



[REALITY IS THE BEST MEDICINE HARRIET HALL

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Antioxidants: The Hype and the Reality

Everyone is talking about antioxidants, but misconceptions abound. For example, I just received an email that described antioxidants as “the ability to soak up toxins in the body.” One dictionary definition of an antioxidant is “(1) a substance that inhibits oxidation, especially one used to counteract the deterioration of stored food products [and] (2) a substance such as vitamin C or E that removes potentially damaging oxidizing agents in a living organism.”

First, what is oxidation? It is the loss of electrons during a chemical reaction and may not involve oxygen at all. It’s the opposite of reduction, where electrons are gained. In redox reactions, oxidation and reduction occur simultaneously when an electron is transferred from one place to another.

Free Radicals

Two other terms that are frequently mentioned along with antioxidants are *free radicals* and *oxidative stress*. Free radicals are unstable molecules that are missing an electron from their outer shell. They react readily with other molecules that can give up an electron to replace the one that is missing. Most of them have short lifetimes. Free radicals are produced naturally in the body. They can also result from ionizing radiation, heat, electrical discharges, electrolysis, smoking, alcohol, and stress. Some free radicals are necessary for life. One important function is the killing of bacteria by phagocytic cells. But they can cause harm. They have been implicated in many diseases, including Parkinson’s disease, Alzheimer’s disease, schizophrenia, hemochromatosis, cancer, asthma, diabetes, degenerative joint disease, senile



dementia, and degenerative eye disease, as well as aging. The body produces its own antioxidants to repair the damage caused by free radicals. When free radicals accumulate in excess of the body’s ability to destroy them, the result is called oxidative stress.

Recommendations for Foods High in Antioxidants

Research has not shown health benefits from antioxidant supplements, so we are advised to get our antioxidants from dietary sources. Commonly recommended foods that are said to be good sources of antioxidants include blueberries, dark chocolate, artichokes, pecans, strawberries, red cabbage, rasp-

berries, beans, red grapes, spinach, beets, kale, and orange vegetables (e.g., sweet potatoes, squash, and carrots). But other lists include a great variety of other foods, from coffee and green tea to red wine, mangos, lean meat, milk, onions, fish, seafood, and nuts. The Better Health Channel, a service of the State of Victoria in Australia, says “Research is divided over whether antioxidant supplements offer the same health benefits as antioxidants in foods” (Better Health Channel n.d.) Then it provides a long list of good food sources of specific antioxidants and ends by recommending we eat a variety of foods from the five main food groups: vegetables and legumes, fruits, whole grain foods and cereals, lean meat (including poultry and alternatives such as fish, eggs, tofu, legumes, nuts, and seeds), and dairy and dairy alternatives, mostly low fat. This is essentially the standard dietary advice for healthy eating in general.

Every source I could find recommended getting our antioxidants from food rather than from supplements, but the National Institutes of Health (NIH) offered a word of caution:

Research has shown that people who eat more vegetables and fruits have lower risks of several diseases; however, it is not clear whether these results are related to the amount of antioxidants in vegetables and fruits, to other components of these foods, to other factors in people’s diets, or to other lifestyle choices. (National Center for Complementary and Integrative Health 2013)

For instance, people who eat more antioxidant-rich foods might be more likely to exercise and less likely to smoke. So antioxidants from foods may not be beneficial either.

Results of Studies

Laboratory experiments showed that antioxidants interact with free radicals to stabilize them and prevent them from causing cell damage.

Double-blind clinical trials tell a different story. Antioxidants are largely ineffective in preventing disease and often cause harm (National Center for Complementary and Integrative Health 2013):

Beta carotene not only failed to reduce the risk of cancer and cardiovascular disease, but it increased the risk of lung cancer in smokers.

In the Women's Health Study, vitamin E failed to reduce the risk of heart attack, stroke, cancer, age-related macular degeneration, or cataracts and did not reduce the overall death rate.

The Women's Antioxidant Cardiovascular Study looked at several antioxidant supplements (vitamin C, vitamin E, and beta-carotene) in high-risk women and found no reduction in the risk of cardiovascular events, diabetes, or cancer and no slowing of changes in cognitive function in the elderly.

The Physician's Health Study II found no decrease in the risk of cardiovascular events, cancer, or cataracts with supplemental vitamin C or E, but it did find an increased risk of hemorrhagic stroke.

The SELECT trial showed that selenium and vitamin E did not prevent prostate cancer. On the contrary, vitamin E taken alone increased the risk of prostate cancer by 17 percent.

Most clinical trial results were negative, but not all of them. The AREDS2 Study found that lutein and zeaxanthin reduced the rate of progression of age-related macular degeneration without increasing cancer risk (National Center for Complementary and Integrative Health 2013).

In a 2018 review of "oxidative stress, aging, and diseases" the authors cautioned: "antioxidant therapy could positively affect the natural history of several diseases, but further investigation is needed to evaluate the real efficacy of these therapeutic interventions" (Liguori et al. 2018).

Yes! That's a key insight that goes a long way toward explaining the large

discrepancy between the hype about antioxidants and the actual evidence. The antioxidant story is appealing and internally coherent, but it's based largely on theory and speculation rather than on actual clinical results. It is logical that antioxidants should reduce the risk of many diseases, but when rigorously tested that doesn't pan out. It may be that free radicals are present in those diseases but in such small amounts that their contribution to causation is minimal or nonexistent.

What Are Some Antioxidants?

An article from Harvard Medical School lists these:

Vitamin C: Broccoli, Brussels sprouts, cantaloupe, cauliflower, grapefruit, leafy greens (turnip, mustard, beet, collards), honeydew, kale, kiwi, lemon, orange, papaya, snow peas, strawberries, sweet potato, tomatoes, and bell peppers (all colors)

Vitamin E: Almonds, avocado, Swiss chard, leafy greens (beet, mustard, turnip), peanuts, red peppers, spinach (boiled), and sunflower seeds

Carotenoids including beta-carotene and lycopene: Apricots, asparagus, beets, broccoli, cantaloupe, carrots, bell peppers, kale, mangos, turnip and collard greens, oranges, peaches, pink grapefruit, pumpkin, winter squash, spinach, sweet potato, tangerines, tomatoes, and watermelon

Selenium: Brazil nuts, fish, shellfish, beef, poultry, barley, brown rice

Zinc: Beef, poultry, oysters, shrimp, sesame seeds, pumpkin seeds, chickpeas, lentils, cashews, fortified cereals

Phenolic compounds: Quercetin (apples, red wine, onions), catechins (tea, cocoa, berries), resveratrol (red and white wine, grapes, peanuts, berries), coumaric acid (spices, berries), anthocyanins (blueberries, strawberries). (Harvard T.H. Chan School of Public Health n.d.)

Other lists include a variety of other foods said to be antioxidants. It leaves one to wonder if any food is *not* an antioxidant. And good news for those of us who love coffee: coffee is said to be a major source of antioxidants in people's daily diets.

The information is far from straight-

forward. Under some circumstances, antioxidants can even act as pro-oxidants.

I Was Fooled

As I began by saying, there are a lot of misconceptions about antioxidants. I, too, was a victim of the hype. I had seen so much information about free radicals and antioxidants that the sheer volume made me think there must be something to it. As I started to question the hype and look for the scientific evidence, I quickly realized that there wasn't much to be found. Antioxidant supplements are largely ineffective and eating antioxidant foods is also largely ineffective. Neither seems to reduce the risk of diseases said to be caused by free radicals and oxidative stress.

The confusion is understandable. The foods that are high in antioxidants also happen to be part of the commonly recommended healthy diet. Eating blueberries is good for our health—not because of the antioxidants they contain but because of their many other components.

Conclusion: A Lot of Hype, Little Evidence

I was a believer, but now I'm a skeptic. Antioxidant supplements don't work, and neither do diets high in antioxidants. I don't think we should waste our time thinking about the antioxidant content of our foods. Our best bet is to eat a varied diet that conforms to the widely publicized standard evidence-based guidelines for healthy eating. ■

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