

USAF
Green Tea
Apple Fruit
Selenium
Turmeric
Resveratrol
Acai Berry
Mangosteen
Quercetin



**MORE THAN
A POWERFUL
ANTIOXIDANT**

GREEN TEA EXTRACT (DECAFFEINATED)

Green tea (*Camellia sinensis*) is different from black tea in that it is not fermented. Leaves used to make green tea are prepared immediately after harvest to preserve their beneficial phytochemicals.¹ Clinical trials have demonstrated that green tea significantly increases antioxidant activity in the blood.² Green tea offers antioxidant protection against diseases and protects the cells against chromosome damage by reducing free radical oxidative DNA damage and lipid peroxidation.

The beneficial properties of green tea are primarily attributed to polyphenols, which are potent antioxidant phytochemicals. Polyphenolic constituents of green tea are classified as catechins. There are several types of these water-soluble compounds in green tea, including epigallocatechin-3-gallate (EGCG), epigallocatechin (EGC), epicatechin gallate (ECG) and epicatechin (EC). EGCG is considered to be the most active of the green tea polyphenols.¹

Green tea polyphenols appear to have antimutagenic effects. They may protect DNA from damage and protect against abnormal cell growth.¹ Several studies have shown that green tea decreases cell proliferation and/or increases cell death of a variety of abnormal cell lines.² Recent research found that one of the mechanisms by which green tea protects against abnormal cell growth is by binding to a specific protein known as HSP90. This protein is found in higher levels in abnormally dividing cells. When HSP90 is blocked, levels of proteins that contribute to abnormal cell growth decrease.³

The antioxidant effects of green tea polyphenols may prevent the oxidation and death of neurons (brain cells), which may protect against the development of cognitive dysfunction and neurodegenerative diseases.¹ Green tea polyphenols have also been shown to prevent skin damage from ultraviolet (UV) radiation due to their antioxidant actions.^{1,2}

Studies have demonstrated that catechins and epicatechins in green tea inhibit LDL oxidation, which has a protective effect on the cardiovascular system.² Green tea has been found to be a much more potent antioxidant than both vitamins E and C.⁴

Catechins in green tea may have anti-inflammatory actions.¹ Studies show that green tea polyphenols seem to lessen the degeneration of joints.¹ They may protect cartilage by inhibiting proteoglycan and collagen breakdown.¹ Supplementing with green tea may have a positive effect on bone mineral density. The exact mechanism for the positive effect on bone is not known. Green tea polyphenols may inhibit the resorption of bone and thereby increase mineral metabolism.¹

EGCG in green tea may support a healthy intestinal flora population by increasing levels of the probiotics lactobacilli and bifidobacteria and reducing levels of potentially harmful enterobacteria.¹



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APPLE FRUIT EXTRACT

Apple fruit extract comes from the skin and fruit of apples (*Malus domestica*). The major antioxidant components in apples are more highly concentrated in the skin of the apple than the fruit. These compounds include quercetin glycoside, procyanidin B, phloretin glycoside, chlorogenic acid and epicatechin. Apple fruit extract provides concentrated amounts of beneficial polyphenolic compounds, including procyanidins. Procyanidins have attracted attention due to their potential health benefits as powerful antioxidants, offering protection for the cardiovascular system and other body systems. One apple may contain several hundred milligrams of polyphenols, which is considerably more than one serving of red wine.^{1,2}

Phenolic antioxidants play an important role in the prevention of oxidative damage by free radicals.³ In a recent study, apple extract decreased and prevented oxidative damage to gastric cells, suggesting apple extract may be useful in protecting stomach and intestinal lining from injury by free radicals as well as from NSAIDs (non-steroidal anti-inflammatory drugs), which can cause gastric ulcers.³ These effects were thought to be due to the antioxidant activity of apple polyphenols.³

Population studies have linked the antioxidant actions of apple polyphenols with a lower risk of cellular abnormalities.⁴ In laboratory and animal studies, apple polyphenols have been shown to inhibit the growth of cancerous colon cells.^{5,6} In human lung cells, apple fruit was shown to efficiently neutralize hydroxyl free radicals, thereby reducing lipid peroxidation, DNA damage, cell death and the activation of a protein complex involved in abnormal cellular growth.⁷

Apples offer other health benefits. They contain a phytochemical called phloretin, which provides immune support by inhibiting bacterial activity.⁸ Apple polyphenols have been shown to suppress the release of histamine (a chemical that causes inflammation and itching), and studies indicate that apple polyphenol extract may help reduce both respiratory and skin allergies.^{4,9} Recent studies suggest that apple polyphenols have a positive effect on cholesterol levels¹⁰ and have been shown to inhibit triglyceride absorption.⁴

Apple fruit extract can benefit the structural system. In one study, supplementing with apple fruit extract had a positive impact on body composition by reducing body fat and improving fat metabolism.⁴ One laboratory study indicates that the antioxidant and inflammation-reducing properties of apple polyphenols (specifically phloridzin) may prevent bone loss by improving bone resorption.⁴ Procyanidin B-2 from apple fruit may promote hair growth on the scalp. A study using apple procyanidin B-2 for four months showed a significant increase in the amount and diameter of hair compared to that of a placebo group.¹¹



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SELENIUM

Selenium is a trace mineral found in water, soil and some foods. In plant foods, selenium content is dependent on the quality of the soil in which the plants grow. Likewise, in animal foods, selenium content is dependent on the quality of the foods available to them. Good sources of selenium include grains, nuts, meats and seafood. However, refining or processing these sources can destroy selenium. For those with digestive conditions such as Crohn's disease, the body's ability to absorb selenium is limited.^{1,2} Although trace minerals are needed only in small amounts for optimal health, nutrient-depleted soils and health conditions can lead to deficiencies. Selenium plays a vital role in neutralizing the harmful effects of free radicals in the body, as well as aiding thyroid and immune function.²

While selenium itself is not a potent antioxidant nutrient, it is a crucial component that the body needs to form antioxidant enzymes, known as selenoproteins.^{2,3} Super ORAC contains selenium primarily in the natural form selenomethionine, along with small amounts of other natural selenoproteins. Selenomethionine is absorbed at approximately 95%.⁴ After binding to a plasma protein called selenoproteins P., selenomethionine can be transported and stored throughout the body.⁵

A large part of selenium's physiological function as an antioxidant has to do with its incorporation into glutathione peroxidase (GPX). GPX is a collective term for four enzymes (GPX 1–4) that work throughout the body to reduce oxidative stress from free radicals and hydrogen peroxide. One of GPX's major functions is to stabilize cell membranes, as they are composed of unsaturated fatty acids that are vulnerable to oxidation.^{5,6}

As part of GPX, selenium offers many health benefits, including increased cardiovascular health, decreased cancer risks, arthritis relief and more. In addition to antioxidant effects, GPX has an anti-aggregative effect on platelets by increasing the ratio of prostacyclin (antiaggregant) to thromboxane (proaggregant), which might contribute to reduced clots and atherosclerosis.⁵ Observational studies have shown that populations with higher blood levels of selenium have reduced incidence of death from lung, colorectal and prostate cancers. Mechanisms that have been suggested for selenium's role in this reduction include lessening tumor development by enhancing immune function, suppressing blood vessel growth to tumors, and neutralizing free radicals.^{2,5} Antioxidant effects may also influence inflammation associated with arthritis. Studies of sufferers with chronic joint pain, stiffness, swelling and loss of mobility have shown that these people also have low blood levels of selenium.^{2,6}



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TURMERIC ROOT

Turmeric is a spice derived from the rhizomes of *Curcuma longa*, a member of the ginger family. Its principal active ingredient, curcumin, is a polyphenol compound responsible for turmeric's yellow color. Turmeric curcuminoids have a strong antioxidant effect. In addition, curcumin is noted for its anti-inflammatory, anticancer, lipid-lowering and hypoglycemic effects.¹

Curcumin is an effective scavenger of reactive oxygen species (ROS) as well as reactive nitrogen species (RNS) *in vitro*.^{2,3} It has also been shown to inhibit oxidative DNA damage.⁴ In addition to direct antioxidant activity, curcumin may function indirectly as an antioxidant by inhibiting the activity of inflammatory enzymes and by enhancing the synthesis of glutathione, an important intracellular antioxidant.⁵ Turmerin is a water-soluble peptide from turmeric with antioxidant properties.⁶

Turmeric's anti-inflammatory effects may be the result of several mechanisms. Curcumin has been shown in laboratory studies to inhibit a number of different molecules involved in inflammation.⁷ In a controlled, double-blind study, curcumin was found to significantly reduce edema and tenderness in subjects with post-operative inflammation compared to placebo.⁸

The protective role of curcumin against carcinogenesis has been attributed to its antioxidant effects.⁹ There is also evidence of decreased cellular proliferation and increased apoptosis (programmed cell death) of cancer cells in animal studies.¹⁰ Dietary turmeric extract given to mice significantly inhibited chemically-induced skin and gastric tumors.¹¹ Curcumin may also suppress telomerase activity and induce apoptosis in human cancer cell lines.¹²

Turmeric was shown to have lipid-lowering effects in several studies. Rats fed a diet of 0.5% curcumin for eight weeks had significantly decreased serum low-density lipoprotein (LDL), total cholesterol and triglyceride levels. Curcumin given to healthy human volunteers was associated with a significant increase in high-density lipoprotein (HDL) and a significant decrease in total cholesterol.¹³

Turmeric may also have positive effects on blood sugar balance as animal studies show that curcuminoids in turmeric may exhibit hypoglycemic effects.¹⁴

Turmeric contains both lipid-soluble (curcumin) and water-soluble (turmerin) constituents with antioxidant properties.



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RESVERATROL

Resveratrol is a chemical compound that acts as an antibiotic by plants that are under attack by foreign organisms. Resveratrol has been identified in over 70 plant species, including grapes, peanuts, berries, some pines and the roots and stalks of giant knotweed and Japanese knotweed (*Polygonum cuspidatum*).¹

In test tube studies, resveratrol has strong inhibitory activity on free radicals, including the superoxide anion, hydroxyl radical and hydrogen peroxide.¹ Resveratrol also possesses glutathione-sparing activity. Resveratrol's antioxidant activity may play an important role in the numerous benefits it provides, including anti-inflammatory, neuroprotective, antimutagenic and cardioprotective effects.^{2,3}

Resveratrol may have a positive effect on nervous system cells. It may interfere with the signaling pathways leading to apoptosis (programmed cell death) in neuronal cells.⁴ It has also been suggested that resveratrol's antioxidative action helps maintain neuronal cell viability.⁵

Resveratrol may offer cardio-protective effects through various mechanisms, including the inhibition of COX-2 activity.⁶ Reduced COX-2 activity is associated with a decrease in inflammation. Resveratrol has also been shown to inhibit the oxidation of low-density lipoprotein (LDL) cholesterol.^{7,8,9}

Resveratrol's anti-inflammatory activity is likely due to inhibition of a number of different molecules involved in inflammation, including COX-1 and COX-2, hydroperoxidases and 5-lipoxygenase.² Resveratrol also seems to decrease the activity of inflammatory cytokines.¹⁰ Some evidence suggests that resveratrol is a more potent anti-inflammatory agent than NSAIDs (non-steroidal anti-inflammatory drugs).¹¹

In vitro and animal studies have shown resveratrol to exhibit chemoprotective action. It seems to inhibit tumor growth and promote apoptosis.¹² Dietary administration of resveratrol may also extend the latency period of tumor development.¹³

Quercetin and other flavonoids may improve the bioavailability of resveratrol.¹⁴

The "French paradox"—or the fact that people in France enjoy a high-fat diet yet suffer less heart disease than Americans—may be attributed to the consumption of resveratrol in wine. The resveratrol content of wine is highly dependent on grape type, climate and manufacturing practices. Dietary supplements provide a reliable source of resveratrol.



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AÇAÍ BERRY EXTRACT

Açaí (*Euterpe oleracea*), pronounced *ah-sigh-ee*, is a small, round, purple fruit that is produced by a certain species of palm tree native to Brazil. Açaí is an antioxidant-rich super-food currently considered by many to have the best nutritional value of any fruit on earth. Açaí has traditionally been used for improving general health and well-being.¹ Açaí berries contain protein and fatty acids, as well as vitamins and minerals, including vitamin A, thiamine, vitamin C, calcium, phosphorus and iron.¹ This fruit has been shown to have higher levels of antioxidants than raspberry, cranberry, blackberry, strawberry and blueberry.¹

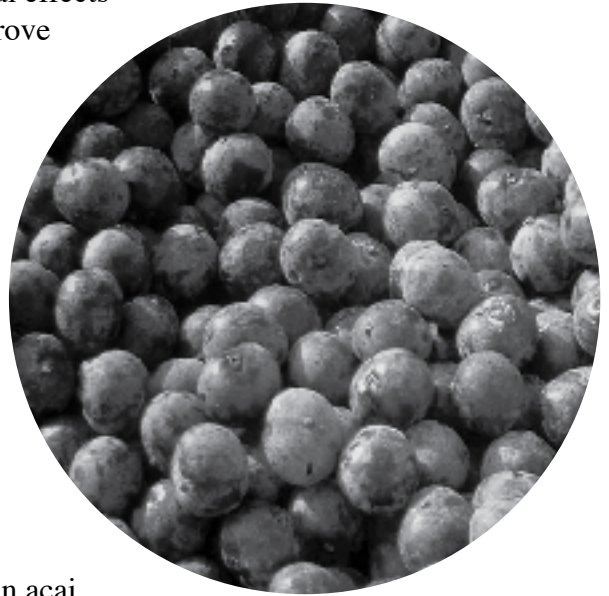
Açaí contains high amounts of anthocyanins — water-soluble pigment compounds with potent antioxidant actions.¹ Anthocyanins have some of the strongest physiological effects among plant compounds.² They may also aid the eyes and improve night vision.

Other beneficial phytochemicals that have been identified in açai fruit include proanthocyanidins, phenolic acids and plant sterols, including beta-sitosterol.^{3,4} Açai fruit has been shown to have significantly high antioxidant protection against a variety of free radicals, especially for superoxide and peroxyl radicals.⁵

Recent studies have demonstrated that antioxidants in açai fruit are able to enter human cells in a fully functional form and neutralize free radicals even at low doses.⁵ The antioxidant actions of açai fruit may also protect against abnormal cell growth and division. In a recent study, açai polyphenols were shown to have antiproliferative effects on human leukemia cells.⁶

The antioxidant effects of anthocyanins such as those found in açai fruit have been associated with improved cardiovascular health. Increased levels of lipid peroxidation have been associated with cardiovascular disease⁷ and preliminary studies indicate that açai fruit decreases lipid peroxidation.⁴ Anthocyanins such as those found in açai fruit are known to improve circulation by reducing capillary permeability and increasing the strength of microvessel walls. Other cardiovascular benefits include helping to prevent blood clots, improving circulation and preventing arteriosclerosis. Plant sterols, such as those found in açai fruit, have been used to maintain cholesterol levels, aid the immune system and maintain a healthy prostate.

Açaí fruit may decrease inflammation by inhibiting specific enzymes that are involved in causing inflammation (COX-1 and COX-2).⁵ Thus açai may be helpful for individuals with joint pain and other inflammatory conditions.



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MANGOSTEEN PERICARP

Mangosteen (*Garcinia mangostana*) consists of a white, fleshy fruit surrounded by an outer purple rind, or pericarp. The fruit and especially the pericarp are rich in xanthenes, a class of active phytochemicals. Several xanthenes have been isolated from mangosteen; mangostin (alpha-mangostin, beta-mangostin, gamma-mangostin) and garcinone E are the most studied.

Xanthenes are potent antioxidants. Alpha-mangostin and gamma-mangostin have been shown to effectively scavenge peroxynitrite, a powerful oxidant. Mangosteen's antioxidant properties also contribute to its anti-inflammatory benefits and health benefits for the cardiovascular system.

Mangostin is a free-radical scavenger and inhibits the oxidation of low-density lipoprotein (LDL) cholesterol.^{1,2} This helps protect the cardiovascular system. Gamma-mangostin has inhibitory activity against molecules involved in inflammation, including prostaglandin E2, and COX-1 and COX-2 enzymes.^{3,4} Alpha-mangostin demonstrated inhibition of NF- κ B kinase and COX-2, which helps reduce inflammation. Alpha-mangostin was also shown to reduce histamine release, demonstrating anti-allergy properties.⁵

Additionally, mangosteen is noted for its cancer chemoprotective and anti-microbial effects. The xanthone garcinone E inhibited the growth of hepatocellular carcinomas as well as gastric and lung cancer cell lines.⁶ Alpha-mangostin had a growth inhibitory effect on human leukemia cell line HL60, and a pericarp extract inhibited breast cancer cells.^{7,8} These benefits may well be due to its inhibition of cancer cell proliferation and stimulation of early apoptosis (programmed cell death).⁹

Studies have shown that mangosteen and an extract of its pericarp have antibacterial and antifungal action.^{10,11} *The Handbook of Biologically Active Phytochemicals and Their Actives* lists mangostin as a compound with antiseptic, bactericidal and fungicidal properties. Research has shown that pericarp extract stimulated immune phagocytes and killed salmonella bacteria.¹² Other studies show it helps inhibit *Staphylococcus aureus* and *Mycobacterium tuberculosis*.^{13,14} Multiple fungal species were also susceptible to mangostin.¹⁵



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QUERCETIN

Quercetin is part of a group of polyphenolic substances known as flavonoids. It is widely distributed in nature and found in plants such as onions, apples, berries, broccoli and St. John's wort.^{1,2,3} As a dietary component, quercetin is thought to have antioxidant, gastroprotective, cardioprotective, anti-allergy, immunomodulating, anti-inflammatory, anti-cancer and anti-viral activities.^{2,4}

Cell membranes are composed of lipids that are susceptible to oxidative damage. Quercetin may provide a protective assistance throughout the body against this damage.

The antioxidant effects of quercetin may be responsible for many of its health benefits. Its antioxidant nature is thought to be the mechanism behind quercetin's gastro-protective and cardio-protective effects. In one study where patients received an alcohol-free red wine extract with quercetin, LDL oxidation was inhibited.³ The researchers ruled out antioxidant vitamins and carotenoids for this effect.

In animal and *in vitro* studies, quercetin has been shown to inhibit the degranulation of mast cells, basophils and neutrophils.^{2,4} In these cases, the mechanisms of action may involve decreased production and activity of prostaglandins and leukotrienes, and inhibition of histamine release. The results of these effects may explain quercetin's anti-inflammatory, anti-allergy and immunomodulatory benefits. *In vitro* preliminary research has also shown a slowing of cyclooxygenase or (COX)-2 production⁴, further supporting the anti-inflammatory effects.

Mechanisms of action for quercetin's anti-cancer and anti-viral properties are not well-studied. However, in rat studies using a diet consisting of 2–5% quercetin, chemically-induced mammary tumor development occurred 50 to 75% less frequently than in control groups.¹ It is theorized that inhibition of signal transduction targets, including tyrosine kinase, protein kinase C and phosphatidyl inositol-3-kinase, along with estrogen receptor binding, may be involved in inactivating malignant precursors or inhibiting carcinogenesis.^{3,4} Anti-viral effects have been seen *in vitro*.²



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