

# **An apple a day keeps doctor away**

## **What is an antioxidant?**

An **antioxidant** is a molecule capable of slowing or preventing the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Oxidation reactions can produce free radicals, which start chain reactions that damage cells. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions by being oxidized themselves. As a result, antioxidants are often reducing agents such as thiols or polyphenols.

Although oxidation reactions are crucial for life, they can also be damaging; hence, plants and animals maintain complex systems of multiple types of antioxidants, such as glutathione, vitamin C, and vitamin E as well as enzymes such as catalase, superoxide dismutase and various peroxidases. Low levels of antioxidants, or inhibition of the antioxidant enzymes, causes oxidative stress and may damage or kill cells.

As oxidative stress might be an important part of many human diseases, the use of antioxidants in pharmacology is intensively studied, particularly as treatments for stroke and neurodegenerative diseases. However, it is unknown whether oxidative stress is the cause or the consequence of disease. Antioxidants are also widely used as ingredients in dietary supplements in the hope of maintaining health and preventing diseases such as cancer and coronary heart disease.

## **Disease prevention**

Antioxidants can cancel out the cell-damaging effects of free radicals. Furthermore, people who eat fruits and vegetables, which are good sources of antioxidants, have a lower risk of heart disease and some neurological diseases, and there is evidence that some types of vegetables, and fruits in general, probably protect against a number of cancers. These observations suggested that antioxidants might help prevent these conditions. There is some evidence that antioxidants might help prevent diseases such as macular degeneration, suppressed immunity due to poor nutrition, and neurodegeneration. However, despite the clear role of oxidative stress in cardiovascular disease, controlled studies using antioxidant vitamins have observed no reduction in either the risk of developing heart disease, or the rate of progression of existing disease. This suggests that other substances in fruit and vegetables (possibly flavonoids), or a complex mix of substances, may contribute to the better cardiovascular health of those who consume more fruit and vegetables.

It is thought that oxidation of low density lipoprotein in the blood contributes to heart disease, and initial observational studies found that people taking Vitamin E supplements had a lower risk of developing heart disease. Consequently, at least seven large clinical trials were conducted to test the effects of antioxidant supplement with Vitamin E, in doses ranging from 50 to 600 mg per day. However, none of these trials found a statistically significant effect of Vitamin E on overall number of deaths or on deaths due to heart disease. Further studies have also been negative. It is not clear if the doses used in these trials or in most dietary supplements are capable of producing any significant decrease in oxidative stress.

Many nutraceutical and health food companies now sell formulations of antioxidants as dietary supplements and these are widely used in industrialized countries. These supplements may include specific antioxidant chemicals, like resveratrol (from grape seeds or knotweed roots), combinations of antioxidants, like the "ACES" products that contain beta carotene (provitamin A), vitamin C, vitamin E and Selenium, or herbs that contain antioxidants - such as green tea and jiaogulan. Although some levels of antioxidant vitamins and minerals in the diet are required for good health, there is considerable doubt as to whether antioxidant supplementation is beneficial, and if so, which antioxidant(s) are beneficial and in what amounts.

It has been suggested that moderate levels of oxidative stress may increase life expectancy in the worm *Caenorhabditis elegans*, by inducing a protective response to increased levels of reactive oxygen species. However, the suggestion that increased life expectancy comes from increased oxidative stress conflicts with results seen in the yeast *Saccharomyces cerevisiae*, and the situation in mammals is even less clear. However, antioxidant supplements do not appear to increase life expectancy.

## **Disease treatment**

The brain is uniquely vulnerable to oxidative injury, due to its high metabolic rate and elevated levels of polyunsaturated lipids, the target of lipid peroxidation. Consequently, antioxidants are commonly used as medications to treat various forms of brain injury. Here, superoxide dismutase mimetics, sodium thiopental and propofol are used to treat reperfusion injury and traumatic brain injury, while the experimental drug NXY-059 and ebselen are being applied in the treatment of stroke. These compounds appear to prevent oxidative stress in neurons and prevent apoptosis and neurological damage. Antioxidants are also being investigated as possible treatments for neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, and amyotrophic lateral sclerosis, and as a way to prevent noise-induced hearing loss.

## **The Top 20 Foods Highest In Antioxidants**

### **Apple**

The proverb "An apple a day keeps the doctor away," addressing the health effects of the fruit, dates from 19th century Wales. Research suggests that apples may reduce the risk of colon cancer, prostate cancer and lung cancer. Compared to many other fruits and vegetables, apples contain relatively low amounts of Vitamin C as well as several other antioxidant compounds. The fiber content, while less than in most other fruits, helps regulate bowel movements and may thus reduce the risk of colon cancer. They may also help with heart disease, weight loss and controlling cholesterol, as they do not have any cholesterol, have fiber, which reduces cholesterol by preventing reabsorption, and are bulky for their caloric content like most fruits and vegetables.

There is evidence that in vitro apples possess phenolic compounds which may be cancer-protective and demonstrate antioxidant activity. The predominant phenolic phytochemicals in apples are quercetin, epicatechin, and procyanidin B2.

Apple juice concentrate has been found to increase the production of the neurotransmitter acetylcholine in mice, providing a potential mechanism for the "prevention of the decline in cognitive performance that accompanies dietary and genetic deficiencies and aging." Others studies have shown an "alleviation of oxidative damage and cognitive decline" in mice after the administration of apple juice. The seeds are mildly poisonous, containing a small amount of amygdalin, a cyanogenic glycoside; usually not enough to be dangerous to humans, but it can deter birds.

### **Small red beans**

People in the United States eat a diet that is very high in fat, often amounting to 40 – 50 percent of their total daily calories. High-fat animal-derived foods have been linked with cancer time and time again.

Your body needs fat, so choose to eat the foods that have the good kind of fat. Beans and legumes are an unusually good choice, because in addition to providing the good fat, they are also chock full of protein and dietary fiber. They are also loaded with complex carbohydrates, the nutrients that are responsible for providing energy to the muscles and brain.

Because they have a low glycemic index, beans have the unique ability to provide energy over a sustained period of time by being slowly released into your blood stream. Also, beans are a great source of dietary fiber, which promotes a healthy digestive tract, helps lower blood cholesterol levels, and can reduce the risk of some types of cancer.

## **Wild blueberries**

Wild Blueberries may be small but they pack a healthy punch! Sweet, tangy and intensely blue, Wild Blueberries are rich in phytonutrients — antioxidants such as anthocyanin, as well as anti-inflammatories. These natural substances, found in fruits and vegetables, are believed to protect against disease and promote healthy aging and with their powerful natural antioxidant qualities, Wild Blueberries are at the top of the antioxidant fruits.

## **Red kidney beans**

Red Kidney beans are a very good source of cholesterol-lowering fiber, as are most other beans. In addition to lowering cholesterol, kidney beans' high fiber content prevents blood sugar levels from rising too rapidly after a meal, making these beans an especially good choice for individuals with diabetes, insulin resistance or hypoglycemia. When combined with whole grains such as rice, kidney beans provide virtually fat-free high quality protein. But this is far from all kidney beans have to offer. Kidney beans are an excellent source of the trace mineral, molybdenum, an integral component of the enzyme sulfite oxidase, which is responsible for detoxifying sulfites. Just one cup of cooked kidney beans supplies 177.0% of the daily value for molybdenum. Sulfites are a type of preservative commonly added to prepared foods like delicatessen salads and salad bars. Persons who are sensitive to sulfites in these foods may experience rapid heartbeat, headache or disorientation if sulfites are unwittingly consumed. If you have ever reacted to sulfites, it may be because your molybdenum stores are insufficient to detoxify them.

## **Pinto beans**

Pinto beans are an excellent source of molybdenum, a very good source of folate and manganese, and a good source of protein and vitamin B1 as well as the minerals phosphorus, iron, magnesium, potassium, and copper.

## **Cultivated blueberries**

Researchers have shown that blueberry anthocyanins, proanthocyanidins, resveratrol, flavonols, and tannins inhibit mechanisms of cancer cell development and inflammation in vitro. Similar to red grape, some blueberry species contain in their skins significant levels of resveratrol, a phytochemical.

Consumption of blueberries (and similar berry fruits including cranberries) may alleviate the cognitive decline occurring in Alzheimer's disease and other conditions of aging.

## **Cranberries**

Cranberries are a source of polyphenol antioxidants, phytochemicals under active research for possible benefits to the cardiovascular system, immune system and as anti-cancer agents.

Cranberry juice contains a chemical component, a high molecular weight non-dializable material (NDM), as noted above, that is able to inhibit and even reverse the formation of plaque by *Streptococcus mutans* pathogens that cause tooth decay. Cranberry juice components also show efficacy against formation of kidney stones.

Raw cranberries and cranberry juice are abundant food sources of the anthocyanidin flavonoids, cyanidin, peonidin and quercetin. These compounds have an unknown effect on human health, but are powerful against human cancer cells in vitro. Their effect in humans, however, is unproven, showing poor absorption into human cells and rapid elimination from blood.

## **Artichokes**

Dried or fresh leaves and/or stems of *Cynara* are used to increase bile production. Cynarin, an active constituent in *Cynara*, causes an increase in bile flow.

## **Blackberries**

Blackberries are exceptional among other *Rubus* berries for their numerous, large seeds not always preferred by consumers. They contain rich amounts of omega-3 (alpha-linolenic acid) and -6 fats (linoleic acid), protein, dietary fiber, carotenoids, ellagitannins and ellagic acid.

## **Prunes**

Prune juice is made by softening prunes through steaming and then putting them through a pulper to create a watery puree. Prunes and their "juice" contain the natural laxative dihydrophenylisatin (related to isatin). For fast results use heated prune juice. Prunes also contain dietary fiber (about 6%, or 0.06 g per gram of prune). Prunes and prune juice are thus common home remedies for constipation. Prunes also have a high antioxidant content.

## **Raspberries**

Raspberries contain significant amounts of polyphenol antioxidants such as anthocyanin pigments linked to potential health protection against several human diseases. The aggregate fruit structure contributes to its nutritional value, as it increases the proportion of dietary fiber, placing it among plant foods with the highest fiber contents known, up to 20% fiber per total weight. Raspberries are a rich source of vitamin C, with 30 mg per serving of 1 cup (about 50% daily value), manganese (about 60% daily value) and dietary fiber (30% daily value). Contents of B vitamins 1-3, folic acid, magnesium, copper and iron are considerable in raspberries.

## **Strawberries**

The ellagitannin content of strawberries has actually been associated with decreased rates of cancer death. In one study, strawberries topped a list of eight foods most linked to lower rates of cancer deaths among a group of over 1,000 elderly people. Those eating the most strawberries were three times less likely to develop cancer compared to those eating few or no strawberries.

## **Red delicious apples**

Apples, and especially apple peels, have been found to have a potent antioxidant activity (scavenges free radicals) that can inhibit the growth of cancer cells, with the antioxidant activity of one apple equivalent to about 1500 mg of vitamin C.

And recent animal and cell culture studies suggest there is an association between polyphenolic compounds found in apples and a wide variety of effects that may help prevent chronic disease. This supports the hypothesis that it is the phytochemicals found in fruits, especially apples that impart healthy benefits.

Red Delicious, Northern Spy and Ida Red have more potent disease-fighting antioxidants reflected in higher levels of polyphenol activity, claim researchers at Agriculture and Agri-Food Canada that tested a variety of different species.

## **Granny Smith apples**

Granny Smith apples are a light speckled green in color, though some may have a pink blush. They are crisp, juicy, tart apples that are excellent for cooking, or eating out of hand. They also are favored for salads because the slices do not brown as quickly as other varieties.

## **Pecans**

Pecans are a good source of protein and unsaturated fats. A diet rich in nuts can lower the risk of gallstones in women. The antioxidants and plant sterols found in pecans reduce high cholesterol by reducing the "bad" LDL cholesterol levels.

Clinical research published in the Journal of Nutrition (September 2001) found that eating about a handful of pecans each day may help lower cholesterol levels similar to what is often seen with cholesterol-lowering medications. Research conducted at the University of Georgia has also confirmed that pecans contain plant sterols, which are known for their cholesterol-lowering ability.

## **Sweet cherries**

Sweet cherry is the fruit of *Prunus avium* tree of the rose family. Sweet cherry originated in Asia, supposedly in Asian Turkey, and then distributed all over Europe. The wood of *Prunus avium* valued among mahogany furniture manufacturers and they produce the furniture of superior quality with this wood. Sweet cherry is a fleshy juicy fruit with thin shiny skin. The color of this amazing fruit varies from yellow to deep red. Sweet cherry is eaten fresh when the season comes (May-July) and used for making compotes and jams. In some countries, sweet cherry oil is extracted from the seed cores. Absolute alcohol preservation is another way to can fresh sweet cherry. Later on, you can use canned fruit for garnishing cocktails and confectionaries. Usually, sweet cherry is eaten fresh as a dessert or used as an ingredient in various fresh fruit salads.

## **Black plums**

The fresh version (plums) and the dried version (prunes) of the plant scientifically known as *Prunus domestica* have been the subject of repeated health research for their high content of unique phytonutrients called neochlorogenic and chlorogenic acid. These substances found in plum and prune are classified as phenols, and their function as antioxidants has been well-documented.

## **Russet potatoes**

Potatoes are a very popular food source. Unfortunately, most people eat potatoes in the form of greasy French fries or potato chips, and even baked potatoes are typically loaded down with fats such as butter, sour cream, melted cheese and bacon bits. Such treatment can make even baked potatoes a potential contributor to a heart attack. But take away the extra fat and deep frying, and a baked potato is an exceptionally healthful low calorie, high fiber food that offers significant protection against cardiovascular disease and cancer.

## **Black beans**

Black beans are an excellent source of the trace mineral, molybdenum, an integral component of the enzyme sulfite oxidase, which is responsible for detoxifying sulfites. Sulfites are a type of preservative commonly added to prepared foods like delicatessen salads and salad bars. Persons who are sensitive to sulfites in these foods may experience rapid heartbeat, headache or disorientation if sulfites are unwittingly consumed. If you have ever reacted to sulfites, it may be because your molybdenum stores are insufficient to detoxify them. A cup of black beans will give you 172.0% of the daily value for this helpful trace mineral.

## **Plums**

Plum fruit is sweet and juicy and it can be eaten fresh or used in jam-making or other recipes. Plum juice can be fermented into plum wine; when distilled, this produces a brandy known in Eastern Europe as Slivovitz, Rakia, Tzuica or Palinka. Dried plums are known as prunes. Prunes are also sweet and juicy and contain several antioxidants.

These damage-preventing substances are particularly effective in neutralizing a particularly destructive oxygen radical called superoxide anion radical, and they have also been shown to help prevent oxygen-based damage to fats, such as the fats that comprise a substantial portion of our brain cells or neurons, the cholesterol and triglycerides circulating in our bloodstream, or the fats that make up our cell membranes.