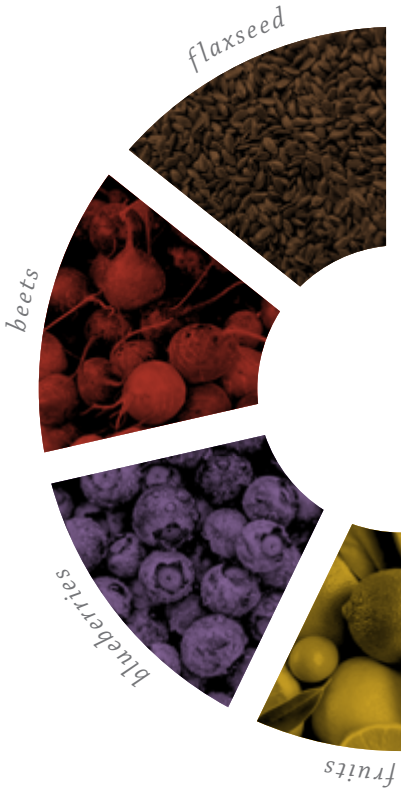
Color of Food

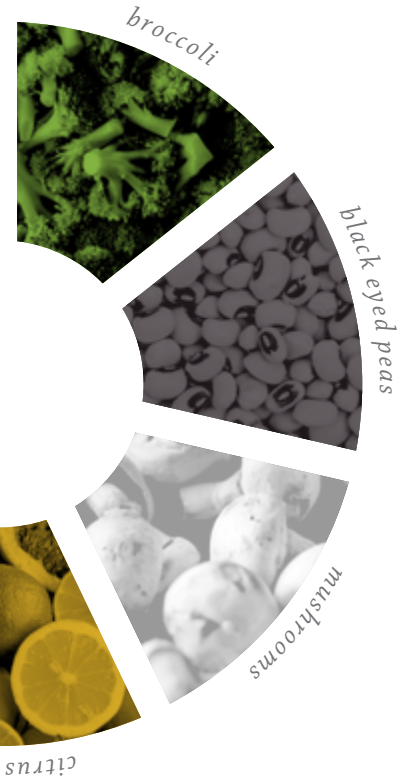
WHOLE FOOD INSIGHTS

Phytonutrients and Color

WHAT ARE PHYTONUTRIENTS?

Phytonutrients are natural, plant-derived compounds that support life and offer protection — innately in plants, but for plant-eating humans as well. For example, a 2014 meta-analysis found that the more vegetables eaten, the lower the risk of all-cause mortality.[1]





WHY CARE ABOUT PHYTONUTRIENTS?

The human body needs phytonutrients in a different way than it needs nutrients like protein, vitamins, and minerals. Phytonutrients are uniquely able to satisfy free radicals that are circulating in the body and looking for electrons. By providing electrons, phytonutrients prevent free radicals from taking electrons from proteins or other nutrients — a "theft" that leads to oxidative stress.

HOW ARE PHYTONUTRIENTS AND FOOD COLOR CONNECTED?

Different plant colors are associated with the beneficial protection of phytonutrients, and encouraging diversity of plant-based colors in a given meal can be a great method for improving diet choices.

WHAT HEALTH BENEFITS DO PHYTONUTRIENTS AND COLOR PROVIDE?

The colors of food have long been associated with improving health conditions. Green foods support heart health and protect against cancer. Red foods align with the cardiovascular system by protecting the heart and blood vessels. Red is also responsible for antioxidant and anti-inflammatory activity. White foods, even though not as "colorful," still yield a tremendous amount of system support by reducing inflammation and lowering cholesterol. Purple improves memory, supports healthy aging, and keeps a healthy heart. Yellow or orange foods protect the gut, support intracellular communication, and support heart health.[2]

POLYPHENOLS

Multiple-phenol compounds with a phenyl group bonded to a hydroxy group; classes of polyphenols include flavonoids, stilbenes, phenolic acids, lignans, and others.

- **FLAVONOIDS:** Antioxidant, anti-inflammatory, anti-mutagenic, and anticarcinogenic; associated with modulation of key cellular enzyme functions; often components of colorful plant pigments
- **STILBENES:** High bioavailability; neuroprotective activity; anti-inflammatory and antioxidant
- **PHENOLIC ACIDS:** Antioxidant, antimicrobial, and anti-cancer
- **LIGNANS:** Antioxidant, anti-inflammatory, anti-tumor; associated with balancing metabolic and hormonal systems

GLUCOSINOLATES

Sulfur-containing compounds associated with cruciferous vegetables; including glucobrassicin, gluconasturtiin, and glucoraphanin, which is hydrolyzed into the bioactive form of sulforaphane, known for antioxidant activity and induction of phase II detoxification enzymes.

CAROTENOIDS

Yellow-orange plant pigments; some associated with provitamin A activity (alpha-carotene, beta-carotene, and beta-cryptoxanthin) as well as lycopene, lutein, and zeaxanthin.

- **LUTEIN & ZEAXANTHIN:** Antioxidant activity, especially in relation to reduced risk of age-related macular degeneration
- **LYCOPENE:** Potential beneficial effects on heart health and prostate health

OTHER BIOACTIVE PLANT COMPOUNDS

Multiple-phenol compounds with a phenyl group bonded to a hydroxy group; classes of polyphenols include flavonoids, stilbenes, phenolic acids, lignans, and others.

- **CHLOROPHYLL:** Green pigment found in plants benefitting the plant through photosynthesis support and benefiting human health for those consuming those plants
- **BETALAINS:** Plant pigments associated with red and yellow colors; known for antioxidant activity; including betacyanins and betaxanthins

WHAT IS GALLIC ACID EQUIVALENCE (GAE)?

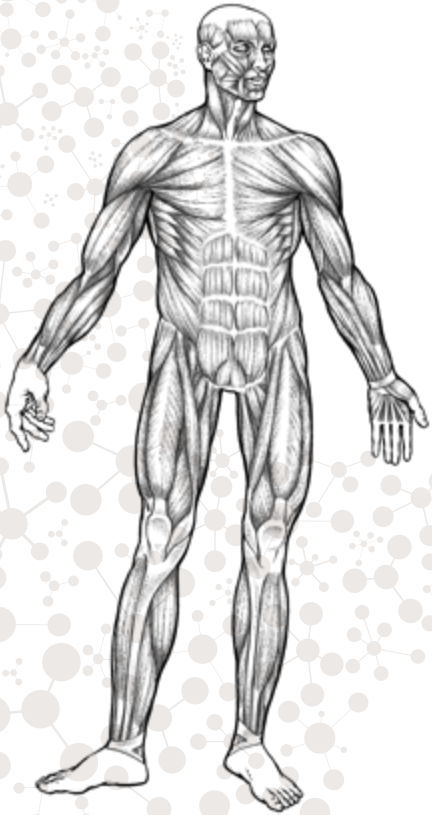
A way to capture total phenolics. Scientists can quantify "total phenolics" between different plants by measuring Gallic Acid Equivalence (GAE), which can be used to compare the amounts of phytonutrients and the total phenolic compound content of different foods. Phenolics are a group of phytonutrients that include phenolic acids, stilbenes, flavonoids, and condensed tannins. Phenolics are universally present in plant-derived foods and have been long-linked to the health properties of a plant-based diet.

WHAT IS THE WHOLE FOOD ADVANTAGE?

The idea of the "whole food advantage" describes the concept that bioactive phytonutrients consumed from whole foods produce stronger health benefits than when the phytonutrient is isolated and consumed alone.[3,4] This idea also includes the notion that some phytonutrients in foods have a synergistic effect when eaten together. Plants have a predominant color that we see, but they also have additional phytonutrients associated with colors seen in other plants. This is part of the whole food advantage – multiple phytonutrients associated with multiple health benefits in just one plant.

THE WHOLE FOOD ADVANTAGE

- Supports balanced immune modulation for healthy inflammation response
- Supports gut microbes and a healthy metabolic fingerprint of the gut
- Enhances nutrient bioavailability up to 60%
- Includes organic and adaptive regenerative farming techniques that deliver a nutrient-dense source of key phytonutrients and help balance healthy lifestyles
- Increases intake of vegetables and fruits in whole food nutrition to influence individual epigenetic expression

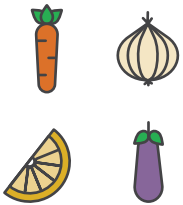


Organic and Sustainable Farming

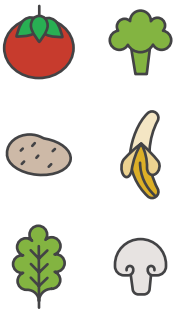
HOW DOES ORGANIC AND SUSTAINABLE FARMING PLAY A ROLE?

Organic and sustainable farms start with a foundation of healthy soil. Healthy soil contains rich biodiversity such as bacteria, fungi, minerals, and other organic matter. This biodiversity promotes water retention, erosion resistance, and higher yield of more nutrient-dense crops.

PHYTONUTRIENT GAP



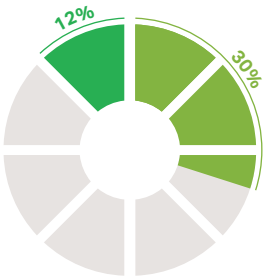
10 SERVINGS
of fruits and vegetables per day can support an overall healthy life.



8 OUT OF 10
Americans have some sort of gap in phytonutrient intake.[5,6]

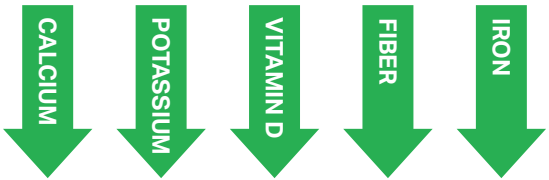
Only **10%** of American adults meet daily recommendations for vegetable intake.[7]

Just over **12%** of American adults meet daily recommendations for fruit intake.[7]



The percentage of Americans consuming **green** fruits and vegetables is under **30%** of the recommended intake.[5,6]

5 SHORTFALL NUTRIENTS



These 5 nutrients fall short in American diets and are of public concern.[8,9]

Potatoes account for more than **25%** of all vegetable consumption.[10,11]

Nearly **80%** do not eat enough green vegetables.[12]

More than **90%** do not eat enough orange and red vegetables.[12]

Daily vegetable intake:
2.5 CUPS [10,11]

Daily fruit intake:
2 CUPS [10,11]

More than **90%** of Americans do not meet this minimum.[10,11]

GREEN

Foods

- *Alfalfa*
- *Barley Grass*
- *Broccoli*
- *Brussels Sprouts*
- *Cabbage*
- *Chard*
- *Collard Greens*
- *Kale*
- *Kalette*
- *Lettuce*
- *Peas*
- *Spinach*
- *Turnip Greens*

Phytonutrients

Chlorophyll
Lutein & Zeaxanthin
Isoflavones
Isothiocyanates
Phytocannabinoids
Myrosinase

BLACK

Foods

- *Alfalfa*
- *Barley*
- *Black Beans*
- *Black Eyed Peas*
- *Chickpeas*
- *Cinnamon*
- *Cloves*
- *Hemp*
- *Oats*
- *Spanish Black Radish*
- *Sorghum*

Phytonutrients

Tannins
Saponins
Phytocannabinoids

WHITE

Foods

- *Apples*
- *Barley*
- *Beetroot*
- *Buckwheat Seed*
- *Garlic*
- *Mushrooms*
- *Oat*
- *Onion*
- *Radish*
- *Tofu*

Phytonutrients

Phenolic Acids
Flavanols
Allicin

YELLOW

Foods

- *Carrots*
- *Citrus Fruit*
- *Lemons*
- *Oranges*
- *Peppers*
- *Pineapple*
- *Sweet Potato*
- *Turmeric*
- *Winter Squash*
- *Yellow Squash*

Phytonutrients

Beta-Carotene
Beta-Cryptoxanthin
Betaxanthins
Flavones
Curcumin
Bromelain
Flavanones

PURPLE

Foods

- *Acai*
- *Aronia Berry*
- *Blueberries*
- *Cherries*
- *Cranberries*
- *Currants*
- *Eggplant*
- *Elderberry*
- *Red Cabbage*
- *Red Wine*
- *Whole Buckwheat Plant*

Phytonutrients

Anthocyanidins
Procyanidins
Stilbenes
Resveratrol

RED

Foods

- *Beets*
- *Cherries*
- *Chilies*
- *Peppers*
- *Pink Grapefruit*
- *Pomegranates*
- *Raspberries*
- *Strawberries*
- *Swiss Chard*
- *Tomatoes*
- *Watermelon*

Phytonutrients

Lycopene
Nitrate
Betacyanins
Ellagic Acid
Capsaicin

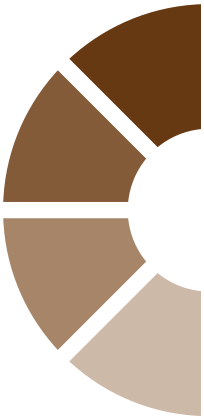
BROWN

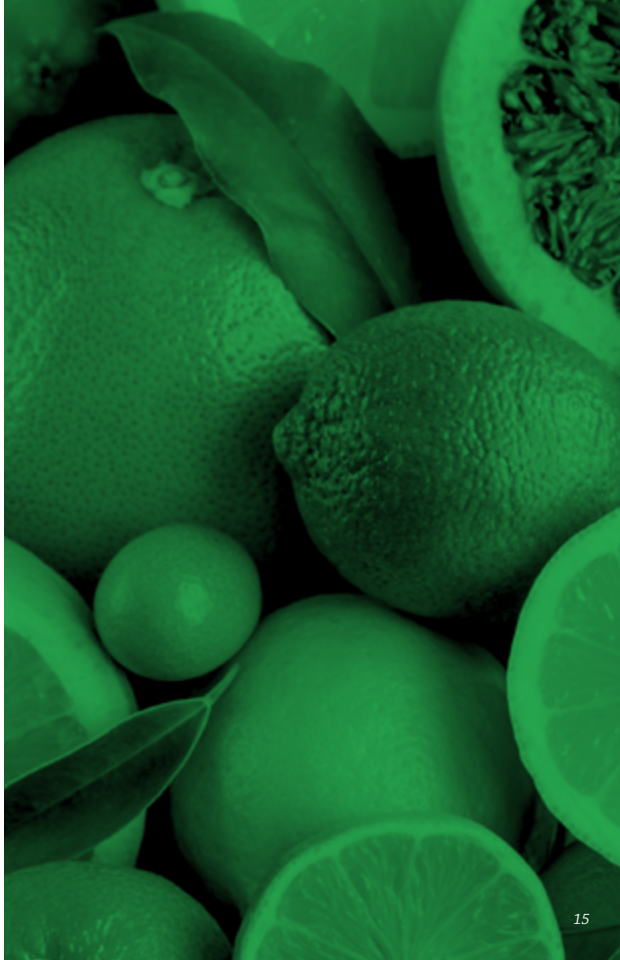
Foods

- *Apricot*
- *Beans*
- *Cocoa*
- *Figs*
- *Flaxseed*
- *Green Banana*
- *Lentils*
- *Mushrooms*
- *Nuts*
- *Oats*
- *Potato*
- *Rye*
- *Tea*

Phytonutrients

Lignans
Beta-Glucans
Theobromine
Resistant Starch
Other Fibers





Fruit and Vegetable Serving Examples

Consumption of fruits and vegetables in America is subpar, yet we know that 10 servings of fruits and vegetables per day can add years to your life. While 10 servings may seem daunting, if you break it into meals and snacks throughout the day, it is actually quite manageable.

For example, along with your other protein, fat, and carbohydrate sources, 10 servings of fruits and vegetables could look like this during the day (see table to the right):

WHAT DOES A DAY OF COLORFUL EATING LOOK LIKE?

2 RED + 3⅓ GREEN + 1 BLUE + 1⅓ ORANGE + 2⅓ WHITE

= 10 SERVINGS

BREAKFAST		
½ cup cooked red bell peppers	1 serving	1 red
½ cup cooked spinach	1 serving	1 green
1 cup raw blueberries	1 serving	1 blue

SNACK		
1 apple	1 serving	1 white

LUNCH		
3 cup loose spinach mix	1 serving	1 green
1 cup chopped raw carrot, cucumber, radish mix	1 serving	⅓ green ⅓ white ⅓ orange

SNACK		
1 cup raw cherry tomatoes	1 serving	1 red

DINNER		
½ cup cooked cauliflower	1 serving	1 white
½ cup cooked broccoli	1 serving	1 green
1 small cooked sweet potato	1 serving	1 orange

ABOUT COLOR OF FOOD SERIES

This overview booklet is just one part of a multi-faceted series on the Color of Food. Understanding the significance of phytonutrient and nutrient gaps, the GAE connection, and the whole food advantage provides the tools needed to make conscious decisions about our health and the health of the people around us.

Please check out other items in the Color of Food Series:

- Featured Crops: Nutrient and Phytonutrient Profiles
- Fruits and Vegetables

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