional needs increase during pregnancy and lactation, especially careful diet planning is important. Pregnant vegetarians should seek prenatal care early in pregnancy and obtain nutritional counseling if possible. Adequate intakes of all nutrients during pregnancy and lactation are important for the health of both the mother and child. Supplements may be necessary in some instances. Most pregnant women, vegetarian or otherwise, are advised to take iron and folic acid

supplements during pregnancy. Vegan women also need supplements of vitamin B₁₂ during both pregnancy and lactation, and they may also need vitamin D supplements if their exposure to sunlight is inadequate. Women who do not drink adequate amounts of milk need supplements of calcium as well.

Older Adults

Older vegetarians should pay special attention to ensuring that their intake of vitamin B₁₂ is adequate. Because absorption of this vitamin declines with age, older people may be at especially high risk of vitamin B₁₂ deficiency.

Vitamin D deficiency is surprisingly common among older people in Western countries.⁶¹ Older adults who exclude dairy products from their diets may be at higher risk of vitamin D deficiency than others of similar age. Because the ability of the skin to synthesize vitamin D decreases with age, older people should not count on sunlight as their sole vitamin D source, even if they go outdoors regularly. It would be prudent for older vegetarians who do not drink vitamin D–fortified milk on a regular basis to consider taking a vitamin D supplement.

Older vegetarians should also pay particular attention to their zinc intake. It has been reported that elderly vegetarians are at higher risk than elderly omnivores for zinc deficiency.³⁸

Summary

Vegetarian diets can be healthful and nutritionally adequate when appropriately planned, and they can meet official guidelines for good nutrition.

Some scientific studies indicate that vegetarians enjoy lower risks of chronic diseases than do meat eaters. It is uncertain, however, whether these reduced risks are attributable to any unique health benefit of vegetarianism.

The diets of lacto- and lacto-ovo-vegetarians are usually nutritionally adequate, provided that some care is taken to include good sources of bioavailable iron and zinc. Vegan diets are deficient in vitamin B₁₂ and are often low in calcium and vitamin D. All vegans should take a vitamin B₁₂ supplement or eat foods fortified with this vitamin. Vegans should plan their diets carefully to ensure adequate intakes of calcium, iron, and zinc; they should take a vitamin D supplement if exposure to

sunlight is inadequate.

Well-balanced semi-vegetarian, lacto-ovo-vegetarian, and lacto-vegetarian diets are generally acceptable for people with increased nutritional needs, such as infants, children, adolescents, pregnant or lactating women, and individuals with medical problems. People who plan to follow vegan or near-vegan diets during times of increased nutritional needs (or who plan to feed diets of this type to an infant or child) should seek nutritional counseling from a knowledgeable physician or registered dietitian.

Some teenage and college-age women who describe themselves as vegetarians may actually be practicing unhealthy forms of weight control or suffering from an eating disorder. These young women are at risk for serious health problems.

Young people who become vegetarians for ethical or environmental reasons may also be placing their health at risk because they may lack the knowledge and motivation needed to plan healthful vegetarian meals.

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The 1995 Dietary Guidelines for Americans

- Eat a variety of foods.
- Balance the food you eat with physical activity—maintain or improve your weight.
- Choose a diet with plenty of grain products, vegetables, and fruits.
- Choose a diet low in fat, saturated fat, and cholesterol.
- Choose a diet moderate in sugars.
- Choose a diet moderate in salt and sodium.
- If you drink alcoholic beverages, do so in moderation.

What the Dietary Guidelines Report Says About Vegetarianism

The 1995 edition of the *Dietary Guidelines for Americans* was the first edition to describe vegetarianism as an acceptable dietary alternative. Here's what the *Guidelines* report had to say about vegetarian diets:

“Some Americans eat vegetarian diets for reasons of culture, belief, or health. Most vegetarians eat milk products and eggs, and as a group, these lacto-ovo-vegetarians enjoy excellent health. Vegetarian diets are consistent with the *Dietary Guidelines for Americans* and can meet Recommended Dietary Allowances for nutrients. You can get enough protein from a vegetarian diet as long as the variety and amounts of foods consumed are adequate. Meat, fish, and poultry are major contributors of iron, zinc, and B vitamins in most American diets, and vegetarians should pay special attention to these nutrients.

“Vegans eat only food of plant origin. Because animal products are the only food sources of vitamin B₁₂, vegans must supplement their diets with a source of this vitamin. In addition, vegan diets, particularly those of children, require care to ensure adequacy of vitamin D and calcium, which most Americans obtain from milk products.”

Table 1
Types of Vegetarians

Type	Foods Consumed						
	Beef, pork, other red meat	Poultry	Fish, other seafood	Eggs	Milk, other dairy products	Grains, legumes, vegetables	Fruits, nuts
Semi-vegetarian*		•	•	•	•	•	•
Pollo-vegetarian		•		•	•	•	•
Pesco-vegetarian			•	•	•	•	•
Lacto-ovo-vegetarian				•	•	•	•
Lacto-vegetarian					•	•	•
Ovo-vegetarian				•		•	•
Vegan [#]						•	•
Fruitarian [†]							•

*In some instances, the term semi-vegetarian may refer to a person who limits the amount of flesh foods that he or she eats rather than restricting the type of flesh foods eaten.

[#]Some individuals who refer to themselves as vegans also avoid the use of leather, wool, fur and other non-food products of animal origin.

[†]Some people who call themselves fruitarians also eat those vegetables that are the fruit portion of the plant (e.g., peppers, tomatoes, and cucumbers) but not root or leaf vegetables. Some also eat honey and olive oil.

**Table 2:
Calcium Content of Foods from the Five Major Food Groups***

Foods	Calcium (mg)	Calories
Bread, Cereal, Rice, & Pasta		
Bread, whole wheat (1 slice)	25	62
Bread, enriched white (1 slice)	21	67
Cornflakes (1 cup)	4	110
Oatmeal (1 cup)	22	153
Raisin bran (1 cup)	26	170
Rice, enriched white (1 cup)	21	206
Rice, brown (1 cup)	23	218
Macaroni, enriched (1 cup)	8	197
Vegetables		
Broccoli (1 cup, chopped, frozen)	94	52
Carrots (2 medium)	38	47
Cauliflower (1 cup)	34	30
Celery (1 cup)	43	20
Collards (1 cup, chopped, frozen)	357	60
Corn, sweet (1 ear)	2	85
Kale (1 cup)	94	40
Lettuce, iceberg (1/4 head)	23	20
Lettuce, romaine (1 cup)	20	10
Onion (1 cup, chopped)	40	55
Potato (1 baked, with skin)	20	220
Snap beans, green (1 cup)	58	45
Sweet potato (1 baked, peeled)	32	115
Tomato (1 raw)	9	25
Fruits		
Apples (1 raw)	8	81
Bananas (1 medium)	10	105
Cantaloupe (1/4 melon)	14	47
Dates (pitted, 1 cup)	57	490
Figs (10 dried)	269	477
Grapes (1 cup)	15	56
Orange juice (1 cup)	25	112
Orange juice, calcium-fortified (1 cup)	300	112
Peaches (1 raw)	4	35
Pears (1 medium)	19	98
Raisins (2/3 cup)	48	290
Strawberries (1 cup)	21	45

Milk, Yogurt, & Cheese

Milk, whole (1 cup)	288	150
Milk, 2%, solids added (1 cup)	313	125
Milk, skim (1 cup)	202	85
Cheese, cheddar (1 oz)	205	115
Cheese, Swiss (1 oz)	272	105
Cheese, processed American (1 oz)	174	105
Cheese, cottage, creamed (1/2 cup)	63	108
Yogurt, lowfat (1 cup)	415	145

Meats, Poultry, Fish, Dry Beans and Peas, Eggs, & Nuts

Beef, lean ground, broiled (3 oz)	10	230
Chicken, broiled (breast meat; 3 oz)	13	140
Pork, roasted (3 oz)	6	295
Lamb, roasted (3 oz)	8	205
Salmon, canned (with bones; 3 oz)	167	120
Tuna, canned in water (3 oz)	17	135
Sardines, canned (with bones; 3 oz)	372	175
Shrimp, canned (3 oz)	98	100
Chickpeas (1 cup)	78	268
Kidney beans (1 cup)	50	225
Navy beans (1 cup)	128	258
Soybeans (1 cup)	175	298
Tofu processed with calcium sulfate (1/2 cup)	258	94
White beans (1 cup)	161	250
Egg (1 large)	27	70
Peanut butter (1 tbsp)	9	94

*The calcium data in this table were compiled from various sources.

They represent the amounts of calcium present in the food, without any correction for differences in bioavailability. Caloric values compiled from: the eighth edition of Mahan LK and Arlin A, *Krause's Food, Nutrition and Diet Therapy*, (Philadelphia: WB Saunders Company; 1994:718-773), and from the Nutrition Analysis Tool, University of Illinois-Urbana/Champaign (URL is <http://spectre.ag.uiuc.edu/~food-lab/nat/>).

Table 3
Some Sources of Iron in the Vegetarian Diet[†]

	Iron (mg per serving)	Calories
Soybeans (1/2 cup cooked)	4	149
Tofu (1/2 cup)	6.6	94
Lentils (1/2 cup cooked)	3	115
Kidney beans (1/2 cup cooked)	3	112
Black beans (1/2 cup cooked)	2	114
Chickpeas (1/2 cup cooked)	3	134
Potato (baked or microwaved with skin)*	2.5	220
Collards (1/2 cup cooked)	1	18
Swiss chard (1/2 cup cooked)	2	18
Spinach (1/2 cup cooked)	3	21
Turnip greens (1/2 cup cooked)	1.6	15
Egg (1)	1	70
Apricots, dried (10 halves)	1.6	83
Figs, dried (10)	4	447
Prunes (4)	1	80
Raisins (5 Tbsp)2	140	
Almonds (1 oz.)	1	167
Cashews (1 oz.)	1	163
Pumpkin seeds (1 oz.)	4	148
Sunflower seeds (1 oz.)	2	165
Breakfast cereal, 1 serving (fortified to contain 10% of the Daily Value of iron per serving)		
Rice Krispies, 1 1/4 cup	1.8	120
Breakfast cereal, 1 serving (fortified to contain 25% of the Daily Value of iron per serving)		
Golden Grahams, 3/4 cup	4.5	120
Breakfast cereal, 1 serving (fortified to contain 45% of the Daily Value of iron per serving)		
Special K, 1 cup	8	110

* Most of the iron in potatoes is in the skin. A potato eaten without its skin provides only about one-half milligram of iron.

[†]* The iron data in this table were compiled from various sources. They represent the amounts of iron present in the food, without any correction for differences in bioavailability. Caloric values compiled from: the eighth edition of Mahan LK and Arlin A, *Krause's Food, Nutrition and Diet Therapy*, (Philadelphia: WB Saunders Company; 1994:718-773), and from the Nutrition Analysis Tool, University of Illinois-Urbana/Champaign (URL is <http://spectre.ag.uiuc.edu/~food-lab/nat/>).

Table 4
Zinc Content of Animal Protein Foods

Food (3.5 oz. cooked)	Zinc (mg)	Calories
Beef, lean ground	5.1	278
Turkey, dark meat	4.5	186
Crabmeat	4.0	96
Pork loin, lean	3.0	212
Chicken, dark meat	2.8	203
Turkey, light meat	2.0	156
Chicken, light meat	1.2	172
Shrimp	1.2	98
Tuna, chunk light	0.9	130
Salmon, canned	0.9	138

†* The zinc data in this table were compiled from various sources.

They represent the actual amounts of zinc present in the food, without any correction for differences in bioavailability. Caloric values compiled from: the eighth edition of Mahan LK and Arlin A, *Krause's Food, Nutrition and Diet Therapy*, (Philadelphia: WB Saunders Company; 1994:718-773), and from the Nutrition Analysis Tool, University of Illinois-Urbana/Champaign (URL is <http://spectre.ag.uiuc.edu/~food-lab/nat/>).

Table 5
Some Sources of Zinc in the Vegetarian Diet^{†*}

	Zinc (mg per serving)	Calories
Baked beans (1/2 cup)	1.8	118
Lentils (1/2 cup cooked)	1.3	115
Kidney beans (1/2 cup cooked)	0.9	112
Soybeans (1/2 cup cooked)	2.0	149
Tofu (1/2 cup)	1.0	94
Almonds (1 oz.)	0.9	167
Cashews (1 oz.)	1.3	163
Peanut butter (2 Tbsp.)	0.9	188
Pumpkin seeds, roasted (1 oz.)	2.1	148
Sunflower seeds, roasted (1 oz.)	1.5	165
Wheat germ (1 oz.)	4.7	102
Whole wheat bread (2 slices)	0.8	123
Breakfast cereal, 1 serving (fortified to contain 10% of the Daily Value of zinc per serving)		
Bran Flakes, 3/4 cup	1.5	100
Breakfast cereal, 1 serving (fortified to contain 25% of the Daily Value of zinc per serving)		
Special K, 1 cup	3.7	110
Milk, whole, low-fat, or skim (1 cup)	1	150
Cottage cheese, 1% fat (1 cup)	0.8	163
Ricotta cheese, part skim (1/2 cup)	1.7	171
Cheese, process American (1 oz.)	0.8	105
Yogurt, low fat, plain (8 oz.)	2.0	145

^{†*} The zinc data in this table were compiled from various sources.

They represent the actual amounts of zinc present in the food, without any correction for differences in bioavailability. Caloric values compiled from: the eighth edition of Mahan LK and Arlin A, *Krause's Food, Nutrition and Diet Therapy*, (Philadelphia: WB Saunders Company; 1994:718-773), and from the Nutrition Analysis Tool, University of Illinois-Urbana/Champaign (URL is <http://spectre.ag.uiuc.edu/~food-lab/nat/>).

* People often assume that the economic and ecological arguments in favor of vegetarianism are self-evident, but this is not the case. Some knowledgeable scientists and policy makers have taken issue with the contention that vegetarianism is necessarily better for the environment and for economic well-being. Readers who are interested in thoughtful analyses of the arguments for and against vegetarianism may wish to consult references 1 and 2, both of which were published as part of a major symposium on vegetarianism in 1994.

* Every day, some of the vitamin B₁₂ stored in the liver is secreted into bile, which then enters the upper part of the small intestine. The vitamin is then reabsorbed from the gastrointestinal tract into the bloodstream. In individuals with normal vitamin B₁₂ absorption, virtually all of the B₁₂ that is secreted into bile is returned to the bloodstream. However, in individuals with malabsorption, the body's stores of the vitamin can be depleted relatively quickly.