

Color Me Healthy: Enjoying Fruits and Vegetables

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Who would have guessed when great-grandma set her menu by the foods' colors that she was so right in helping to ensure her family's health and well being?

Why Care about Colors?

The color molecules that form the more than 2,000 pigments in plant foods not only look scrumptious but also contain strong antioxidants, the health-promoting substances that neutralize the free radicals formed when cells burn oxygen for energy. Free radicals damage or destroy healthy cells. In general, the deeper the color of a fruit or vegetable, the more powerful its antioxidant action.

Plant pigments are a subset of the naturally occurring antioxidants in vegetables and fruits. Other phytochemicals ("phyto," pronounced fight-o, means plant) besides antioxidants help protect against the damaging effects of toxic substances. Eating a variety of fruits and vegetables allows their different phytonutrients to work together to help fight illnesses.

Functional foods or nutraceuticals are foods that provide health benefits beyond basic nutrition, such as helping to prevent disease. Fruits and vegetables are nature's

original functional foods. Taking dietary extracts or supplements is not the same; research to date has shown they do not substitute for eating fruits and vegetables.

Colors' Health Claims

Fruits and vegetables provide a wide spectrum of healthful qualities, including vitamins and minerals. They are low in calories and sodium, high in water content and contain no cholesterol. Many are good sources of dietary fiber, which helps satisfy hunger and enhances bowel health. Most contain very little fat, and fruit has natural sweetness.

Consuming different colors of fruits and vegetables each day offers satisfying tastes and textures while increasing protection against disease. A diet rich in natural plant pigments protects against heart disease and cancer, slows the aging process, and strengthens mental capacity and the immune system. It also helps decrease the risk of high blood pressure, lung or pulmonary disease such as asthma, stroke, cataracts, age-related macular degeneration, constipation, urinary tract infections, diverticulosis, diabetes, obesity and wrinkling of the skin.

Fruits and vegetables offer an appetizing rainbow of colors. Since

each protects body tissues in its own way, the best way to power up your plate – and please your palate – is to eat a variety of colors and choices within each group. Five categories are listed: red, yellow/orange, green, blue/purple/black and white/ tan/brown.

Color Category: Red

A variety of red fruits and vegetables helps maintain a healthy heart, memory function and urinary tract health, and lowers risk of some cancers. Both red and orange vegetables are sources of carotenoids.

- Beta carotene, an antioxidant pigment, is good for the eyes. It also reduces risk of cancer and cardiovascular disease.
- The red pigment lycopene gives its color to tomatoes and products such as tomato sauce, paste and catsup; guava; pink grapefruit and watermelon. It is a strong antioxidant that helps protect against prostate and other cancers. Cooked tomatoes have more lycopene than fresh ones.
- Anthocyanins – found in red-skinned apples, radishes, cherries and beets – decrease heart disease risk, help prevent hardening of blood vessels, lower blood pressure, help prevent cancer and help stop inflammation.
- Ellagic acid, found in berries and pomegranates, helps prevent cancer

by neutralizing carcinogens found in tobacco smoke, processed foods and barbecued meats.

- The antioxidant vitamin C helps maintain skin, bones, teeth, gums, eyes, muscle, cartilage, blood vessels and the immune system, and increases iron absorption.
- Red and purple grapes, purple grape juice, red wine and mulberries contain the antioxidant resveratrol, which may help decrease risk of heart disease and stroke.

Red fruit and vegetable choices include:

Beets	Red beans
Blood oranges	Red cabbage
Cherries	Red grapefruit
Cranberries	Red grapes
Currants	Red mulberries
Guava	Red onions
Kidney beans	Red pears
Papayas	Red peppers
Pink grapefruit	Red-skinned potatoes
Pomegranates	Rhubarb
Radicchio	Strawberries
Radishes	Tomatoes
Raspberries	Watermelon
Red apples	

Color Category: Orange/Yellow

The orange/yellow category helps maintain heart, vision and immune system health, and lowers risk of some cancers. Many fruits and vegetables in this group are high in vitamin C and folic acid.

- There are more than 600 kinds of orange-colored carotenoids, which help protect the skin and mucous membranes, maintain the immune system, reduce risk of blindness and stroke, and lower cholesterol levels. Their antioxidant properties also help protect against carcinogens. Perhaps the most well-known carotenoid is beta carotene, an antioxidant that converts into vitamin A.

- Oranges and some yellow vegetables – such as yellow peppers and corn – contain high amounts of the pigment lutein, which helps maintain vision.
- Orange fruits and vegetables, especially orange peppers, have high levels of zeaxanthin, another antioxidant pigment that helps maintain vision.
- Oranges, lemons, grapefruit and pineapple are rich sources of vitamin C and flavanones. Even the peel has limonoids, which help prevent cancer.

Yellow/orange choices include:

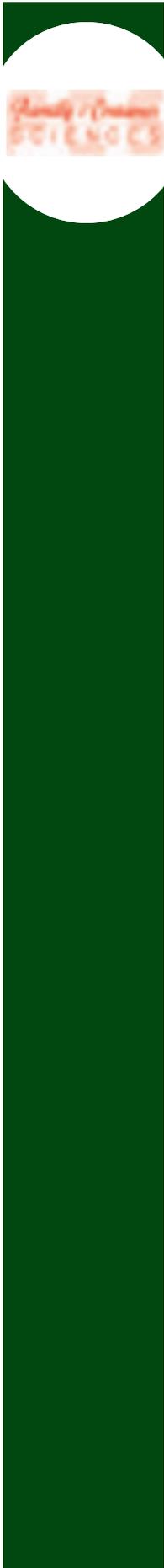
Apricots	Orange peppers
Butternut squash	Papayas
Cantaloupe	Peaches
Carrots	Persimmons
Grapefruit	Pineapples
Golden kiwifruit	Pumpkin
Lemons	Rutabagas
Mandarin oranges	Sweet corn
Mangoes	Sweet potatoes
Nectarines	Tangerines
Oranges	Yellow apples

Yellow beets	Yellow summer squash
Yellow figs	
Yellow pears	Yellow tomatoes
Yellow peppers	Yellow watermelon
Yellow potatoes	Yellow winter squash

Color Category: Green

Green fruits and vegetables help lower risk of some cancers, reduce risk of heart disease, maintain vision health, protect against birth defects and keep red blood cells, bones and teeth strong.

- The green pigment chlorophyll masks the orange-yellow carotenoid pigments in some green foods. Many green vegetables contain lutein and zeaxanthin, which help protect against vision loss.
- Strong-flavored green cruciferous vegetables – including bok choy, broccoli, Brussels sprouts and cabbage – contain sulforaphane, isothiocyanate and indoles. They have disease-fighting properties, especially against many kinds of cancer.
- The antioxidant glutathione, found in fruits and vegetables such as asparagus, avocados, spinach and broccoli, helps protect DNA and RNA from oxidative stress and strengthens the immune system.
- Folic acid, a B vitamin found in dark green leafy vegetables, helps reduce risk of heart disease and helps prevent birth defects.
- Iron, vitamin K, magnesium and calcium are found in many green vegetables. They help keep bones and



teeth strong and promote healthy blood.

Green choices include:

Artichokes	Green onions
Arugula	Green pears
Asparagus	Green peppers
Avocados	Honeydew melon
Bok choy	Kale
Broccoflower	Kiwifruit
Broccoli	Leafy greens
Broccoli rabe	Leeks
Brussels sprouts	Lettuce
Celery	Lima beans
Chayote squash	Limes
Chinese cabbage	Mustard greens
Chives	Okra
Collard greens	Parsley
Cucumbers	Peas
Culinary herbs	Spinach
Edamame	Sprouts
Endive	Sugar snap peas
Green apples	Swiss chard
Green beans	Turnip greens
Green cabbage	Watercress
Green grapes	Zucchini

Color Category: Blue/Purple/Black

Blue, purple and even black fruits and vegetables provide antioxidants that help lower risk of some cancers, promote healthy aging, and improve urinary tract health, memory function and heart health.

- Blue pigments include anthocyanins and other flavonoids,

while red-violet pigments include the betacyanins.

- Blueberries have the highest antioxidant action of any fruit.
- Anthocyanin flavonoids, which are particularly high in bilberries and blueberries, and the pigments in spinach and other deeply colored fruits and vegetables have been shown to help protect against age-related memory loss.
- Blueberries and cranberries help protect against bladder infections and possibly ulcers and gum diseases. Substances known as condensed tannins in the berries prevent undesirable bacteria from attaching to cells and organs.

Blue/purple/black choices include:

Bilberries	Plums
Black beans	Purple asparagus
Blackberries	Purple Belgian endive
Black currants	Purple cabbage
Black mulberries	Purple carrots
Black salsify	Purple figs
Blueberries	Purple-fleshed potatoes
Boysenberries	Purple grapes
Dried plums/Prunes	Purple peppers
Eggplant	Raisins
Elderberries	

Color Category: White/Tan/Brown

White, tan and brown fruits and vegetables (and we are talking “original brown,” not “brown because they are too old” here!)

contain few vivid pigments, but help maintain heart health and lower cancer risk. They provide health-promoting phytochemicals. Folic acid, fiber, potassium, selenium and vitamin C are found in many of the fruits and vegetables in this color group.

- Many of these vegetables make up for their lack of color with a strong taste that comes from sulfur compounds that protect DNA, help lower cholesterol and maintain healthy immune systems.
- Parsnips contain polyacetylenes. Onions, apples and pears contain powerful polyphenols such as the pigment quercetin, a compound that protects against heart disease. Both of these phytochemicals also have anticancer properties.
- Allicin, found in the garlic and onion family, helps destroy cancer cells.
- Saponins, also found in onions and garlic, help stimulate the immune system and lower circulating levels of fats. They also inhibit enzymes involved in cancer proliferation.
- Pears and mushrooms contain flavonoid antioxidants that protect cell membranes.
- Phytoestrogens, such as genistein in soy products, help protect against breast cancer.
- Isoflavone phytochemicals – found in dried beans, peanuts, lentils, soy and other legumes – help reduce risk of heart disease and colon, prostate and stomach cancer.

White/tan/brown choices include:

Bananas	Kohlrabi
Black-eyed peas	Leeks
Brown pears	Lentils
Cauliflower	Mushrooms
Dates	Onions
Figs	Parsnips
Garbanzo beans or Chick peas	Peanuts Pinto beans
Garlic	Shallots
Ginger	Turnips
Great northern beans	White Corn White-fleshed potatoes
Jerusalem artichoke	White nectarines
Jicama	White peaches

Make a Colorful Diet Common

Brightly colored fruits and vegetables are definitely not boring! Many are portable and require little preparation, making them natural “convenience foods.” For the most nutrients per calorie, choose the ones without added salt, sugar, syrup or sauces. Before use, thoroughly rinse all fresh fruits and vegetables under cool, running water.

When putting more colors on your plate, select a variety of fresh, frozen, dried and canned fruits and vegetables, or modest portions of juices. (Juices offer less fiber than other forms of preparation, so it is easy to get surprisingly more calories from them.)



The number of fruit and vegetable servings depends on your calorie needs. One serving is a medium piece of fruit, 1 cup raw, leafy vegetables, 1/2 cup fruit or vegetables (raw, cooked, canned or frozen), 1/4 cup dried fruit, or 3/4 cup (6 ounces) 100% juice. (The serving size for toddlers and preschoolers is about one tablespoon for each year of age.)

You have a delicious opportunity to help ensure your better health by eating “5 to 9 the Color Way.” To help remind yourself and family members to eat them, store fruits and vegetables where you will see them often. For example, put a mixture of fresh fruits and small containers of dried fruits, 100% juices and canned fruits in a bowl on the kitchen table or near the door. Place cut-up, ready-to-eat vegetables and fruits in see-through containers in a prominent place in your refrigerator.

5 or More the Easy Way

Fill in the blanks below for your own on-the-go examples of appetizing and easy ways to include fruits and vegetables throughout your day:

- Grab some fruit for breakfast:

- Snack on fruit or vegetables in the morning:

- Add vegetables (maybe in soup or a salad?) to lunch:

- Snack on dried fruit in the afternoon:

- Choose two or more vegetables at dinner:

- Drink 100 percent juice for a snack in the evening:

Recommended Number of Servings for:	Fruits	+	Vegetables
Young children, sedentary women, older adults	2	+	3
Older children, teen girls, active women, most men	3	+	4
Teen boys, active men, very active women	4	+	5

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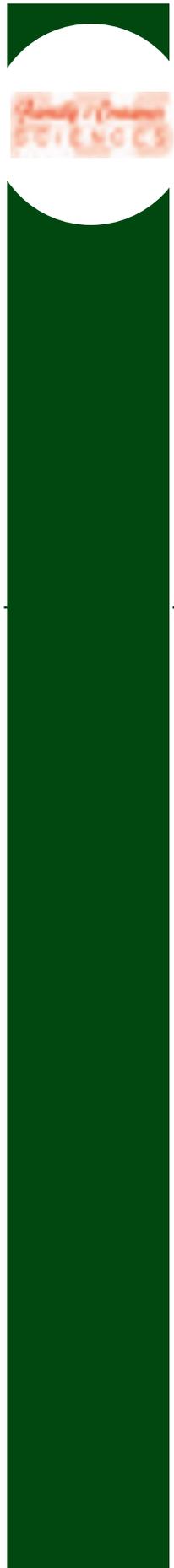
Summary

Five to nine servings of a variety of colorful fruits and vegetables – red, yellow, orange, green, blue, purple, black, white, tan and brown – are recommended each day. Eating a rainbow of fruits and vegetables makes meals look and taste great and improves the immune system, slows aging and reduces risk for heart disease, cancer and other illnesses. Many kinds of fresh, canned, frozen, dried and juiced fruits and vegetables can be conveniently included throughout each day.

For More Resources about Fruits and Vegetables

The Web site www.oznet.ksu.edu/humannutrition/freshfruitsandvegetables.htm includes: a cookbook that suggests ways to select, store and prepare fresh fruits and vegetables; nutrition and food safety information; posters and activities; and links to other sites.

The author thanks reviewer Julie Garden-Robinson, PhD, LRD, Food and Nutrition Specialist and Assistant Professor, North Dakota State University Extension Service, Fargo, N.D.



Participant Survey for Color Me Healthy: Enjoying Fruits and Vegetables

Please help us improve our programs and materials by answering the following questions.

Date _____ Your County _____

Are you: Male ___ Female ___

Are you: White, non-Hispanic ___ White, Hispanic ___ African-American/Black ___
Native American ___ Asian-American ___ Other ___

Your age category: Teen ___ 19-40 yrs. ___ 41-59 yrs. ___ 60 yrs and over ___

1. Did you learn anything today that you did not know or that surprised you?

Yes ___ No ___ Please specify:

2. After today, how often will you eat more than one kind of vegetable or fruit per day? (Circle one)

Never Often Always
1 2 3 4 5

3. Before today, how often did you eat more than one kind of vegetable or fruit per day? (Circle one)

Never Often Always
1 2 3 4 5

Suggested References for Further Reading:

- 5 a day the color way, available at www.5aday.com
- Hyson, D. 2002. The health benefits of fruits and vegetables. Produce for Better Health Foundation, available at www.5aday.com/html/research/summaries.php
- VanDuyn, MAS, and Pivonka, E. 2000. Overview of the health benefits of fruit and vegetable consumption for the dietetics professional: Selected literature. Journal of the American Dietetic Association 100:1511-1521.

4. After today, how many servings of fruits and vegetables will you eat per day? _____

Examples of a serving are:

1 medium banana, apple or orange	
3/4 cup juice	1/2 cup cooked vegetable
1/2 cup canned fruit	1 cup tossed lettuce salad

5. Before today, how many servings of fruits and vegetables did you eat per day? _____

6. Before today, how important was it to you to eat a variety of fruits and vegetables daily? (Circle one)

Very Important	Somewhat Important	Neither Important Nor Unimportant	Somewhat Unimportant	Very Unimportant
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7. After today, how important will it be to you to eat a variety of fruits and vegetables daily? (Circle one)

Very Important	Somewhat Important	Neither Important Nor Unimportant	Somewhat Unimportant	Very Unimportant
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8. If you do not eat fruits and vegetables, please explain why not:

9. Do you intend to eat more fruits and vegetables in the future? Yes _____ No _____

Please specify why or why not:

Thank you for your time!

Leaders, please return surveys to: Dr. Mary Meck Higgins, Department of Human Nutrition, 202 Justin Hall, Manhattan KS 66506