

The DNA of antioxidants

How they provide nutritional benefits and which foods are the best sources By Karen Ansel, MS, RD

HARDLY A WEEK GOES by without news of antioxidants' health-promoting benefits. Experts believe these nutritional substances may help prevent heart disease, fight certain cancers, ward off dementia, and even slow certain aging processes. There are thousands of antioxidants found in fruits, vegetables, whole grains, nuts, legumes, meats, poultry, and fish. Even foods once not known for being especially healthful, such as chocolate, coffee, and red wine, are now recognized as potent delivery systems for beneficial antioxidants. However, the growing number of antioxidants being discovered (so far, there are more than 4,000 known flavonoids, and that's only one class of antioxidant) and the continual discoveries of new antioxidant food sources cloud understanding of these substances.

"Most people know that calcium is good for bone health, for example, but they don't know specifically what antioxidants do or how these chemicals benefit human health," says Milton Stokes, RD, a spokesperson for the American Dietetic Association.

Read on as we simplify the latest science to answer those questions for you.

Antioxidants 101

We need oxygen to live. It travels from the lungs to every corner of the body, helping cells metabolize food into energy. But oxygen has a downside. Normally, the molecules in our cells have a full set of electrons, which keep them stable (think of them as a fortress surrounding a castle). But when these molecules come into contact with oxygen (i.e., they are "oxidized") they lose an electron, converting to an unstable type of molecule known as a free radical.

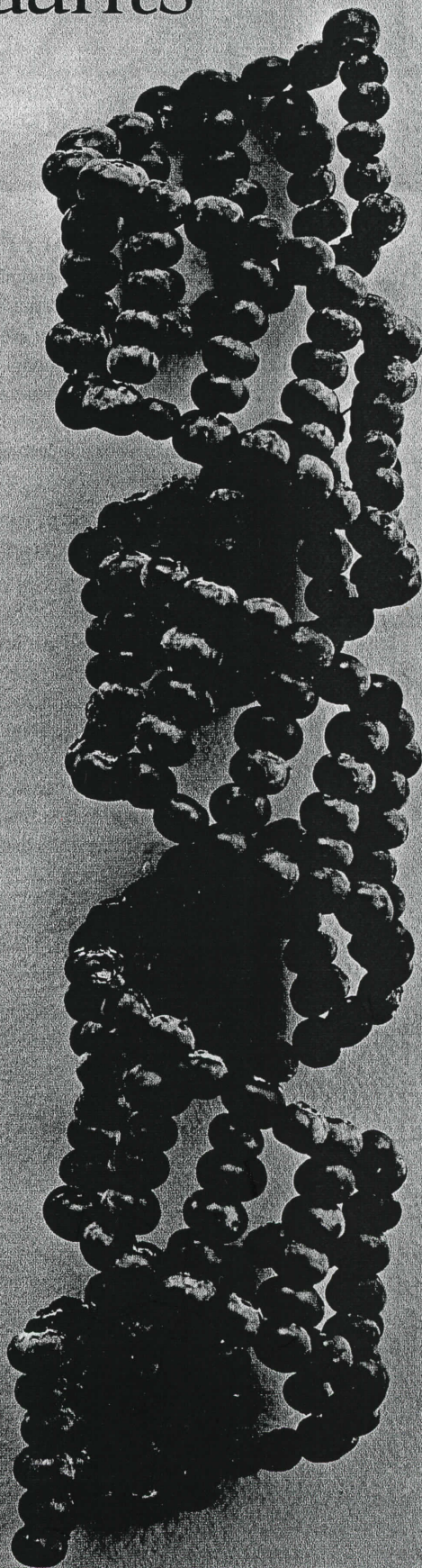
"Free radicals, if left unchecked, assault whatever cell constituents are nearby, including proteins, fats, and DNA," says Joe Vinson, PhD, a professor of chemistry at the University of Scranton.

"Once those molecules are attacked, their structure and function are changed and they don't work as well."

Ingeniously, Mother Nature created an instant free-radical fix. Antioxidants disable free radicals by donating electrons to replace those lost during oxidation.

Some antioxidants can be manufactured by your body; others must be obtained from food. Dietary antioxidants fall into two groups. The first is made up of certain familiar vitamins and minerals, like vitamins C and E, selenium, and zinc, that have antioxidant capabilities. The second consists of the thousands of organic compounds found in plant foods that have functions like giving grapes their purple skins or cabbages their slightly sulfurous odor. They have names like anthocyanidins, catechins, lutein, quercetin, and resveratrol.

Preventing oxidation may have earned antioxidants their name, but we now know these substances do more than disable free radicals. Antioxidants also help reduce inflammation, keep arteries flexible, and preserve the genetic material every cell contains to prevent mutation. Each antioxidant also offers unique perks. For example, flavonoids in berries may help improve artery health, while lutein in spinach may help prevent macular degeneration.



Sorting out food sources

To measure a food's antioxidant content, scientists test it in a lab, where they usually measure equal quantities of each food they test. However, that amount may not be close to the serving size we usually eat. Realizing this, many—but not all—researchers convert their findings to common portion sizes before publishing the results of their work. That's one reason why Monday's health news may place blueberries on top of the antioxidant heap, while Thursday's may claim broccoli contains the highest levels of the compounds.

Also, several kinds of tests are used to measure a food's antioxidant power, another reason for the multiplicity of findings. The most popular test is Oxygen Radical Absorbance Capacity (ORAC). ORAC measures an antioxidant's ability to protect against the

most common free radical in human plasma, the peroxyl radical.

ORAC is a helpful starting point to guide consumers to foods that are rich in antioxidants as part of a diet that contains many different antioxidant-rich foods, especially since new antioxidants are being discovered all the time. But most nutrition researchers view antioxidant-counting surveys critically. How a food behaves in a test tube is one thing; how it behaves in our bodies is another.

"We don't know as much about what happens during digestion, absorption, and metabolism," says Ronald L. Prior, PhD, a research chemist with the USDA's Arkansas Children's Nutrition Center. "Some of these compounds may be absorbed well and others not as well." Anthocyanidin-rich blueberries are a good example. They may be antioxidant

ON THE WEB

Anteup
Optimize your diet
with our guide to colorful
antioxidant-rich produce.
CookingLight.com/features

powerhouses in a test tube, but we don't absorb their antioxidants well and their effectiveness in our bodies is short lived. To gain the full benefit, you'd likely need to eat more of them than foods with a lower ORAC score that contain more readily absorbable antioxidants, such as kiwi-fruit or grapes.

What's more, antioxidant levels vary among different samples of the same food. For example, all apples don't have the same amount of quercetin and all lettuces don't provide the same dose of lutein. "The variability has to do with the climate, the nutrients in the soil, and storage conditions," Vinson says.

Growing and storing conditions can affect antioxidant levels in different samples of the same food.



Eating for optimal nutrition

When it comes to dietary antioxidants, variety and timing are the key points.

Experts agree—while there's no formal recommendation for the amount of antioxidants we need—the best way to obtain them is from a varied diet. The reason? Antioxidants work synergistically and may provide a greater benefit together than they do individually. Consider a recent *European Journal of Clinical Nutrition* study that found the total antioxidants in a person's diet had a more substantial impact on plasma beta-carotene levels than the amount of beta-carotene in a person's diet. Researchers surmise other antioxidants pitch in to “spare” beta-carotene so it can work harder when it's needed. The same is true for other antioxidant vitamins. By consuming antioxidant-rich foods, you end up protecting or recycling compounds like vitamins C and E, increasing their levels so they're more available to function.

Unlike many other nutrients, you can't store antioxidants, so you have to keep replenishing the supply. “The important thing is getting antioxidants throughout the day and keeping levels high because they go

down very quickly,” Vinson says. Even small amounts can provide significant benefits. When German researchers recently looked at the impact of small amounts of polyphenols in dark chocolate on blood pressure, they found that just 0.2 ounces of dark chocolate shaved three systolic points and two diastolic points off hypertensive subjects' blood pressure.

As for supplements? Experts aren't as enthusiastic. Supplements are not substitutes for a healthy diet. “People tend to focus on a single nutrient because that's what research may be highlighting,”

says Jeffery Blumberg, PhD, director of the Antioxidants Research Laboratory at Tufts University. “But the benefits of eating lots of fruits, vegetables, and whole grains can't be overemphasized. You need to have diversity in your diet, and there is no pill that provides it all.”

The unknowns about antioxidants provide another reason to focus on food sources. “Because the science of nutrition is still evolving, we have to accept that everything there is to know isn't known,” Stokes says. “Until then, just eat healthy whole foods.”

“You need to have diversity in your diet, and there is no pill that provides it all.”



The ABCs of antioxidants

Although scientists speculate that many antioxidants are as yet undiscovered, others are increasingly well known. Below are antioxidants you may have read about; they're categorized by family of associated compounds and listed with some of their most common food sources.

Carotenoids

- **Beta-carotene**
Orange/yellow fruits and vegetables (carrots, cantaloupe); dark leafy greens (spinach, kale)
- **Lycopene**
Red-fleshed fruits and vegetables (watermelon, tomato)
- **Lutein/Zeaxanthin**
Romaine lettuce, dark leafy greens, citrus fruits, corn, egg yolks

Flavonoids

- **Anthocyanidins**
Berries, grapes, wine
- **Catechins**
Tea, cocoa
- **Flavonols**
Tea, cocoa, coffee, berries, grapes, apples, wine
- **Flavonones**
Citrus fruits
- **Isoflavones/Phytoestrogens (daidzein, equol, enterolactone, genistein)**
Soybeans, whole wheat, flaxseed
- **Quercetin**
Apples, tea, capers, citrus fruits

Organosulfurs

Cabbages, Brussels sprouts, cauliflower

Selenium

Brazil nuts, red meat, tuna

Sulfides

Onions, garlic, leeks, chives

Vitamin C

Citrus fruits, bell peppers, broccoli, kiwifruit

Vitamin E (tocopherols)

Wheat germ, mono-unsaturated oils (sunflower oil, safflower oil), tree nuts (almonds, hazelnuts), peanuts

Vetting antioxidant tests

Many over-the-counter tests claim to evaluate a person's free radical levels by measuring by-products of free radical metabolism via a urine sample. However, assessing antioxidant status isn't that simple. No single test will provide the total picture of what antioxidants may be busy doing inside your body. "What you want to measure is antioxidant concentration in a localized part of the body, like the surface of your arteries where antioxidants help neutralize free radicals, which accelerate atherosclerosis [hardening of the arteries]," Vinson says. A simpler insurance policy? Following U.S. Dietary Guidelines, which recommend a minimum of four-and-a-half cups of produce and three ounces of whole grains each day. "If you're eating a varied diet with lots of fruits and vegetables, you're getting enough," Vinson says. ☺

Karen Ansel, MS, RD, is a freelance writer and registered dietitian in Long Island, New York.

