THE INSTITUTE FOR FUNCTIONAL MEDICINE®

VERSION 9

Phytonutrient *Spectrum*

Comprehensive Guide

Table of Contents

Why Phytonutrients?

Natural compounds called phytonutrients, or phytochemicals, are components of plants that are powerful defenders of health. Eating more healthy plant foods is associated with better brain health[1–3] and lower inflammation,[4,5] as well as a reduced risk of chronic diseases such as heart disease,[6,7] type 2 diabetes,[8,9] and cancer.[6] Phytonutrients provide many functions in the plant itself, such as providing protection from pests and environmental stressors, along with imparting color and distinctive tastes and smells.[10]

Fruits and vegetables are rich sources of phytonutrients, along with whole grains, legumes, herbs, spices, nuts, seeds, and teas.11 Phytonutrients in food come in all different colors—green, yellow-orange, red, blue-purple, white, tan, and brown. To promote good health, it is important to eat fruits and vegetables of varied colors each day. Eating at least one serving of each color per day is an excellent goal to strive for.

Anyone can start with color as a first basic step when developing a healthy way of eating. This is foundational to all food plans within functional medicine, as plants are good medicine for chronic disease prevention and treatment.

Touring Through the Phytonutrient Food List—*Red*

Red

The primary phytonutrients found in red foods include anthocyanins and anthocyanidins,[12,13] betalains,[12,14] and carotenoids such as lycopene.[12]

Additional phytonutrients found in red foods include astaxanthin, ellagic acid, fisetin, flavones, flavonols, flavan-3-ols, flavanones, and proanthocyanidins.[13,14]

The Food List: Red Foods

There is a vast selection of red foods for you to choose from on the food list. The red fruits on the list include red skinned apples, blood oranges, cranberries, cherries, goji berries, grapes, plums, pomegranate seeds, raspberries, strawberries, watermelon, and rhubarb. If you buy dried cranberries, cherries, or grapes (red raisins), make sure there is no added sugar. When it comes to red vegetables, there are red bell peppers, beets, red onions, red potatoes, radicchio, radishes, sweet red peppers, and tomatoes. This category of foods also presents you with options for red- colored legumes to choose from such as adzuki and kidney beans. Eating the skin of red foods, like red-skinned apples and red potatoes, will provide you with more phytonutrients.

Red plant foods may be particularly beneficial for regulating inflammation. For example, tart cherries, pomegranates, and tomatoes are linked to lower levels of inflammatory markers like C-reactive protein (CRP) and tumor necrosis factor-alpha (TNF-alpha).[15–18] Red foods are also linked to heart health benefits. Beets, grapefruit, pomegranate, tart cherries, strawberries, and prickly pears are tied to reduced cholesterol,[19,20] blood pressure,[21–28] and cardiovascular disease risk,[29,30] and improvements in memory and cognitive function.[31]

Potential Health Benefits

- Reduced inflammation[15–18]
- Reduced total and LDL cholesterol[19,20]
- Reduced blood pressure[21–28]
- A lower risk of cardiovascular disease[29,30]
- Improvements in memory and cognitive function[31]
- A reduced risk of lung, head and neck, prostate, and breast cancers[32–35]
- Increased beneficial gut bacteria[36–39]
- Increased protection of the skin from sun damage[40]
- Protection against cell damage[41,42]

Examples of Red Foods

- Apples, red skinned
- Beans, red (*adzuki, kidney, etc.*)
- Beets
- Bell pepper, red
- Blood oranges
- Cranberries
- Cherries
- Grapefruit, pink
- Goji berries
- Grapes, red skinned
- Guava
- Onions, red
- Plums
- Pomegranate
- Potatoes, red
- Prickly pear
- Radicchio
- Radishes
- Raspberries
- Strawberries
- Sweet peppers, red
- Rhubarb
- Rooibos tea
- Tomato
- Watermelon

Images courtesy of 123RF

Touring Through the Phytonutrient Food List—*Red*

Featured Red Phytonutrient

Lycopene

Lycopene is a red-colored phytonutrient, and there is some evidence to suggest that eating a diet rich in lycopene is associated with a lower risk of prostate cancer.[34,35] It is typically found in tomatoes and tomato-based products such as tomato juice, spaghetti sauce, tomato soup, and tomato paste, as well as, watermelon, pink grapefruit, and guava. Cooked tomato products result in the lycopene being more "available" to be absorbed by the body.[43,44] Lycopene is also fat-soluble, which means fat is required to optimize absorption into the body.[45,46] Therefore, an ideal combination could be making a cooked tomato sauce with olive oil.

Tips for Enjoying Red Foods:

- Add fresh tomatoes, goji berries, raspberries, pomegranate seeds, or pink grapefruit sections to your green salads.
- If you eat pasta, use marinara (red) sauce instead of an Alfredo (white) sauce to increase your lycopene and reduce your saturated fat intake. You can also use marinara sauce on vegetables.
- Make a Mediterranean salad with tomatoes, olives, garlic, herbs, and feta cheese.
- Prepare salsa using chopped tomatoes, chopped red onions, and chili peppers.
- If you drink juice, try blood orange, grapefruit, and/or guava juice.
- Make a chili with kidney beans and tomato sauce.
- Great snack ideas include watermelon slices, raspberries, cherries, strawberries, and apple slices.
- Prepare bruschetta using chopped tomatoes and red onion with fresh basil.

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Touring Through the Phytonutrient Food List—*Orange*

Orange

The primary phytonutrients found in orange foods are carotenoids, including alpha-carotene, beta-carotene, beta-cryptoxanthin, lutein, and zeaxanthin.[12,14,47,48]

Additional phytonutrients found in orange foods include bioflavonoids, carotenoids, and curcuminoids.[12,14]

The Food List: Orange Foods

When you look at the food list, you will find many orange-colored foods to include in your daily diet. The orange fruits include apricots, cantaloupe, mango, nectarine, oranges, papaya, persimmon, and tangerines. You can have these fruits fresh or dried; however, note that dried fruits purchased from the store will most likely have sugar and/or sulfites added. You will have to read the label carefully to be sure there is no added sugar (or sulfites if you are sensitive to them). Orange vegetables on this list are acorn squash, orange bell pepper, butternut squash, carrots, pumpkin, and sweet potatoes. Note that sweet potatoes are orange, purple, or white-fleshed root veggies common in U.S., while true yams are starchy, white-fleshed tubers native to Africa and Asia.

Orange foods, along with leafy green vegetables, contain a family of phytonutrients called carotenoids. Eating carotenoid-rich orange foods is linked to multiple health benefits, including a reduced risk of type 2 diabetes,[49] coronary heart disease,[50,51] osteoporosis and bone fractures,[52–54] and breast, cervical, head, neck, and bladder cancers.[32, 34, 55–57]

In addition to fruits and vegetables, turmeric root is also included in this list. Turmeric is an important food as well as a spice when dried into a powder. Turmeric contains curcumin, a phytonutrient that is associated with reduced inflammation, protection against cell damage, and supports heart health by protecting the inner walls of blood vessels.[58,59] There are several ways to incorporate this food into your diet—you can sprinkle or grate turmeric into stir-fries, rice, meats, soups, tea, or even add it to smoothies.

Potential Health Benefits

- A decreased risk of type 2 diabetes[49]
- A lower risk of coronary
- heart disease (CHD)[50,51]
- A reduced risk of breast, cervical, head, neck, and bladder cancers[32,34,55–57]
- A lower risk of osteoporosis and bone fractures[52–54]
- A reduced risk of asthma[60,61]
- A healthy sperm count[62,63]

Examples of Orange Foods

- Apricots
- Bell pepper, orange
- Cantaloupe
- Carrots
- Mango
- Nectarine
- Orange
- Papaya
- Persimmons
- Pumpkin
- Squash (*acorn, buttercup, butternut, winter*)
- Sweet potato (sometimes referred to as "yams" in the U.S.)
- Tangerines
- Turmeric root

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Touring Through the Phytonutrient Food List—*Orange*

Featured Orange Phytonutrient

Beta-Carotene

Beta-carotene is important because it can turn into vitamin A in the body.[64] Vitamin A has many functions such as promoting healthy vision, immune function, cell growth, and reproduction.[65] There are actually several plant compounds that convert to vitamin A in the body (the "carotenoids") and beta-carotene is just one.[66]

Most food sources of vitamin A are of animal origin such as seafood, eggs, fish, and dairy products like yogurt, milk, and cheese.[67] Therefore, if you are a vegan or do not eat select animal products, it will be essential for you to eat plenty of carotenoid-containing foods which are of the red, orange, yellow, and green varieties. Additionally, it may not be enough to have carotenoids as your sole source of vitamin A as there are a number of factors that can limit the conversion of carotenoids into vitamin A such as genetics, digestive issues, excessive alcohol intake, and deficiencies of other nutrients like zinc.[64,68]

Cooking carotenoid-containing vegetables allows heat to "free" the carotenoids from the food to be absorbed.[69,70] A little fat is also needed to make the carotenoids become more available to the body.[46,71] Therefore, having cooked carrots drizzled with olive oil would be an ideal combination to maximize how much beta-carotene your body absorbs.

Tips for Enjoying Orange Foods:

- Have a baked sweet potato instead of a baked white potato.
- Sprinkle turmeric powder onto a tofu and vegetable stir-fry.
- Put orange slices into your water pitcher.
- Drink carrot or orange juice instead of soft drinks.
- Have a clementine, tangerine, nectarine, or peach as a mid-morning or afternoon snack.
- Puree carrots, butternut squash, or pumpkin and use as a soup base.
- Make a tropical fruit smoothie containing fresh, cubed mango, papaya, or orange in a base of nut milk with your choice of protein powder.
- Make a trail mix containing unsweetened dried orange fruits like apricots, mango, and papaya.

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Touring Through the Phytonutrient Food List—*Yellow*

Yellow

The primary phytonutrients in yellow foods include carotenoids such as alpha-carotene, lutein, zeaxanthin, and rutin.[12,72]

The Food List: Yellow Foods

Like the other categories, it is recommended that you get a variety of yellow foods. Note that some of the yellow foods like banana, corn, and potatoes are starchy and should be eaten with protein and fat to support blood sugar balance. Yellow fruits to choose from include yellow skinned apples, Asian pears, gold kiwi, lemons, pineapple, and starfruit. The yellow vegetables include yellow bell peppers, corn, and potatoes.

You'll also find ginger root on this list. Ginger has been widely used around the world for centuries as an herbal medicine. Ginger is associated with decreased inflammation, reduced pregnancy and postoperative nausea, a reduction in joint pain in people with arthritis, and improved blood sugar control.[73,74] You can grate fresh ginger into tea or into a stir-fry, or use the powdered ginger spice in oatmeal.

Another yellow food with, which has beneficial effects on digestive health, is gold kiwi. Eating gold kiwis is linked to improved bowel regularity and reduced digestive discomfort,[75,76] these benefits have been shown to be true for green kiwis as well.[77,78] Natural plant-based sources of fiber, like kiwi and prunes, have been shown to be better tolerated than isolated fiber supplement, such as psyllium.[78,79]

Potential Health Benefits

A lower risk of asthma[60,61]

A reduced risk of metabolic syndrome and type 2 diabetes[49,80]

A decreased risk of stroke[80]

Healthy vision[81–83]

A lower risk of breast, head, neck, bladder, and prostate cancers[32,34,55,57]

Protection against cell damage[84,85]

Examples of Yellow Foods

Apples, yellow skinned
Asian pears
Banana
Bell peppers, yellow
Corn
Ginger root
Gold kiwi
Jackfruit
Lemon
Millet
Olive oil, extra virgin
Passionfruit
Pineapple
Plantains
Potatoes, yellow
Starfruit
Summer squash

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Touring Through the Phytonutrient Food List—*Yellow*

Featured Yellow Phytonutrients

Lutein & Zeaxanthin

Similar to lycopene and beta-carotene, lutein and zeaxanthin are both carotenoids. These two carotenoids, which are helpful for eye health, are not just found in yellow foods. Some green foods like kale and spinach also contain lutein. Whereas, zeaxanthin can also be found in orange peppers and goji berries.[86,87] A good yellow food source of lutein and zeaxanthin is corn.[83] Since corn is in many foods as a processed ingredient and is often genetically modified (GMO), it is preferable to get your corn as organic corn-on-the-cob or the whole kernel form of corn.

Keep in mind that corn tends to be starchy and can increase your blood sugar, so you will want to have it in a meal containing other foods that are higher in fiber, protein, and even fat. Like the other carotenoids, lutein and zeaxanthin are fat-soluble so they need fat to be absorbed by your body.[83] A drizzle of olive oil or a few slices of avocado would be a great way to add healthy fat.

Tips for Enjoying Yellow Foods:

- Slice a banana into warm oatmeal.
- Keep frozen corn kernels on hand and add them to stir-fries, rice and bean dishes, or sprinkled on a Southwestern-style chicken salad.
- Have slices of a Golden Delicious apple or an Asian pear as a mid-morning or afternoon snack together with a thin layer of nut butter (e.g., almond butter or cashew nut butter).
- Add diced yellow bell pepper to a vegetable stir-fry.
- Have Yukon Gold and French fingerling potatoes rather than a starchy, white Russet potato.
- Grate ginger into a stir-fry of vegetables like snap peas, cabbage, and carrots.
- Make a ginger tea with freshly squeezed lemon juice.
- Have pineapple slices as a dessert.

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Touring Through the Phytonutrient Food List—*Green*

Green

The main phytonutrients in green foods are chlorophyll, catechins, glucosinolates, and carotenoids.[14,88]

Additional phytonutrients found in green foods include chlorogenic acid, epigallocatechin gallate, hydroxytyrosol, indole-3-carbinol, isoflavones, isothiocyanate, oleocanthal, oleuropein, phenolic diterpenes, phytosterols, phenols, sulforaphane, tannins, and tyrosol.[14,88–90]

The Food List: Green Foods

The green fruits listed here are green skinned apples, avocado, limes, kiwi, olives, and pears. Avocado and olives are considered fruits, as they contain a pit. These two foods are the "super foods" of the Mediterranean diet and an excellent addition to daily meals. Avocados are truly a remarkable food—one whole avocado has a substantial amount of fiber (about 9 grams) and even more potassium than a banana (about 700 mg).[91] Regularly eating avocados is associated with improved cognitive function[92,93] and increased levels of beneficial gut bacteria.[94,95]

Olives and olive oil are also great choices. Extra-virgin olive oil should be used unheated or in low-heat cooking. Studies show that extra-virgin olive oil is linked to a variety of health benefits, including a reduced risk of cardiovascular disease, coronary heart disease (CHD), and type 2 diabetes.[96,97] There is also research linking extra-virgin olive oil intake to improved cognitive function in people experiencing cognitive impairment.[98,99]

The green vegetables on this list are numerous: artichoke, bamboo sprouts, bean sprouts, bitter melon, bok choy, broccoli, broccolini, Brussels sprouts, green cabbage, celery, cucumber, edamame/soy beans, green beans, green peas, greens of all types (beet, chard, collards, dandelion, kale, lettuce, spinach, and turnip), okra, snow peas, and watercress. The cruciferous vegetables, like Brussels sprouts, broccoli, and watercress, contain phytonutrients called glucosinolates that are associated with a reduced risk of lung, bladder, colon, ovarian, pancreatic, stomach, prostate, and kidney cancers.[100–102]

Beyond their associations with a reduced risk of cardiovascular disease and cancer, green plant foods and the phytonutrients they contain may also increase antioxidants in the body, helping to protect the body against damage from free radicals, reactive compounds that can harm DNA, cells, and proteins inside the body.[103–107]

Image courtesy of 123RF

Touring Through the Phytonutrient Food List—*Green*

Potential Health Benefits

A reduced risk of lung, bladder, colon, ovarian, pancreatic, stomach, prostate, and kidney cancers[100–102]

A lower risk of depression[101]

A decreased risk of coronary heart disease (CHD) and stroke[102] Healthy brain function with aging[108, 109]

Protection against cell damage[103–105]

Enhanced detoxification of harmful chemicals[106, 107] Healthy estrogen detoxification[110, 111]

Examples of Green Foods

Apples, green skinned

Artichoke

Asparagus

Avocado

Bamboo sprouts

Bean sprouts

Bell peppers, green

Bok choy

Broccoli

Broccolini

Brussels sprouts

Cabbage, green

Celery

Chayote

Cucumbers

Edamame/Soybeans

Feijoa

Green beans

Green peas

Green tea

Greens *(arugula, beet, chard, collard, dandelion, kale, lettuce, mustard, spinach, turnip)*

Herbs *(basil, cilantro, parsley, thyme)*

Kiwi

Limes

Nopales

Okra

Olive oil, extra virgin

Olives, green

Pears, green skinned

Peppers, green

Snow peas

Tomatillos

Watercress

Zucchini

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Touring Through the Phytonutrient Food List—*Green*

Featured Green Phytonutrient

Glucosinolates

Cruciferous vegetables have been associated with reduced risk of cancer.[100] One class of phytonutrients that makes the cruciferous vegetables (also known as Brassica vegetables) so beneficial for health is called glucosinolates.[112] Glucosinolates are responsible for the sulfur aroma of these vegetables. When cruciferous vegetables are chopped or chewed, the glucosinolates turn into active compounds called isothiocyanates (examples of these include indole-3-carbinol and sulforaphane).[112] It is theorized that these activated compounds help regulate the body's natural detoxification and antioxidant systems, which play a role in cancer development.[113]

Eating these vegetables either raw, steamed, or microwaved is best to retain the full array of nutrients.[114, 115] Cruciferous vegetables are also important sources of fiber, vitamins, and minerals. The following green vegetables are included in the cruciferous family: arugula, bok choy, broccoli, broccolini, Brussels sprouts, cabbage, Chinese cabbage (napa), collard greens, kale, kohlrabi, mustard greens, and watercress.

Tips for Enjoying Green Foods:

- Have an avocado in your salad or on top of a hamburger or grilled chicken breast.
- Make a stir-fry with bok choy, broccolini, carrots, and edamame.
- Have a cup of green tea instead of coffee.
- Use extra virgin olive oil instead of refined vegetable oils like corn and soybean oils.
- Add more green-colored herbs and spices like rosemary, oregano, dill, and thyme to meat and vegetable dishes.
- Make guacamole with fresh cilantro, green pepper (such as serrano), and avocado.
- Toss some greens into your morning smoothie.
- Make grilled Brussels sprouts and drizzle with olive oil.
- Add green olives, green peas, cucumber, and celery into a salad.
- Have diced asparagus and spinach in your morning omelet.
- Squeeze fresh lime into your water.

Image courtesy of 123RF

Touring Through the Phytonutrient Food List—*Blue/Purple/Black*

Blue/Purple/Black

The primary phytonutrients in blue/purple/black foods are anthocyanins/anthocyanidins and resveratrol.[12,14]

Additional phytonutrients found in blue/purple/black foods include procyanidins and stilbenes, such as pterostilbene.[14]

The Food List: Blue/Purple/Black Foods

One of the reasons why people eat too few of these foods is because there are not as many options as the green and orange food categories. Therefore, it requires a conscious effort to eat these foods regularly.

The blue/purple/black fruits include a wide variety of berries: blueberries, blackberries, boysenberries, huckleberries, and marionberries. These berries and the phytonutrients they contain are linked to healthy brain function and improvements in blood sugar control.[116–118]

Other blue/purple fruits include black olives, figs, grapes, prunes, and raisins. When buying prunes, dried figs, and raisins at the grocery store, read the label to be sure that no added preservatives (e.g., sulfites, BHT, BHA) or added sweeteners have been included. You are probably already aware that prunes are tied to improvements in constipation.[79, 119] Prunes are also associated with maintenance of bone mineral density.[120, 121]

The blue/purple/black vegetables and grains listed are purple cabbage, eggplant, purple kale, black rice, and purple rice. There are also purple varieties of certain vegetables like bell pepper, carrots, potatoes, and cauliflower.

Potential Health Benefits

- Maintenance of healthy cognitive function[116, 117]
- Decreased blood pressure[24, 122]
- A reduced risk of cardiovascular disease[30]
- Protection from liver damage caused by inflammation[123, 124]
- Reduced fasting blood sugar and hemoglobin A1c[118]
- Less muscle soreness and faster recovery after exercise[125]
- Healthy levels of immune cells that defend the body against harmful microbes[126, 127]
- Protection against DNA damage[128, 129]

Examples of Blue/Purple/Black Foods

- Bell pepper, purple
- Berries (*blueberries, blackberries, boysenberries, huckleberries, marionberries*)
- Cabbage, purple
- Carrots, purple
- Cauliflower, purple
- Eggplant
- Figs
- Grapes, blue/purple/black skinned
- Kale, purple
- Olives, purple/black
- Plums
- Potatoes, purple
- Prunes
- Raisins
- Rice, purple/black

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Touring Through the Phytonutrient Food List—*Blue/Purple/Black*

Featured Blue/Purple/Black Phytonutrient

Anthocyanins

Anthocyanins are phytonutrients that provide the blue/purple/black color to plants, such as blackberries and blueberries.[10] They are also present in red plants, such as strawberries and red onion. Eating foods rich in anthocyanins is associated with lower blood pressure, improvements in blood sugar control, and a reduced risk of fat buildup in the liver, which can harm liver function.[24, 118, 122–124]

Tips for Enjoying Blue/Purple/Black Foods:

- Add berries to a smoothie.
- Add blueberries or blackberries to yogurt, oatmeal, breakfast cereal, and pancakes/waffles.
- Try purple kale instead of the usual green kale.
- Make a stir-fry with purple vegetables like eggplant, purple potatoes, and complement with purple rice.
- Substitute purple or black rice for white rice.
- Try shredding some purple cabbage into salads.
- Make purple carrot puree and use as a base for soups or sauces.
- Snack on fresh figs, plums, and berries or unsweetened raisins.

Image courtesy of 123RF

Touring Through the Phytonutrient Food List—*White/Tan/Brown*

White/Tan/Brown

The primary phytonutrients in white/tan/brown foods are sulfur compounds, such as allicin, flavones, and lignans.[12, 14, 130, 131]

Additional phytonutrients found in white/tan/brown foods include allyl sulfides, sesamin, sesamol, tannins, terpenoids, and theobromine.[12, 131–134]

The Food List: White/Tan/Brown Foods

When thinking of the white/tan/brown category, processed foods may come to mind, such as bagels, cereals, breads, pastas, cakes, cookies, and crackers. Although these processed foods are widely available, they are not a rich source of phytonutrients. However, there are many white/tan/brown whole foods that are rich in phytonutrients and beneficial to health, including nuts, seeds, certain fruits and vegetables, legumes, and whole grains.

White/tan/brown fruits include apples (the non-skin part of the apple) and applesauce, coconut, dates, lychees, and pears. There are several types of coconut products which could be included into one's diet such as shredded, unsweetened coconut, coconut milk, coconut butter, and coconut oil. Dates can be used as a natural sweetener to replace table sugar. Lychees and pears are refreshing choices that make for a convenient snack.

White/tan/brown vegetables include cauliflower, garlic, mushrooms, onion, sauerkraut, and shallots. Garlic, onion, and shallots are part of the Allium family of plants. The Allium vegetables are associated with several health-promoting effects, including reductions in total cholesterol and a decreased risk of cancer.[135, 136] Allium foods are also sources of prebiotics, ingredients that promote the growth of beneficial bacteria in the gut.[137]

Nut intake is associated with cardiovascular health.[138] Nut butters are wonderful complements to fruits, such as a layer of almond butter on an apple slice or cashew nut butter on a sliver of pear. Similarly, seeds have many phytonutrients.[139–141]

They are found as seed oils (e.g., sesame seed oil, flaxseed oil), whole seeds, and seed butters (e.g., tahini is the paste made from sesame seeds). In addition to phytonutrients, nuts and seeds contain a mixture of healthy fats and oils, fiber, minerals, and vitamins.

There are several whole grains on this list. Some people may not be able to eat gluten-containing grains (the common ones are barley, rye, wheat, and spelt), in which case, alternate whole grains like brown rice, wild rice, millet, and quinoa are good substitutes.

Beverages, like coffee and tea, are included on this list. Both moderate coffee and tea intake are linked to a decreased risk of cognitive decline.[142] There are mixed reviews about the benefits of drinking coffee related to cardiovascular disease and blood pressure. Some research links coffee consumption to stiffening of the

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Touring Through the Phytonutrient Food List—*White/Tan/Brown*

arteries.[143] However other studies show coffee has a positive effect on blood vessel health.[144, 145] There is also research to suggest that coffee intake is associated with reduced risk of diabetes.[146] There are individual factors, like genetic variants, that can influence the metabolism of caffeinated beverages like coffee.[147] Caffeinated drinks may not be suitable, or preferred for everyone, in which case, decaf varieties are available.

You will see dark chocolate on this list. The phytonutrients in dark chocolate are associated with an increased release of nitric oxide in blood vessels, which promotes healthy blood flow.[148] Check the ingredients of chocolate products to make sure they are not high in processed sugar or unnecessary preservatives.

Culinary mushrooms are associated with improvements in markers of cardiovascular health.[149] Examples of mushrooms to try include Shiitake, button, portobello, crimini, oyster, and chanterelle.

Within this category, here are some specific options to consider: legumes of all types (hummus, bean dips, dried beans or peas, lentils, chickpeas, peanuts, refried beans), nuts (Brazil, cashew, almond, hazelnut, pine nut, walnut) and nut butters, seeds (sesame, pumpkin, sunflower, flaxseed, and flaxseed meal) and seed butters (tahini, sunflower seed, and others), and whole grains (wheat, rye, oats, spelt, barley, triticale).

Potential Health Benefits

A decreased risk of breast, colon, esophageal, stomach, and pancreatic cancers[150–153]

Decreased total and LDL cholesterol[135, 154]

A reduced risk of cardiovascular disease and supports heart health by protecting the inner walls of blood vessels[138, 155–161]

A decreased risk of type 2 diabetes[162, 163]

Examples of White/Tan/Brown Foods

Apples

Applesauce

Bean dips

Cassava (yuca root)

Cauliflower

Cherimoya

Cocoa

Coconut

Coffee

Dates

Garlic

Ginger

Jerusalem artichokes

Jicama

Legumes (*chickpeas, dried beans or peas, hummus, lentils, peanuts, refried beans/low-fat*)

Lychee

Mushrooms

Nuts (*almonds, cashews, pecans, walnuts*)

Onions

Pears

Pitaya (dragon fruit)

Sauerkraut

Seeds (*flax, hemp, pumpkin, sesame, sunflower*)

Shallots

Soy

Tahini

Taro root

Tea (*black, white*)

Turnips

Whole grains (*amaranth, barley, brown rice, oat, quinoa, rye, spelt, teff, wheat*)

Image courtesy of 123RF

Touring Through the Phytonutrient Food List—*White/Tan/Brown*

Featured White/Tan/Brown Phytonutrient

Lignans

Several plant foods contain the phytonutrient, lignans. Lignans are not to be confused with another phytonutrient class called lignins, which are related to fiber.[164] The top food sources of lignans are flaxseeds and sesame seeds.[165, 166] Other food sources of lignans include cashew nuts, peanuts, and sunflower seeds.[167] Lignan-rich flaxseeds are associated with reductions in blood lipids measured in a standard lipid panel, such as total cholesterol and LDL cholesterol, as well as improvements in advanced lipid markers, like lipoprotein(a).[168] Lowering these lipid levels may benefit cardiovascular health by limiting the accumulation of plaque, fatty deposits on the inner walls of blood vessels that can restrict blood flow.[169, 170]

Flaxseeds are also associated with better blood sugar control in people with pre-existing blood sugar imbalances.[171]

Tips for Enjoying White/Tan/Brown Foods:

- Add some cocoa powder to your smoothie.
- Add brown spices (cinnamon, clove, allspice) to your cooking and baking.
- Use dates instead of refined sweeteners to sweeten dishes.
- Add diced onion to a stir-fry.
- Drizzle warm tahini over vegetables (e.g., broccoli, cauliflower, carrots).
- Dip vegetables into hummus (ground chickpea dip) or bean dip.
- Add mushrooms to broths and soups for more flavor and medicinal impact.
- Sprinkle sesame seeds on a vegetable stir-fry.

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Frequently Asked Questions

How can I get more phytonutrients in my diet?

Start by observing your meals and colors eaten each day. Gradually shift to eating a broader spectrum and more color variety whenever possible. It is common to get stuck in a rut of eating the same foods over and over again. Aiming to eat the full seven colors every day is an excellent goal.

Here are some simple ways to jump start getting more phytonutrients in your diet:

- Make it your goal to try one new plant food (fruit, vegetable, nut, seed, legume, whole grain) per week. Try different cuisines from around the world for greater variety.
- Stock up on frozen vegetables for easy cooking. Frozen berries tend to retain their phytonutrients.[172] Cruciferous vegetables like broccoli are least desirable for freezing because pre-freezing processing methods like blanching decrease their phytonutrients.[173]
- Use fruits and vegetables that go bad quickly first. Save hardier varieties for later in the week.
- Keep a bowl or container of fresh cut vegetables on the top shelf of your refrigerator, within easy reach.
- Keep a fruit bowl on the kitchen counter, table, and desk at work.
- Bring fruit and vegetables with you to work to eat as a snack.
- Choose fruit for dessert (fruit kabobs, berry compotes, fruit salads, etc.).
- Have dishes with lots of vegetable variety (e.g. soup, stir-fry).
- Use vegetable and mushroom-based sauces.
- Dip vegetables into herb-packed sauces such as pesto, chimichurri, gremolata, or Chermoula.
- Try mashed cauliflower as a substitute for mashed white potatoes.
- Make a switch from corn to squash.
- Toss red peppers, tomatoes, garlic, onions or broccoli into omelets.
- Add rinds of oranges or lemons to water, chicken, and fish.
- Try a little bit of every color at a salad bar.
- Be generous with your use of spices!

Image courtesy of 123RF

Frequently Asked Questions

Where can I find phytonutrients? Can I just take a supplement?

Sources of phytonutrients include all plant foods, including fruits, vegetables, whole grains, legumes, nuts, seeds, and spices.[10,11] Although you can purchase supplements that contain phytonutrients, it is better to get the majority of these beneficial health compounds from a wide variety of whole, or minimally processed foods. Eating fruits, vegetables, legumes and other phytonutrient rich foods in their whole food form provides many other health promoting compounds including fiber, vitamins, minerals, and amino acids.

Are some foods higher in phytonutrients than others?

The short answer is: yes.

Some plant foods clearly provide more phytonutrients than others. For example, mashed purple potatoes or sweet potatoes contain more phytonutrients than mashed white potatoes.[174] Substituting white rice with purple, brown, or black rice provides a wider array of phytonutrients.[175] One way to get more plant foods would be to think of foods that are commonly eaten that may not be as nutrient dense, and replace those with more nutrient-dense options.

How many servings of phytonutrient-rich foods should I be eating every day?

Globally, people are not eating enough vegetables and fruits. The World Health Organization (WHO) recommends 400 g or 5 servings of vegetables and fruits per day.[176, 177] However, eating much more—at least 9 servings per day— is linked to a reduced risk of chronic disease.[178, 179]

A typical serving is a half a cup of cooked vegetables, one cup of raw vegetables, three cups of raw leafy greens, or a medium-sized piece of fruit. Fresh, cooked, and processed fruits and vegetables including frozen and canned, 100% fruit juices, 100% vegetable juices, and dried fruits all contribute to the total daily servings of fruits and vegetables. It would be best to aim for 3 servings at every meal (not including snacks), to achieve the recommended amount of servings on a daily basis.

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Is variety that important?

There are thousands of phytonutrients in nature.[10,11] If we eat the same foods over and over again, even if they are colorful, we may be missing the plethora of other phytonutrients across the spectrum. Rather than getting all of your blue-purple phytonutrients from blueberries, you may want to try other blue-purple foods like purple potatoes, purple rice, and even purple cabbage—all of which will give you different phytonutrients within the blue-purple color. One helpful tip is to try a new food every week to ensure you get as many phytonutrients as possible.

Frequently Asked Questions

When do I eat plant foods raw and when do I cook them?

For the most part, a combination of raw and cooked foods is recommended. Raw foods are typically eaten in the summer months and cooked foods are best in the winter when it is cold outside. People with compromised digestion (bloating, constipation, IBD/IBS, gas, and pain) will often do better with more cooked plant foods. Aside from seasonal and symptomatic concerns, preparation of plant foods to enhance absorption depends on the phytonutrient.

Here are some general guidelines:

- Carotenoids, found in red, orange, yellow, and green foods, are better digested and absorbed with heat preparation and when eaten with some fat/ oil.[71, 180]
- Air frying, steaming, baking, sous vide, sautéing, and microwaving preserve nutrients better than boiling or other heating methods.[181–186]
- The antioxidant content increases in the following foods when they are cooked: carrots, mango, pineapple, spinach, chard, onion, broccoli, and zucchini.[181, 187–189]
- Cook to the point of making the vegetables tender and not mushy.
- Using heat, mechanical processing, soaking, fermentation, and germination/
- malting when it comes to foods like seeds, nuts, grains, and legumes can increase the availability of phytonutrients and decrease the content of plant nutrients that are not beneficial, like phytate, goitrogens, and thiaminases.[190, 191]
- Eating cruciferous vegetables raw, or very lightly cooked is best to preserve the enzyme that produces anti-cancer compounds.[112]
- Avoid peeling apples. The peels contain significant amounts of phytonutrients.[192]

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Frequently Asked Questions

Should I be using more spices and herbs?

The answer is definitely YES! One of the many reasons the Mediterranean diet is so healthy is because of the liberal use of spices and herbs. As a point of distinction, a spice comes from parts of a plant other than the leaves, such as the plant's root, stem, bark, bud, flower, or seed. Spices are edible, aromatic, and dried. In comparison, herbs are usually the leaves of a plant. Spices provide phytonutrients linked to improved blood sugar control and support a healthy gut microbiota.[193–195] When it comes to purchasing spices, avoid additives (e.g., sugar, maltodextrin, gluten, artificial colors, preservatives, synthetic anti-caking agents).

Here are some other tips on buying herbs and spices:

- If you buy spices in bulk, store them in air-tight glass or tin containers. Don't buy large quantities—only what you will use within 6-12 months.
- You can buy herbs and spices in their fresh, dried, whole, cracked, coarsely
- ground, and finely ground forms.
- Store in a cool, dark place. Heat, light, and moisture will accelerate loss of flavor. High temperatures can cause spices to cake or harden and change or lose color.
- Don't let them sit around the stove. Close container well after using.
- Under ideal conditions, ground spices will keep for about a year and whole
- spices for 2-3 years.
- To test, rub between fingers to detect presence of aroma.
- Roast slowly before grinding for maximum impact.

Images courtesy of 123RF

Frequently Asked Questions

Ways to get more herbs and spices in your eating:

- Add to smoothies.
- Make tea and add it to smoothies.
- Combine finely chopped garlic and basil to extra virgin olive oil and lemon juice as a salad dressing.
- Add fresh herbs such as cilantro, chives, basil or mint to salads or sandwiches.
- Sprinkle cumin or fennel seeds in soups or salads.
- Marinate lean meats in curry powder or curry pastes.
- Sprinkle cinnamon and nutmeg over oatmeal or wholegrain toast for breakfast, steamed soy milk, and even on vegetables.
- Add fresh parsley or chives to scrambled eggs.
- Stew fruits with cinnamon stick and a vanilla pod.
- Steep lemongrass, ginger or mint in hot water.
- Add freshly grated garlic to mayonnaise.
- Add fresh or dried herbs to your favorite pasta dish.

What about frozen fruits and vegetables?

It is more important to eat fruits and vegetables in any form (e.g., frozen, dried, canned) than to not eat them at all. Freezing foods can reduce flavor, and the final nutrient content will depend on the initial quality of the food before it was frozen. If the food was initially considered to be of high-quality (e.g., organic and fairly fresh at the time of freezing), then the final nutrient content may be retained to a large degree. For instance, studies have shown that frozen berries retain many of their phytonutrient content during freezing.[172] That said, not all frozen foods are 100% comparable to fresh foods. There are some concerns with freezing as the blanching process that occurs before freezing can result in a loss of nutrients like vitamin C.[196] In general, freezing foods properly for no longer than six months will help to maintain the nutrient content of frozen foods. For guidance on freezing foods at home, visit the National Center for Home Food Preservation.

Frequently Asked Questions

Is it OK to eat dried fruit?

In general, fresh fruits are higher in phytonutrients in comparison to dried fruits. Dried fruits lose both water and nutrients in the drying process.[197] Another point to consider is that losing water in the drying process concentrates calories and sugar content. Eating dried fruit will result in consuming more calories than if you ate the same amount of fruit fresh. For example, 1 cup of fresh apricots contains 74 calories, whereas, 1 cup of dried apricots contains 313 calories. All that being said, eating unsweetened dried fruit in moderation can be a healthy and convenient option.

Another thing to keep in mind is that sweeteners are often added to dried fruit, especially cranberries which are extremely tart. While it may make sense to add some sweetness to cranberries, try to purchase dried berries and other fruits without added sugar. In the case of cranberries, it would be better to have a natural sweetener like apple juice concentrate rather than corn syrup or high-fructose corn syrup.

Why should I eat organically-grown food?

Adopting an organic lifestyle helps to enhance the health of people and the planet. It is generally agreed upon by many that growing and eating organic food is better for the environment. Growing foods organically excludes, when possible, the use of synthetic fertilizers, pesticides, growth regulators, and additives to livestock feed. Organic farmers usually rely on crop rotation and animal manures to maintain soil productivity, to supply plant nutrients, and to control weeds, insects, and other pests.

Eating organic food is associated with a reduced exposure to potentially harmful pesticides and antibiotic-resistant bacteria because organic farming doesn't allow the use of synthetic pesticides or antibiotics.[198, 199]

The Organic Seal of Approval guarantees the consumer that there has been no usage of genetically modified crops or sewage sludge as fertilizer, helping to reduce toxic runoff into rivers and lakes and the subsequent contamination of watersheds and drinking water.

Image courtesy of 123RF

Frequently Asked Questions

If you are unable to purchase organic produce, it is wise to be aware of foods that are the most contaminated with pesticides. The Environmental Working Group publishes the Dirty Dozen™ and Clean 15™ lists, which are updated annually. Foods are listed in order of importance. Their lists may be downloaded on the Environmental Working Group website.

Easy Ways to Reduce Your Pesticide Intake From Plant Foods:

1. Buy organically-grown produce.[198, 199]
2. Wash produce in baking soda and water. This strategy is linked to reduced pesticides on the surface of apples and lettuce, and might work for other fruits and vegetables.[200, 201] This method may not be ideal for delicate fruits like berries.
3. Wash your hands for 20 seconds with warm water and soap before and after preparing fresh produce.
4. Cut away any damaged or bruised areas before preparing or eating.
5. Wash produce before you peel it, so dirt and bacteria aren't transferred from the knife onto the fruit or vegetable.
6. Dry produce with a clean cloth or paper towel to further reduce bacteria that may be present.

Summary

6 Steps to Getting More Phytonutrients

Food is more than calories. It is essential for optimal health to eat plenty of phytonutrients and to be nourished through the enjoyment of eating and cooking in a way that fosters creativity, community, and connection.

1 *Aim for 9 Servings of Plant Foods Every Day*[178, 179]

A typical serving is half a cup of cooked vegetables, one cup of raw vegetables, 3 cups of raw leafy greens, or a medium-sized piece of fruit. Try to include three servings of plant foods at each meal so that at three main meals per day (not including snacks), you would make your serving requirement daily.

2 *Know Your Phytonutrient Sources*

The options for phytonutrient-rich meals are limitless. It can be fun to experiment with new varieties and colors even within one category of food. Phytonutrients are found in: any and all plant foods, including fruits, vegetables, whole grains, legumes, nuts, seeds, and even herbs and spices.

3 *Eat the Rainbow of Colors*

Instead of eating the full rainbow of color, many people eat a limited array of food colors of brown, yellow, and white. For example, think of the typical breakfast menu—waffles, pancakes, ready-to-eat cereal, sausage, and eggs—which typically does not provide much color early in the day. However, if you had a fruit smoothie with blueberries, peaches, and raspberries, you'd have three of the seven colors of the rainbow first thing in the morning! Make it your goal to get the full seven colors every day with a variety of foods.

4 *Vary Your Choices*

There are thousands of phytonutrients in nature. If we eat the same foods over and over again, even if they are colorful, we may be missing the plethora of important phytonutrients in foods. One helpful hint is to try a new food every week to ensure that you are getting a wider variety of foods.

5 *Maximize Combinations*

When we put certain foods together, we may achieve a better effect than if we just had the foods by themselves. Sometimes, there can be a "synergistic" result from combining certain foods. For example, combining turmeric with black pepper in a meal may enhance your absorption of phytonutrients from turmeric.[202, 203] Consuming carotenoid-rich citrus fruits and green tea together may improve phytonutrient absorption from the tea and support a healthy body weight.[204-206] Try putting plant foods together for an enhanced health benefit, such as combining turmeric with black pepper in a curry or lemon juice in your green tea.

6 *Be Creative with Substitutions*

One way to get more phytonutrients is to replace less nutrient dense foods with more nutrient-dense options. Some foods clearly give us more phytonutrients than others! For example, you could substitute mashed potatoes with mashed purple potatoes or sweet potatoes. You could substitute white rice with purple, brown, or black rice. Or try using spiralized vegetable noodles made from zucchini or squash in place of pasta.

Resources and Tools for Success

The Phytonutrient Spectrum is intended to be a nutrient-dense and anti-inflammatory approach to eating that is suitable for everyone. The following resources are available from your functional medicine practitioner to assist you in implementing the IFM Phytonutrient Spectrum:

- **Phytonutrient Spectrum Foods**
- **Phytonutrient Spectrum Checklist**
- **Phytonutrient Spectrum Rainbow Recipes**

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