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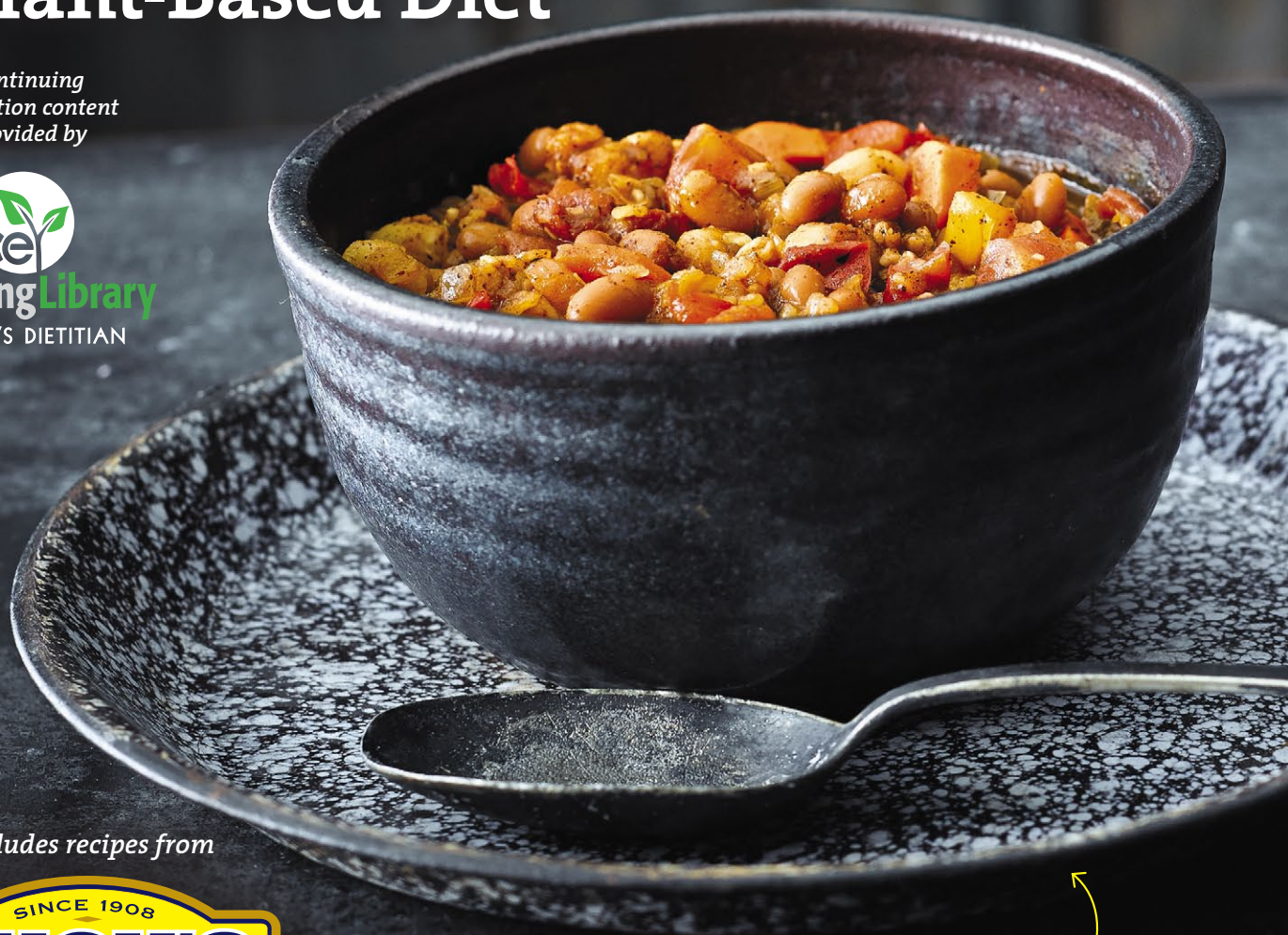
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Nutrients of Concern for Individuals Following a Plant-Based Diet

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NUTRIENTS OF CONCERN FOR INDIVIDUALS FOLLOWING A PLANT-BASED DIET

By Sharon Palmer, RD

Thanks to a variety of influences, including vegan celebrities such as Bill Clinton and Ellen DeGeneres and popular plant-based eating blogs and websites, the public is becoming more familiar with the health and environmental benefits of eating a plant-based diet. In fact, meatless eating has landed on several food and diet trend lists for 2014 compiled by food gurus, magazines, and organizations such as the Food Network and NPR.^{1,2} And many people, as well as schools, workplaces, and entire cities, have embraced the Meatless Monday campaign, a non-profit initiative that works with the Johns Hopkins Bloomberg School of Public Health to promote the message of going meat free one day per week.³

Mintel released a report in 2013 indicating that 7% of consumers identify as vegetarian, though 36% use meat alternatives, demonstrating that people appear to be more interested in a semivegetarian diet.⁴ A 2012 Vegetarian Resource Group poll of 2,030 adults identified a similar trend. In the poll, 4% of adults described themselves as vegetarian and 1% as vegans, yet 47% reported that they eat at least one vegetarian meal per week.⁵

This continuing education course reviews the current body of evidence regarding nutrients of concern for individuals following a plant-based diet as well as strategies to help clients meet their unique nutritional needs when following a vegetarian or vegan diet.

Defining Plant-Based Diets

The Dietary Guidelines Advisory Committee says a plant-based diet emphasizes vegetables, cooked dry beans and peas, fruits, whole grains, nuts, and seeds.⁶ Vegans don't eat animal products, including dairy and eggs. Vegetarians (also known as lacto-ovo vegetarians) don't eat meat but do eat dairy and eggs; pescatarians (or pesco-vegetarians) eat fish but no other meats; and semivegetarians (or flexitarians) occasionally eat fish, poultry, or meat.

Of course, many people call themselves vegetarians but follow eating patterns that diverge from these definitions. For example, some people may be nearly vegan, eating dairy and eggs only on rare occasions, and some may call themselves vegetarians but still eat small amounts of meat. Since there are many variations of a plant-based diet, it's important for health professionals, including dietitians, to establish a person's true eating pattern to accurately assess nutritional intake and status.⁷

Brief History of Plant-Based Eating

While plant-based eating may appear to be a new trend, it actually dates back to ancient times. Claus Leitzmann, PhD, a retired professor from Justus Liebig Universität in Germany, spoke on the history of vegetarianism at the Sixth International Congress on Vegetarian Nutrition in February 2013. He reported that ancient cultures, including those in Egypt, China, India, Peru, and Mexico, ate a predominantly plant-based diet. In the sixth century BCE, the Orphics in Greek culture were the first documented vegetarians in Europe.

According to Leitzmann, throughout history, there were important people who made strong arguments for vegetarian eating, including Greek philosopher Plato, Roman poet Ovid, and Greek essayist Plutarch. These arguments were based on issues such as health, economics, and morality. Other reasons people espoused vegetarian eating included believing that

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LEARNING OBJECTIVES

After completing this continuing education course, nutrition professionals should be better able to:

1. Identify the nutrients of concern for people following a plant-based diet.
2. Assess the nutritional status of plant-based eaters and their specific needs.
3. Develop a nutritional plan of care that addresses all nutrients of concern for this population.

Suggested CDR Learning Codes

2020, 2090, 4110; Level 2

killing animals, which could think and feel, was unjust; that eating meat was harmful; that people may be reincarnated as animals; and that enough food already was available to eat without killing animals.

Major world religions also advocated vegetarian eating, including Hinduism, Buddhism, Judaism, and Christianity. And from the Middle Ages through the Renaissance and beyond, leading minds such as da Vinci, Voltaire, Rousseau, and Percy Bysshe Shelley continued to promote vegetarianism, according to Leitzmann.

In 1809, the first club for people who ate vegetarian diets was established in Manchester, England. The Vegetarian Society was introduced in England in 1847, which coined the term “vegetarian.” In 1850, the first Vegetarian Society was established in North America, and in 1944, the first Vegan Society was established in England.

According to Leitzmann, opinion in the mid-20th century held that vegetarianism presented a nutritional risk and the possibility of nutrient deficiencies. However, in the late 20th century, with the development of an obesity epidemic, the risk of consuming a high-meat diet became apparent.

By the beginning of the 21st century, nutrition experts started praising the benefits of plant foods, further highlighting the positive aspects of a plant-based diet. Today, people’s top reasons for being vegetarian, according to Leitzmann, include consideration for ethical, moral, religious, spiritual, ecological, economical, political, and health issues.

Health Benefits

A growing body of evidence has linked plant-based diets to positive health outcomes. In fact, the Dietary Guidelines for Americans now highlight vegetarian eating patterns, including vegan diets, lacto-ovo vegetarian diets, and diets that include small amounts of meat, poultry, and seafood. The guidelines state⁶:

In prospective studies of adults, compared to non-vegetarian eating patterns, vegetarian-style eating patterns have been associated with improved health outcomes—lower levels of obesity, a reduced risk of cardiovascular disease, and lower total mortality. Several clinical trials have documented that vegetarian eating patterns lower blood pressure. On average, vegetarians consume a lower proportion of calories from fat (particularly saturated fatty acids); fewer overall calories; and more fiber, potassium, and vitamin C than do non-vegetarians. Vegetarians generally have a lower body mass index. These characteristics and other lifestyle factors associated with a vegetarian diet may contribute to the positive health outcomes that have been identified among vegetarians.

Further, the Academy of Nutrition and Dietetics’ position statement on vegetarian diets says that an evidence-based review showed that vegetarian diets are associated with a lower risk of death from ischemic heart disease, and that vegetarians

appear to have lower LDL cholesterol and blood pressure levels as well as lower rates of hypertension, type 2 diabetes, and cancer. In addition, vegetarians tend to have lower BMIs. Certain features of a vegetarian diet, including lower intakes of saturated fat and cholesterol and higher intakes of fruits, vegetables, whole grains, nuts, soy products, fiber, and phytochemicals, may reduce risk of chronic disease.⁷

Newly released findings from the Adventist Health Study-2 (AHS-2), which involved 96,000 Seventh-day Adventist participants in the United States and Canada, further highlight the health benefits of plant-based diets. Five dietary patterns were evaluated as part of the study: vegan, lacto-ovo vegetarian, pesco-vegetarian, semivegetarian, and nonvegetarian. The researchers found a linear relationship among the dietary patterns, with a progression from vegan to nonvegetarian, and their associations with many health outcomes. For example, average BMI increased from vegans to nonvegetarians, with the average BMI for vegans being 23.6; lacto-ovo vegetarians, 25.7; pesco-vegetarians, 26.3; semivegetarians, 27.3; and nonvegetarians, 28.⁸

The same trend was observed for cardiovascular disease markers such as cholesterol, diabetes, high blood pressure, and the metabolic syndrome. And a similar trend was observed for measures of inflammation and overall cancer risk and death rates. In fact, vegans experienced a 15% reduction in the risk of all-cause mortality, and vegetarians had a 9% lower risk compared with nonvegetarians.⁸

Studies also have found that vegetarians tend to have healthier lifestyles. For example, the AHS-2 found that, compared with nonvegetarians, vegetarians and vegans watched less television, slept more hours per night, consumed more fruits and vegetables and less saturated fat, and typically ate foods with a low glycemic index, such as beans, legumes, and nuts. These healthful behaviors significantly contribute to the lower risk of chronic disease seen in plant-based eating.⁸

Environmental Benefits

The benefits of plant-based eating extend from the individual to the environment as well. For example, according to one study by Italian researchers, animals make inefficient “food production machines” because they use large amounts of feed, water, and fossil fuels to turn plants into protein. The researchers conducted a life-cycle assessment to evaluate the cradle-to-grave environmental impact of several human dietary patterns. An organic vegan diet, for instance, had the smallest environmental impact, while a conventionally farmed diet that included meat had the greatest impact. To produce 1 kcal from beef requires 40 kcal of fossil fuel, whereas producing 1 kcal from grains requires only 2.2 kcal of fuel.⁹

The Environmental Working Group commissioned a life-cycle assessment to determine the greenhouse gas emissions generated by common food sources. It found that the emissions of conventionally produced lamb, beef, cheese, and pork and farmed salmon were far greater than those from plant-based

food choices such as lentils and beans. In fact, the group found that if a four-person family took steak off the menu one day per week for one year, the environmental advantage would be equivalent to taking their car off the road for almost three months.¹⁰

According to a life-cycle assessment applied to the AHS-2 data, greenhouse gas emissions for a vegan diet were 41.7% lower compared with a nonvegetarian diet, with a lacto-ovo vegetarian diet being 27.8% lower, a pesco-vegetarian diet 23.8% lower, and a semivegetarian diet less than 20% lower.⁸

Nutritional Adequacy

With so much interest in plant-based eating, dietitians must increase their knowledge of specific related nutritional concerns to help their clients and patients meet their nutritional needs. Well-planned plant-based diets can be nutritionally adequate for people of all ages.⁷

One main benefit of a plant-based diet is that it tends to be rich in many nutrients. An analysis of National Health and Nutrition Examination Survey (NHANES) data found that the average intake of fiber; vitamins A, C, and E; thiamin; riboflavin; folate; calcium; and magnesium by those following vegetarian diets exceeded that of nonvegetarians, suggesting that vegetarian diets are nutrient dense and consistent with dietary guidelines.¹¹

However, vegetarian diets should be planned so there's an emphasis on nutritional adequacy. Nutritional concerns regarding vegetarian and vegan diets include the intake of protein, omega-3 fatty acids, vitamins B12 and D, calcium, iron, zinc, and iodine. This [handout](#) provides tables detailing vegetarian and vegan food sources of these nutrients.

Nutrients of Concern

Protein

Protein is an essential macronutrient that helps maintain muscle and bone mass and also supports the immune system. Amino acid chains form proteins; the 20 amino acids that the body can't make are called essential. Animal proteins, such as those found in meat, poultry, fish, dairy, and eggs, are considered high-quality or complete proteins because they contain good percentages of essential amino acids.¹²

While protein may be one of the greatest perceived stumbling blocks to nutritional adequacy for vegetarian and vegan diets, data don't support this concern. Research shows that an assortment of plant foods consumed over the course of the day can provide all of the essential amino acids and ensure adequate nitrogen retention and use for healthy adults.⁷

While it can be somewhat easier to meet protein needs on a vegetarian diet that includes high-quality sources such as milk, cheese, cottage cheese, and eggs, it's still possible to consume adequate protein on a vegan diet. In fact, studies have shown that typical protein intakes for vegetarians and vegans meet or exceed the current Dietary Reference Intakes (DRI) for protein, although some research shows that some vegan women may have marginal protein intakes.⁷

It was once thought that plant proteins, which typically provide a lower percentage of at least one amino acid, needed to be combined by mixing grains and legumes to make a complete protein. However, it's now known that the liver stores essential amino acids, so it's not critical to combine them in one meal.¹²

All plant foods, except those that are highly processed, such as sugar and oil, contain certain amounts of protein. Legumes, soyfoods, whole grains, nuts, seeds, and some vegetables are good sources of protein. Soyfoods are unique because they contain good percentages of all of the essential amino acids, with a similar profile to animal proteins.¹²

One amino acid in particular that may be limited in a vegan diet is lysine; the highest plant-based sources include tofu, tempeh, soyfoods, lentils, and seitan. It would be difficult for a vegan to consume an adequate amount of lysine without regularly consuming these foods.¹²

The overall daily protein recommendations for vegetarians are the same as those established for the general public: 0.8 g/kg of body weight.¹³ Vegans may require a slightly higher daily protein intake due to the slight decrease in the digestibility of plant proteins compared with animal proteins.⁷ These estimates may vary, but studies show that 1 to 1.1 g/kg of protein may be an appropriate level to compensate for reduced digestibility.¹²

In addition, new research suggests that adults older than 60 may benefit, in terms of optimal muscle and bone mass, from slightly higher intakes of protein than those currently recommended in the DRI, perhaps 1 to 1.2 g/kg/day.¹⁴ No data indicate that plant proteins may not meet protein needs for older adults, though. While additional research is needed, it may be advantageous for dietitians to plan for a higher percentage of older adults' calories to come from protein. Advising clients and patients to include adequate servings of protein-rich foods at meals and snacks, as suggested by the USDA MyPlate, is essential for meal planning.

It's important to note, however, that plant proteins may provide a better "protein package" compared with animal proteins. While animal proteins may include high levels of saturated fat, plant proteins contain fiber, heart-healthy fats, vitamins, minerals, and phytochemicals. This may be one reason why vegetarians and vegans experience lower rates of chronic disease. For example, Harvard researchers have followed 85,000 female nurses and 45,000 male health professionals since the mid-1980s. They have discovered that the more protein these subjects consumed from red meat, the higher their chances of developing heart disease as well as dying. Yet those who ate a diet rich in plant proteins had lower risks of heart disease and death.¹⁵

Omega-3 Fatty Acids

Since vegetarians and vegans avoid fish and seafood, the main dietary source of EPA and DHA, their intake of these long-chain omega-3 fatty acids may be low. EPA and DHA are important for cardiovascular health and for eye and brain

development, and they provide a growing list of potential benefits, ranging from improved cognitive and mental health to relief from arthritis.

Vegetarians may obtain some EPA and DHA from the eggs of hens given feed rich in alpha-linolenic acid (ALA) and from milk. Vegans, however, essentially consume no dietary EPA and DHA. Both vegetarians and vegans may obtain these fatty acids in marine algae supplements, though.⁷

The body can convert the short-chain omega-3 fatty acid ALA into EPA and DHA, but that conversion is thought to produce only low levels (less than 10%). Conversion rates for ALA tend to improve when levels of dietary omega-6 fatty acids, found primarily in refined vegetable oils such as soy, safflower, and sunflower, aren't high.⁷

Some studies have shown that blood levels of EPA and DHA for those following a plant-based diet, particularly vegans, are lower than those for nonvegetarians.⁷ Tim Key, PhD, a professor of epidemiology at the University of Oxford in England, presented findings from the EPIC-Oxford Study related to EPA and DHA at the International Congress on Vegetarian Nutrition. The study included approximately 34,000 meat eaters; 10,000 fish eaters; 1,900 vegetarians; and 2,500 vegans throughout England.

Key reported that large differences in EPA and DHA levels were found among the different dietary patterns. Vegetarians had much lower levels of EPA and DHA, and vegans had even lower levels, indicating a cause for concern.

Also at the congress, William Harris, PhD, an omega-3 expert and a professor at the University of South Dakota Sanford School of Medicine, reported on a study evaluating the omega-3 index (the measure of EPA and DHA in red blood cells) in 196 meat eaters, 231 vegetarians, and 232 vegans. He said vegans had an omega-3 index one-half that of the meat eaters.¹⁶

The general recommendation for vegetarians and vegans has been to maximize ALA intake by consuming plant foods such as flaxseeds, walnuts, and soy to boost ALA's conversion to EPA and DHA. In addition, stearidonic acid, found in an engineered soybean oil, more readily converts to EPA than does ALA. Harris calls this type of fat a "pro-EPA" because it shows a 25% conversion rate to EPA.

In addition, nonfish sources of EPA and DHA have been produced through marine algae. Harris reported that, within four months, vegans taking supplements containing 175 mg of DHA and 88 mg of EPA increased their levels of these omega-3 fatty acids to those found among the general population.¹⁷ Additionally, bioengineered sources of EPA and DHA, such as those found in yeasts and the rape plant, are being explored.

It's also important to note that ALA may have its own benefits aside from its ability to be converted into EPA and DHA. Vegetarian and vegan diets tend to be high in this fatty acid, which has anti-inflammatory action, according to Thomas Sanders, PhD, a professor of nutrition and dietetics at King's College, London, who also spoke at the International Congress on Vegetarian Nutrition. While the DRI for daily ALA intake is 1.6 and 1.1 g for men and women, respectively, this may not be

optimal for vegetarians.⁷ In fact, Sanders suggests that men and women should consume around 2 g/day of ALA, considering EPA and DHA intake may be low.

Ultimately, those following a vegetarian or vegan diet should include good sources of ALA, such as flaxseeds, walnuts, canola oil, and soy. And marine algae supplements may be considered, particularly by pregnant and lactating women, who are supporting the developmental and growth needs of a fetus or infant.

Vitamin B₁₂

Vitamin B₁₂ intake is a significant nutritional concern for vegetarians and vegans, as it's generally found only in animal foods. This nutrient plays a major role in metabolism, red blood cell formation, central nervous system maintenance, and DNA creation. Vitamin B₁₂ deficiency may result in megaloblastic anemia, with symptoms that include difficulty walking, memory loss, and disorientation.

Research suggests that vegetarians, and especially vegans, may have inadequate levels of vitamin B₁₂. Vegetarians obtain vitamin B₁₂ from dairy foods and eggs, but vegans don't. Foods such as nutritional yeasts, breakfast cereals, and meat alternatives can be fortified with vitamin B₁₂, but a regular, consistent supply should be included in the diet. In addition, folacin—typically high in vegetarian and vegan diets—can mask the presence of vitamin B₁₂ deficiency.⁷

Findings presented by Key at the International Congress on Vegetarian Nutrition showed vitamin B₁₂ intake is much lower among vegetarians, and even lower among vegans, compared with meat eaters. In fact, he reported that 52% of vegans had a blood level of vitamin B₁₂ that was at the point of deficiency.

In a 2013 review of the literature on vitamin B₁₂ status in vegetarians and vegans, scientists found that vegetarians develop vitamin B₁₂ depletion or deficiency regardless of demographics, place of residency, age, or type of vegetarian diet.¹⁸

Regardless of dietary preference, the National Institutes of Health recommends that all adults older than 50 obtain most of their B₁₂ through supplements and fortified foods due to impaired absorption that occurs during aging.¹⁹

Calcium

In addition to its important role in bone health, calcium is required for vascular, muscle, and nerve function. Evidence indicates that the calcium intake of vegetarians, who rely on dairy products as a main food source, is similar to or higher than that of nonvegetarians. However, vegans' calcium intake tends to be lower, possibly falling below recommended intakes. Some studies have indicated that vegans may have a higher risk of bone fracture, raising concerns that it may be due to poor calcium intake.⁷

Key reported at the International Congress on Vegetarian Nutrition that calcium intake was much lower among vegans in the EPIC-Oxford study. Katherine Tucker, PhD, a professor of nutritional epidemiology at the Bouve College of Health Sciences at Northeastern University in Boston, who also presented on bone health among vegetarians at the congress,

said studies have shown that vegans have a greater risk of fractures and 6% lower bone mineral density compared with nonvegetarians.²⁰ This risk may result from low intakes of nutrients such as calcium, vitamins B₁₂ and D, total protein, and omega-3 fatty acids.

However, Tucker noted that vegan diets also are high in many bone-protective nutrients. Evidence suggests that many other nutrients, such as manganese; vitamins A, C, and K; some B vitamins; and magnesium, amply found in a well-planned vegan diet, may be an important factor in bone health.²¹

High renal acid load, which is related to diets high in meat, fish, and dairy, can increase urinary losses of calcium. Diets high in fruits and vegetables, such as those consumed by vegetarians and vegans, produce a high renal alkaline load, which slows calcium losses in urine.⁷ However, some studies have found that vegan diets don't affect acid-base homeostasis.²² Still, experts seem to agree that vegans should ensure their diets meet calcium requirements, as recommended by the Institute of Medicine. Ultimately, however, more research is needed in this area. (The Institute of Medicine DRIs for calcium and vitamin D can be found [here](#).)

To achieve adequate calcium levels, vegetarians can follow the USDA MyPlate recommendations, which call for consuming dairy products such as low-fat or fat-free milk and yogurt as well as calcium-fortified foods and beverages.²³ Vegans can replace these dairy servings with other calcium-rich foods and beverages, such as fortified plant milks, fortified juices, tofu made with calcium sulfate, and leafy greens.

However, it's important to note that spinach and Swiss chard may be poor calcium sources due to poor absorption caused by their high oxalate content. A calcium supplement may be considered for individuals whose calcium intake is inadequate.

Vitamin D

Vitamin D also plays an important role in bone health as well as in immune, nerve, and muscle function. Vitamin D status primarily depends on sunlight exposure and consuming vitamin D-rich foods (though there are few food sources) and supplements.⁷ Getting adequate sunlight exposure to meet vitamin D needs depends on the season, the time of day, the length of day, cloud cover, smog, skin melanin content, and sunscreen use. Vitamin D researchers suggest that individuals get five to 30 minutes of sun exposure on the face, arms, legs, or back, without sunscreen, between 10 AM and 3 PM twice per week.²⁴

Vitamin D is plentiful in fatty fish and fish liver oils and available in smaller amounts in beef liver, cheese, and egg yolks. In addition, mushrooms exposed to light during production (labeled as such on package) can be a good source of vitamin D. But the primary vitamin D source for US diets is fortified foods such as milk, cereals, orange juice, and yogurt.²⁴

Vegetarians who don't consume fish, the highest source of naturally occurring dietary vitamin D, may obtain adequate vitamin D from dairy products fortified with it. However, vegans

who avoid egg yolks and milk may be at greater risk of low vitamin D intake. They may obtain adequate vitamin D from regular sun exposure, fortified foods such as plant-based milk and orange juice, and mushrooms exposed to vitamin D.

In addition, vegetarians and vegans may need vitamin D supplementation to meet recommended levels. It's important to note that vegans may want to avoid vitamin D₃ (cholecalciferol) because it comes from an animal source (lanolin). However, vegans can consume vitamin D₂ (ergocalciferol) because it's produced from yeast.⁷

A study analyzing NHANES data found that vitamin D status wasn't related to vegetarian status.²⁵ However, data from the EPIC-Oxford study found that plasma vitamin D concentrations were lower in vegetarians and vegans than in meat and fish eaters.²⁶ Indeed, Key reported at the International Congress on Vegetarian Nutrition that a stepwise change in vitamin D levels was observed in this study, from meat eaters, fish eaters, vegetarians, and vegans, with the lowest levels in vegans. However, he reported that all of the diet groups had higher levels of the vitamin in the summer.

Iron

Iron, an essential mineral, is a component of cell growth and oxygen transport for body tissues. Inadequate iron intake can result in fatigue, decreased physical performance, and compromised immunity.²⁷

Foods contain one of two types of iron: heme, found in animal foods such as red meat, poultry, and fish; and nonheme, found in plant foods such as beans and lentils. While individuals absorb only 10% to 15% of dietary iron (heme is better absorbed than nonheme), the body can store it, and when stores drop, absorption increases.²⁷

Because nonheme iron sources have lower bioavailability, vegetarians and vegans should consume 1.8 times the recommended intake for nonvegetarians. Nonheme iron in plant foods is sensitive both to absorption inhibitors and enhancers. Inhibitors include phytates, calcium, and polyphenolics in tea, coffee, and cocoa; fiber only slightly inhibits iron absorption. Soaking, sprouting, fermenting, and cooking beans, grains, and seeds can diminish phytate levels and enhance iron absorption, and vitamin C also can help increase iron absorption.⁷ (The Institute of Medicine DRIs for iron can be found [here](#).)

Those following a vegetarian diet still can obtain adequate iron. Serum iron levels typically fall within the same range for both vegetarians and nonvegetarians.⁷ In fact, in a study that analyzed NHANES data, iron intake was higher for vegetarians than for nonvegetarians.¹¹

Many studies have found an increased risk of chronic diseases with high red meat consumption, and some studies have linked high heme iron intake to disease risk. Researchers from the Harvard School of Public Health hypothesize that this increased risk may be due to several ingredients in red meat, including heme iron.²⁸ More research is needed to understand the relationship between heme iron and disease risk.

Zinc

Found in cells throughout the body, zinc is an important micronutrient with roles in the immune system as well as DNA structure. Zinc is found in animal foods such as oysters, red meat, poultry, seafood, and dairy products as well as plant foods, including beans, nuts, and whole grains.²⁹ Zinc's bio-availability in plant foods is lower than in animal foods because of the higher phytic acid content of plant-based diets. Soaking, sprouting, and leavening beans, grains, and seeds can reduce the binding of zinc by phytic acid and increase bioavailability.⁷

Research indicates varying levels of zinc intake among vegetarians, some showing that they're close to recommendations and some that they're significantly lower.⁷ A recent review and meta-analysis of zinc status among vegetarians, which included 34 studies, found that dietary and serum zinc concentrations were significantly lower in longtime vegetarians than in nonvegetarians.³⁰

The National Institutes of Health suggests that vegetarians may need to eat as much as 50% more zinc than the recommended intakes for the general population.²⁹ Consuming adequate zinc levels may be accomplished by eating nuts, grains, soy products, and legumes. The addition of zinc supplements (present in most multivitamin/mineral preparations) may be considered as well. (The Institute of Medicine's DRIs for zinc can be found [here](#).)

Iodine

The body needs the mineral iodine to make the thyroid hormones that control metabolism and other important body functions. Iodine is naturally found in foods such as fish and dairy products. It's also found in fruits and vegetables, with varying amounts depending on the soil in which they grew and the fertilizer used. It's also added to iodized salt, although many processed food products do not use iodized salt.³¹

Sea vegetables can contain varying levels of iodine and sometimes very high levels. Thus, those who regularly consume sea vegetables should have their iodine levels monitored to ensure they aren't consuming excess amounts. Some plant foods, including cruciferous vegetables, soybeans, and sweet potatoes, contain naturally occurring goitrogens, which may help to counteract high iodine intake.⁷

Little research has been done on the iodine status of vegetarians and vegans. In a recent study of vegetarians and vegans in Boston, researchers found that the vegetarians had insufficient levels of iodine, and that the vegans were at risk of low iodine intake.³² Iodine supplements may be considered for at-risk clients. (The Institute of Medicine's DRIs for iodine can be found [here](#).)

Individualized Nutritional Management

As with all dietary patterns, a vegetarian or vegan pattern may be based either on nutrient-rich or nutrient-poor foods. While a well-planned vegetarian diet may meet an individual's nutrient needs throughout the entire life cycle, nutrition professionals must ensure that individuals meet their nutrition

requirements, including during infancy, childhood, adolescence, pregnancy, lactation, and older age. Vegetarian diets tend to be rich in beneficial nutrients, but it's important to assess clients' and patients' individual needs to ensure they're satisfying nutrient needs for normal growth, development, and body function.⁷

Several resources may aid in plant-based meal planning. The USDA MyPlate provides a blueprint for healthful meal planning, with specific eating tips for vegetarians, and the Oldways Vegetarian Network recently published a peer-reviewed [Vegetarian and Vegan Diet Pyramid](#). The Academy of Nutrition and Dietetics recommends a variety of menu-planning approaches to help vegetarians and vegans obtain adequate nutrition and suggests that the DRIs are a valuable resource to ensure patients meet their nutritional needs. In addition, the following guidelines can help your vegetarian clients and patients plan appropriate diets⁷:

- Choose a variety of foods, including whole grains, vegetables, fruits, legumes, nuts, seeds and, if desired, dairy products and eggs.
- Minimize intake of foods that are highly sweetened, high in sodium, and high in fat, especially saturated fat and trans fatty acids.
- If animal foods such as dairy products and eggs are consumed, choose lower-fat dairy products and consume both eggs and dairy products in moderation.
- Regularly consume a food source of vitamin B₁₂ and, if sunlight exposure is limited, of vitamin D.

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Examination

- 1.** What percentage of people eat vegetarian meals at least once per week?
 - a. 15
 - b. 25
 - c. 37
 - d. 47
- 2.** According to National Health and Nutrition Examination Survey data, vegetarian diets tend to be high in which of the following nutrients?
 - a. Protein, saturated fat, and calcium
 - b. Calcium, magnesium, and vitamin C
 - c. Zinc, iron, and phosphorus
 - d. Iodine, choline, and vitamin D
- 3.** Which of the following is an amino acid of potential concern for vegans?
 - a. Leucine
 - b. Tyrosine
 - c. Lysine
 - d. Methionine
- 4.** Due to the concerns regarding the digestibility of plant proteins, vegans should aim for which of the following daily amounts of protein?
 - a. 0.8 to 1 g/kg of body weight
 - b. 1 to 1.1 g/kg of body weight
 - c. 1.1 to 1.2 g/kg of body weight
 - d. 1.2 to 1.3 g/kg of body weight
- 5.** The strategy for optimal omega-3 fatty acid intake for vegetarians and vegans includes which of the following?
 - a. Eating fish rich in omega-3s every day.
 - b. Taking a daily omega-3 fish oil supplement.
 - c. Optimizing alpha-linolenic acid intake and considering a marine algae omega-3 supplement.
 - d. Increasing omega-6 fatty acid intake.
- 6.** According to data presented at the International Congress on Vegetarian Nutrition, what percentage of vegans are deficient in vitamin B₁₂?
 - a. 32
 - b. 42
 - c. 52
 - d. 62
- 7.** Vegan calcium-rich food sources include which of the following?
 - a. Fortified plant-milks and green leafy vegetables (except spinach and Swiss chard)
 - b. Spinach and Swiss chard
 - c. Dairy products
 - d. Canned salmon with bones
- 8.** Which of the following recommendations for sunlight exposure is ideal for those following a plant-based diet?
 - a. Thirty minutes per day on the face, arms, legs, or back, without sunscreen, between 10 AM and 3 PM
 - b. One hour per day on the face, arms, legs, or back, without sunscreen, between 10 AM and 3 PM
 - c. Forty-five minutes each week on the face, arms, legs, or back, without sunscreen, between 10 AM and 3 PM
 - d. Five to 30 minutes twice per week on the face, arms, legs, or back, without sunscreen, between 10 AM and 3 PM
- 9.** According to the National Institutes of Health, vegetarians should consume what percentage more zinc than is required for nonvegetarians?
 - a. 50
 - b. 60
 - c. 70
 - d. 80
- 10.** Which of the following plant-based food sources can contain very high levels of iodine?
 - a. Tofu
 - b. Sea vegetables
 - c. Wheat
 - d. Lentils

Meatless Menu Options Full of Flavor

Bruschetta
White Bean
Burger



Bruschetta White Bean Burger

YIELD: 24 burgers

Ingredients

- 1 #10 can Bush's Best® Garbanzo Beans, drained and rinsed
- 1 #10 can Bush's Best® Great Northern Beans, drained and rinsed
- 8 each eggs, large, whole, lightly beaten
- 36 each garlic cloves
- ¼ cup rosemary leaves
- 4 cups bread crumbs, Italian style
- ¾ cup olive oil
- 24 each ciabatta rolls
- 24 each onion rings, purple
- 24 each romaine lettuce leaves
- Garlic Butter, recipe follows
- Pesto Mayo, recipe follows
- Bruschetta topping, recipe follows

Directions

1. In a food processor, combine both beans, garlic cloves, rosemary leaves, and bread crumbs. Pulse until smooth; add in eggs and pulse until combined.
2. Preheat flat-top griddle or sauté pan to medium heat. Heat olive oil.
3. Form bean mixture into 6.7 oz burgers (24 total).
4. Cook until internal temperature reaches 145°F.
5. Toast ciabatta rolls with ¼ tsp garlic butter on each side.
6. To assemble, spread 2 tsp pesto mayo on bottom bun, place bean burger on bun, top with romaine lettuce leaf, onion ring, 2 Tbsp bruschetta, and top bun.

Garlic Butter

YIELD: ¼ cup

Ingredients

- 4 Tbsp butter, unsalted
- 0.5 oz garlic, minced
- ½ tsp pepper
- ½ tsp salt

Directions

1. Combine all ingredients in a food processor and pulse until well blended and smooth. Refrigerate and use as needed.

Pesto Mayo

YIELD: 1 cup

Ingredients

- 2.6 oz basil, fresh
- 0.3 oz garlic
- 2 oz mayonnaise
- ½ tsp salt
- ¼ tsp pepper
- ⅓ cup + 1 Tbsp extra virgin olive oil
- ½ cup Parmesan, shredded

Directions

1. In a food processor, combine basil, garlic, mayo, salt, pepper, and extra virgin olive oil and pulse until smooth. Fold in shredded Parmesan. Refrigerate and use as needed.

Bruschetta

YIELD: 3 cups

- 5½ cups tomatoes, Roma, medium diced
- 5⅓ Tbsp red onion, small diced
- 2⅔ Tbsp extra virgin olive oil
- 2⅔ tsp balsamic vinegar
- 2⅔ Tbsp basil, minced
- 1⅓ tsp salt
- ⅔ tsp pepper

Directions

1. Combine all ingredients in a bowl; fold together. Refrigerate and use as needed.

Red Bean and Cauliflower Curry Over Basmati Rice

YIELD: about 14

SERVING SIZE: 1½ cups

Ingredients

- 2 Tbsp olive oil
- 2 each onion, white, diced
- 2 tsp ginger, ground
- 2 Tbsp green chile, minced
- 8 each garlic cloves, minced
- 8 each Roma tomatoes, diced
- 2 each cauliflower head, florets
- 2 Tbsp cumin, ground
- 2 Tbsp coriander, ground
- 2 tsp turmeric, ground
- 2 tsp cayenne, ground
- 58 oz tomato sauce, low sodium
- 1 #10 can Bush's Best® Low-Sodium Dark Red Kidney Beans, drained and rinsed
- 21 cups basmati rice, prepared
- ¾ cup + 2 Tbsp yogurt, plain
- As needed cilantro, garnish

Directions

1. In a large stockpot, over medium heat, heat oil. Add in onions and ginger. Sauté until translucent. Add in minced garlic and green chile; cook about one minute, and add in tomatoes, cauliflower, remaining spices, tomato sauce, and kidney beans. Allow to cook for 20 to 30 minutes. Taste and adjust seasoning with salt and pepper, as needed.
2. To serve, place 1½ cups of prepared basmati rice in a shallow bowl, top with 1½ cups cauliflower curry mix, and garnish with 1 Tbsp drizzled plain yogurt and fresh cilantro leaves.



Sweet and Spicy Vegetarian Chili

Sweet and Spicy Vegetarian Chili

YIELD: 256 oz; twenty-five 10-oz servings

PREP TIME: 25 min

COOK TIME: 45 min

Ingredients

- 1 #10 can Bush's Best® Bean Pot™ Vegetarian Baked Beans
- ½ #10 can Bush's Best® Golden Hominy, drained and rinsed
- ¼ cup olive oil
- 4 cups white onion, diced
- 3 cups carrots, cut into rondelles
- ½ cup jalapeños, minced
- 3 cups tri-color bell peppers, large dice
- ¼ cup garlic, minced
- 56 oz whole canned tomatoes, cut into thirds
- 48 fl oz vegetable stock
- ¾ cup honey
- 1 Tbsp salt
- ½ cup chili powder
- ¼ cup cumin, ground
- ½ tsp thyme
- ½ tsp cayenne pepper, ground
- ½ tsp cinnamon, ground
- ¾ cup masa harina or corn flour

Directions

1. In a large stockpot over medium heat, add oil. Once oil is hot, add onions, carrots, jalapeños, and bell peppers. Allow to sauté for 10 to 12 minutes. Add garlic and sauté an additional 2 to 3 minutes. Add tomatoes, beans, hominy, and stock. Bring to a boil. Add honey, spices, and masa harina. Mix well to combine. Return to a boil, reduce heat, and allow to simmer for 25 to 30 minutes. Reserve warm.
2. To serve: Ladle 10 oz of chili into bowl. Serve.



Red Bean and Cauliflower Curry Over Basmati Rice

Beans and Greens Pasta

Garlic-sautéed kale, shitake mushrooms, and shallots are combined with Bush's Best® Great Northern Beans and white wine sauce over al dente whole grain fettuccini pasta. Served finished with a sprinkling of grated Parmesan-Reggiano for a rich and healthy farmers' market fresh vegetarian entrée.

YIELD: 12

SERVING SIZE: 3 cups

PREP TIME: 10 minutes

COOK TIME: 10 minutes

Ingredients

6 cups Bush's Best® Great Northern Beans, drained and rinsed
3¼ lbs whole grain fettuccini pasta, cooked al dente
¾ cup olive oil
1½ cups shallots, julienned
6 cups fresh shitake mushrooms, thinly sliced
12 each garlic cloves, thinly sliced
3 cups dry white wine
3 cups vegetable broth
24 oz kale, ribs removed and roughly chopped
6 oz butter, unsalted
As needed kosher salt
As needed fresh ground black pepper
As needed Parmesan-Reggiano, grated

Directions

1. Cook fettuccini for half the time indicated on the package. Drain and drizzle with olive oil as needed to prevent sticking and transfer to sheet trays in flat layer and chill. Store in airtight container to bag under refrigeration for service.
2. To make pasta entrée to order, heat 1 Tbsp oil in a sauté pan over medium heat, add ½ sliced shallot and ½ cup sliced mushrooms; sauté for 4 to 5 minutes or until shallots are translucent and mushrooms are slightly caramelized. Next add 1 clove sliced garlic and continue to cook for 2 more minutes.
3. Flambé with ¼ cup white wine and let reduce to syrup consistency, then add ¼ cup vegetable stock, ½ cup beans, 2 oz blanched kale and vegetable broth and sauté for 3 minutes or until greens are slightly wilted. Add 1 Tbsp butter and swirl pan until it melts. Season with salt and pepper.
4. Add 2½ cups al dente cooked pasta. Toss and plate in low pasta bowl and sprinkle with fresh grated Parmesan-Reggiano.

Avocado Hummus (Garbanzo)

Low Sodium Bush's Best® Garbanzo Beans taste wonderful when crushed and combined with zesty lime and chunky avocado for a great-textured and great-tasting hummus.

YIELD: 6 cups

SERVING SIZE: ¼ cup portions

PREP TIME: 10 minutes

**This recipe should be made very close to the time of reception.*

Ingredients

1 lb 1.8 oz Low Sodium Bush's Best® Garbanzo Beans, drained and liquid reserved
½ cup bean liquid
½ cup tahini paste
¼ cup fresh lime juice
1 tsp fresh lime zest
2 each garlic cloves, crushed
1½ Tbsp cilantro, minced
¼ cup extra virgin olive oil
4 each ripe avocados, cut into chunks
Salt and pepper, to taste

Directions

1. Add all ingredients to a food processor and purée until smooth. Adjust seasoning with salt and pepper.
2. Hold in refrigerator with plastic wrap pressed down on the hummus.



Beans and
Greens Pasta



Cuban Rice
and Beans
Con Huevos

Cuban Rice and Beans Con Huevos

A common dish in Cuba, *Moros y Cristianos* can be served any-time of the day. Put an egg on top of this great-tasting combination to create an unexpected breakfast item that will impress your customers.

YIELD: 24; 8 oz portions

PREP TIME: 20 minutes

COOK TIME: 20 minutes

Ingredients

- 3 qt Low Sodium Bush's Best® Black Beans with brine
- 4 cups chopped onion
- 4 cups chopped green and red bell peppers
- ½ cup chopped garlic
- 2 Tbsp ground cumin
- 2 Tbsp dry oregano
- 1 cup chopped fresh cilantro
- 4 each bay leaves
- As needed olive oil
- 3 qt cooked white rice
- 1 cup vegetable stock
- 3 Tbsp apple cider vinegar
- As needed kosher salt
- As needed cracked black pepper

Directions

1. Sauté onion, bell pepper, garlic, cumin, oregano, and bay leaves in olive oil until the onion is tender, about 5 minutes.
2. Stir in rice, Low Sodium Bush's Best® Black Beans with brine, vegetable stock, vinegar, salt, and pepper.
3. When mixing all of the ingredients, make sure to warm the rice and beans until the vegetable stock has completely integrated all of the ingredients.
4. Once everything is warm, mixed, and combined, add the cilantro, check for seasoning, and serve.

Korean Red Bean Lettuce Cups

This simple dish packs the flavor in. Low Sodium Bush's Best® Light Kidney Beans meet Asian flavors like ginger, sesame, and oyster.

YIELD: 20

SERVING SIZE: ½ cup

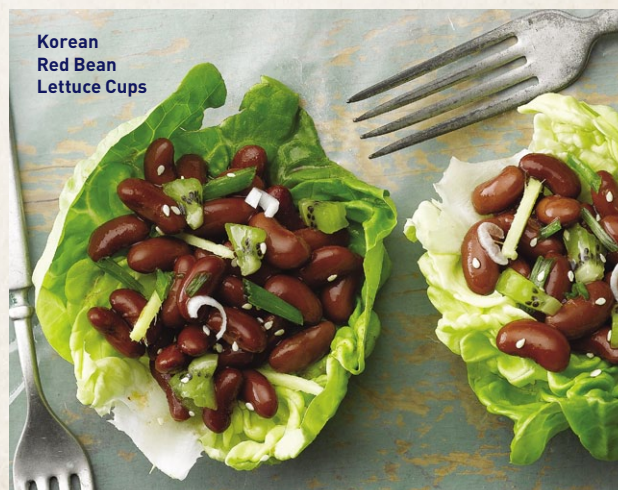
PREP/COOK TIME: 6 hours, 10 minutes

Ingredients

- 1 #10 can Low Sodium Bush's Best® Light Kidney Beans, drained and rinsed
- 5 each fresh garlic, minced
- 2 Tbsp honey
- 2 Tbsp sesame oil
- ½ cup light soy sauce
- 1 Tbsp oyster sauce
- 2 Tbsp gochujang paste
- 1 each yellow onion, thinly sliced half moons
- 1 bunch scallions, bias cut
- 2 each 2-inch fresh ginger pieces, peeled and thin matchsticks
- 6 heads bib lettuce, picked into individual cups, reserve chilled
- 5 each kiwi, peeled and medium dice
- Garnish: white sesame seeds

Directions

1. Combine garlic, honey, sesame oil, soy sauce, oyster sauce, and gochujang paste and whisk to blend. Add drained kidney beans and toss to combine. Refrigerate for 6 hours.
2. Add sliced onions, scallions, and ginger. Toss to combine. Serve ½ cup of the bean mixture in the individual lettuce cups and garnish with a few diced kiwi and white sesame seeds.



Korean
Red Bean
Lettuce Cups



Times have changed, but beans have remained the same. And Bush's Best® can be the key to creating meatless options that inspire your clients to break out of their routine. Find out how Bush's Best® can make your menu better at bushbeansfoodservice.com®



CAN DO.