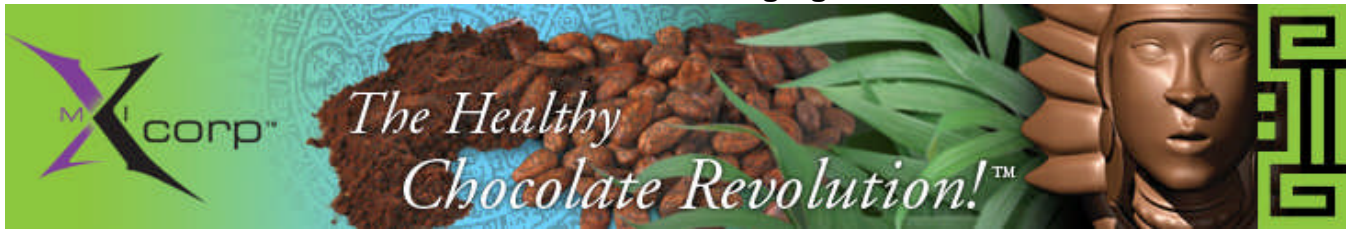


## Chocolate and Aging



### The Brain-Cocoa Connection

#### Optimal Mental Health through Polyphenol Protection

**A 2006 study indicates that flavanol-rich chocolate improves blood flow to the brain, resulting in potential improvement in cognitive tasks.**

The brain has some pretty heavy responsibilities, controlling body functions such as breathing, walking, the five senses and digestion. Obviously, it also controls our thinking – what we remember, how we reason and our ability to figure things out. Without a healthy and functioning brain, our lives would be extremely difficult and virtually meaningless.

Hundreds of studies over the years have investigated the effect of food, toxins and other compounds on the physical health of the brain, as well as its ability to function optimally. We know that the brain is a highly sensitive and fragile organ, susceptible to influence from a variety of factors.

The good news is that, for all the possible dangerous threats to our brain, there are numerous steps we can take to protect this amazing organ. Some scientists and health experts feel that increasing our consumption of chocolate is one such step.

#### **Aging: Why Cognitive Decline is a Big Fear**

It's no secret that with increased age comes the increased risk of mental decline, Alzheimer's disease being the most common form. In fact, losing our memory and ability to think is one of our biggest fears. An estimated 12 million people worldwide suffer from Alzheimer's disease, and that number is expected to rise as the population ages.

The illness is characterized by the buildup of protein deposits called amyloid plaques between nerve cells in the brain and tangles of a protein called *tau* inside nerve cells. And what are the causes of Alzheimer's? While there is still much we don't know, various bodies of research point to several contributors:

- **Increase in Age:** This is the biggest risk factor for dementia. Simply put, the older we get, the more likely we are to "lose our mind." The risk of Alzheimer's nearly doubles every five years, so of those who live to 95, nearly half will have Alzheimer's disease.
- **Environmental Factors:** Some research points to the damaging effects of long-term exposure to various chemicals and toxins (including aluminum). However, though there is much debate regarding the causative role of environmental factors in the onset of dementia, there is no conclusive proof.
- **Family History/Hereditry:** Research shows that those who have a parent, sibling or

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child with Alzheimer's are more likely to develop Alzheimer's than those who don't. The risk increases if more than one family member has the illness. When diseases tend to run in families, either heredity (genetics) or environmental factors, or both, may play a role.

- **Heart Health:** Because the brain is nourished by one of the body's richest complexes of blood vessels, it's no surprise that a dysfunctional heart and vascular system can affect the health of the brain. Every heartbeat pumps 20 to 25 percent of your blood to your head, where brain cells use at least 20 percent of all the nutrients and oxygen your blood carries.

Research indicates that the risk of developing Alzheimer's corresponds to many conditions that damage the cardiovascular system, including high blood pressure, heart disease, stroke, diabetes and high cholesterol levels.

- **Head Injury:** Scientists have established a firm link between serious head injury and future risk of Alzheimer's.

### Linking Brain Function to Vascular Health and Free Radicals

While the fundamental causes of nearly every cognitive and neurodegenerative disorder remains unknown, most forms of mental decline demonstrate abnormalities in both the brain's networks of neurons and blood vessels. Many experts believe these abnormalities are the result of oxidative damage by free radicals. If oxidation is indeed the underlying cause, then it is all the more likely to damage neural tissue, since the brain and nerves use large amounts of oxygen, and their ability to scavenge free radicals declines with age.

The prestigious *Townsend Letter for Doctors and Nurses* recently published an article supporting the inclusion of more herbs, fruits and vegetables in the diet as a way to significantly reduce the risk of cognitive decline and dementia by protecting the vascular and neuronal networks within the brain. The article says the protective role botanicals play in mental health is due at least in part to the antioxidant compounds within whole foods, but also states, "additional benefits are believed to come from as yet unidentified components." Certainly chocolate possesses both antioxidant compounds and other compounds that may protect the brain and preserve mental performance.

The good news is that cocoa polyphenols have been shown in various studies to offer relief from the effects of diabetes, heart disease, vascular disease, free-radical damage and inflammation, all factors that may play a role in the progression of dementia, mental decline and cognitive failing. The reason is that all of these conditions adversely affect the circulatory system, including the blood vessels that feed the brain. Consequently, many experts feel that the active compounds in chocolate can improve memory and other cognitive activity by reducing the risk of these other conditions, as well as boosting the health of the blood vessels within the brain itself.

### Chocolate, Dementia and Brain Health: What the Research Shows

We know that individuals who consume relatively large amounts of antioxidants – either in their food or through supplements – have a lower risk of developing dementia.

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We also know that increased intake of antioxidants can slow the progression of most forms of dementia, as well as protect the brain from the effects of stroke. For instance, a recent study involving older Japanese-Americans who drank fruit or vegetable juices three times a week demonstrated a 75 percent reduction in risk of developing Alzheimer's.

So what about chocolate? What can science tell us about its abilities to protect the brain and preserve cognitive function? Plenty, it turns out. Several recent studies investigated the potential benefits that cocoa may have on dementia and other neurodegenerative diseases.

For instance, a 2006 study completed by researchers at the University of Nottingham in England found that flavanol-rich chocolate can improve the blood flow to the brain, resulting in potential improvement in cognitive tasks.

The study found that after a five-day diet that included chocolate, the blood oxygenation levels of the volunteers' brains increased in response to cognitive tests. Regarding the results, the researchers stated, "A single acute dose of flavanol-rich cocoa showed that it can increase the cerebral blood flow to gray matter, suggesting the potential of cocoa flavanols for treatment of vascular impairment, including dementia and strokes, and thus for maintaining cardiovascular health."

A study completed in 2005 by researchers from Cornell University examined the effects of cocoa flavonoids on amyloid beta proteins and consequent reduced risk of dementia. Amyloid plaques are often found in Alzheimer's patients and are thought to be a prime marker for the disease (though their role in the development of the disease isn't clear). The study found that epicatechin and catechin – both polyphenols present in cocoa – protected brain cells from amyloid plaque buildup. In response to their findings, the researchers stated, "The present results showed that the major flavonoids of cocoa, epicatechin and catechin, protect PC12 cells from Abeta-induced [i.e., amyloid beta-induced] neurotoxicity, and suggest that cocoa may have an anti-neurodegenerative effect in addition to other known chemopreventive effects."

## **Chocolate's Psycho-Stimulating Effects**

Another recent study, this one undertaken by researchers at Wheeling Jesuit University in West Virginia provided support for the notion that eating chocolate can improve brain activity – this time, due to its stimulant effects. In the study, volunteers were given 3 ounces of chocolate (about the size of an average chocolate bar) 15 minutes before performing a number of cognitive tasks.

The research team discovered that those eating either milk or dark chocolate performed about 20 percent better in their reaction times and short-term memory than those who weren't given any chocolate.

The difference in this study, compared with most others looking at chocolate's possible brain benefits, is that the researchers ascribe the improvement to cocoa's stimulating compounds, namely theobromine, phenethyl-amine and caffeine.

"Chocolate contains many substances that act as stimulants, such as theobromine, phenethylamine, and caffeine," notes lead researcher Dr. Bryan Raudenbush. "These substances by themselves have previously been found to increase alertness and attention, and what we have found is that by consuming chocolate you can get the

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stimulating effects, which then lead to increased mental performance.”

One interesting note regarding this study – the volunteers who consumed the milk chocolate product performed even better than those eating dark chocolate.

Another study investigating the brain-stimulating effects of chocolate also had similar results. Researchers from the U.K.’s University of Bristol gave various groups either cocoa powder, a mix of caffeine and theobromine, milk chocolate, dark chocolate, “white” chocolate (which contains no cocoa) or a placebo. Afterward, the volunteers were given a battery of tests, and their reaction times, information processing times and mood were assessed.

The results were impressive, showing that all the groups scored significantly higher than the non-cocoa “white” chocolate and placebo. Said the research team, “Identical improvements in mood (‘energetic arousal’) cognitive function were found for cocoa powder and the caffeine-theobromine combination. In chocolate, both ‘milk chocolate’ and ‘dark chocolate’ improved cognitive function -compared with ‘white chocolate.’”

## Inflammation and Dementia

Professor Jeffrey Kelly of the Scripps Research Institute in California has recently proposed that inflammation could be the beginning of a chain reaction that leads to Alzheimer’s disease. Kelly’s research has found that normal brain molecules are adversely affected as a result of inflammation, which can cause the misfolding of the brain’s amyloid beta proteins, which are thought to have a crucial role in the development of Alzheimer’s. According to Kelly, the inflammation process might occur years before the onset of Alzheimer’s and be the result of any number of factors, principally that of viral and bacterial infections.

Kelly and his team tested their hypothesis by examining the brains of Alzheimer’s victims. They discovered evidence of a relatively new substance called *atheronals*, toxic compounds formed during the inflammatory processes taking place in the body.

The treatment of several common conditions involving the buildup of plaque and hardening of tissues, including atherosclerosis, have revealed that the hard substances removed all contain atheronals. Consequently, researchers are beginning to focus on atheronals as a pivotal player in the development of diseases characterized by hardening processes.

The research team also performed test-tube experiments, finding that atheronals and the compounds produced by fat oxidation have the ability to not only significantly speed up the misfolding of amyloid beta, but also to reduce the concentration of proteins needed to properly regulate the misfolding of amyloid proteins within the brain.

Dr. Kelly’s research supports other findings that cocoa and its primary active compounds can both provide relief of inflammation and promote improved cognitive activity in the brain. Of course, this will take further research to prove definitively.

While Dr. Kelly admits it will be difficult to prove his inflammation-Alzheimer’s theory, it does introduce an entirely new way of thinking about it and related conditions, and provides another avenue of research to investigate the debilitating effects of dementia. “Is [the theory] right?” asks Kelly. “Time will tell -- that’s how science works.” **BIH**

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# The Power of Antioxidants

The last two decades have seen dramatic increases in chronic ailments like arthritis and asthma and lifestyle- and obesity-related diseases such as diabetes, heart disease and cancer. The numbers are staggering. Experts estimate that more than 80 percent of all elderly people suffer from at least one chronic disease. Studies also show that chronic diseases in many forms account for roughly 75 percent of all deaths in people over the age of 65. In fact, researchers estimate that nearly 75 percent of all deaths in people over 65 occur due to chronic and lifestyle conditions, including cancer, heart disease, obesity and diabetes.

Most people express surprise or disbelief when told that chocolate, which many view as one of the least beneficial foods, can actually help them enjoy a better quality of life – but it's true.

The types and qualities of the foods we eat are critical to our wellness, especially in our modern environment. Increased sugar and fat intake coupled with decreased intake of natural foods like whole grains, fruits and vegetables, lack of exercise and exposure to toxins all contribute to the global pandemic of lifestyle-related and chronic diseases.

But there is hope. Certain foods have been proven to reverse the damaging effects of our modern lifestyle. These functional foods have the ability to fight disease and promote both longevity and wellness – adding quality years to our lives. One of the most important functional foods in the world is chocolate. Yes, that's right – chocolate.

Chocolate is one of the most potent and valuable sources of beneficial antioxidants found anywhere on this planet. You may be more used to hearing about how chocolate supposedly causes acne, or that it causes tooth decay and should be used only as a rare treat. The fact is, chocolate could be one of the best additions you could make to your diet.

### The Nutritional Makeup of Chocolate

Dozens of scientific studies have found that chocolate is teeming with a wide range of phytonutrients, chemical compounds found in plants (the prefix *phyto-* is derived from the Greek word *phyton*, which means *plant*), and those found in pure chocolate (cocoa) have become an exciting and promising area of scientific research.

Polyphenols are one of cocoa's most important classes of phytonutrients. These plant chemicals are commonly recognized as some of the most powerful antioxidant and anti-inflammatory compounds in nature. Polyphenols are found in many types of fruits and vegetables, from apples to carrots, green tea, red wine and especially cocoa. Polyphenols are made up of several categories; these include flavonoids or bioflavonoids (the largest, most common group), phenolic acids, simple phenols, phenylpropanoids, quinines, stilbenes and xanthenes.

### Flavonoids

Flavonoids comprise about two-thirds of the polyphenol family. Flavonoids help protect plants from sources of injury, including ultra-violet rays, certain types of diseases and even some types of predators. Flavonoids often affect the flavor of a plant, usually making it bitter (think of pure, unsweetened chocolate or unsweetened green tea).

Dozens of scientific studies confirm that the darker the skin of a fruit or vegetable, the more potent its antioxidant content. Chocolate, with its dark brown color and bitter taste, contains an unparalleled amount of potent antioxidant nutrients.

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Flavonoids are without a doubt one of the most important groups of antioxidants, and are found in abundance in cocoa and chocolate.

### **Anthocyanins**

Anthocyanins are a particularly important subgroup of flavonoids that provide powerful nutritional benefits. Anthocyanins have both anti-inflammatory and antioxidant properties and aid the body in properly metabolizing sugars, which helps normalize blood sugar levels – important to today's obesity and diabetes-riddled lifestyles. Maintaining normal blood sugar levels leads to a lower risk, and possibly even a reversal, of type 2 diabetes. Because anthocyanins are able to modulate blood sugar levels and fight free radicals at the same time, they may be especially helpful in halting free radical damage in the eyes and limbs, which are usually the first to suffer damage from full-blown diabetes.

Anthocyanins are unique also because they prevent and even repair free radical damage to small blood vessels. This kind of damage to blood vessel walls leads directly to atherosclerosis and heart disease. Anthocyanins are also able to block histamine, helping prevent allergic reactions, and associated inflammation and irritation. Studies also indicate that anthocyanins may even block the inflammation connected with arthritis, gastric ulcers and cardiovascular disease.

### **Catechins and Epicatechins**

Catechins and epicatechins are another component of chocolate's disease-fighting abilities. Several studies have shown that they have exciting possibilities in the fight against cancer. Research indicates that catechins and epicatechins prevent the formation of carcinogens (cancer-causing substances), and they can activate the body's natural detoxification response. Studies also show that catechins and epicatechins slow the growth of cancerous cells.

Many other types of polyphenols and phytonutrients are in chocolate. Although much research needs to be done, dozens of reputable studies confirm that the antioxidant nutrients in chocolate may lead to a longer, fuller life.

### **When Oxygen Can Be a Bad Thing**

On this planet, life cannot exist without oxygen; it's absolutely essential to life. Every breath we take sustains us. But what many people don't know is that oxygen can also damage the human body. It seems unlikely, but it's true.

Oxygen has high electron affinity, which means that it can often steal electrons from other stable molecules in the body. This process of stealing electrons can lead to the formation of free radicals, which are responsible for the oxidation or free radical damage mentioned above. Oxidation occurs when a free radical – missing an electron, a state that gives it high electron affinity – takes an electron from a previously stable, healthy cell.

An individual cell can face thousands of free radical attacks every day. Plus, this process initiates a chain reaction that can disrupt the function of normal molecules, which can affect the function of cells. This can lead to a number of problems, including cell weakness, cell death or mutation. Scientific research has implicated free radical damage in many chronic and lifestyle diseases, including arthritis, coronary heart disease, stroke, cancer and high blood pressure.

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### **The Free Radical**

Free radicals occur naturally in the body every day; they are a natural byproduct of the conversion of oxygen and glucose into energy. The body is designed to deal with normal levels of free radical activity, but free radical damage can become a problem when lifestyle and environmental forces combine to expose the body to levels of free radicals for which it is unprepared. Increased free radical levels are almost always the result of exposure to environmental pollutants.

These environmental pollutants include exposure to UV light, burned or charred food, toxic chemicals, industrial pollution and automobile emissions. The most common and most dangerous source of free radicals is, of course, cigarette smoke. Few pollutants are more dangerous than cigarette smoke when it comes to free radical damage. Every time smokers inhale cigarette smoke, they expose themselves to more than 100 quadrillion reactive oxygen species free radicals. Even one free radical can cause a devastating cascade of oxidative damage. Imagine the potential for damage from the trillions and trillions of free radicals found in one puff of cigarette smoke.

### **Natural Antioxidant Protection**

Since free radicals are natural byproducts of the conversion of oxygen, the human body is designed to deal with normal levels of free radical damage, and when it faces only natural amounts of oxidative stress, it does very well. Unfortunately, everyone living in today's environment is exposed to unnatural levels of free radicals.

The body generates enzymes in every cell to help neutralize some radicals, especially those that are natural byproducts of oxygen conversion. Superoxide dismutase (SOD), a naturally occurring enzyme, converts super-oxide free radicals into hydrogen peroxide. Then another enzyme, catalase, consumes the peroxide and changes it to water and oxygen. Superoxide free radicals are an especially dangerous type of free radical, but this SOD mechanism allows the body to deal with naturally occurring levels of activity.

Glutathione, a small molecule made up of three amino acids, is another example of a naturally-occurring free radical scavenger. Glutathione can help prevent hydrogen peroxide from interacting with other molecules, preventing the creation of free radicals.

These defenses are vital to controlling the natural production of free radicals in the body. If we lived in a perfect, pristine world with no pollution and perfect diets, natural defenses like glutathione and superoxide dismutase would be all the protection we would ever need. But we don't, so we need more help.

Antioxidant nutrients are one answer. And chocolate may well be the world's best source of them.

### **Nutritional Protection**

Antioxidant vitamins, minerals and other phytochemicals obtained from diet and nutritional supplementation latch on to free radicals and provide an extra electron, which deactivates the free radicals and prevents the chain reaction. Antioxidants are often called free radical scavengers, because they can neutralize a free radical before it can damage a single cell without becoming a free radical by losing an electron. Antioxidants have extra electrons to give and are able to stop the potentially destructive chain reaction in its tracks.

We can usually obtain most antioxidants from the foods we eat, but today, a truly complete and healthy diet is a rare thing. Soils around the world are becoming increasingly deprived of nutrients, mainly from modern farming techniques, and synthetic fertilizers and pesticides.

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Vitamin A, a particularly important antioxidant, is becoming more difficult to find from natural food sources. Spinach grown in today's soils contains a fraction of the vitamin A that spinach grown a hundred years ago contained. It's quite possible that eating a complete diet may not be enough anymore.

For many people, the only option is to drink or eat a functional food or nutritional supplement with a potent array of antioxidant nutrients. It may be the best way to protect themselves from unnatural sources of free radicals and the stress they place on the body. Many researchers have seen the value of antioxidants and are making them a major focus of their scientific studies. Every year, hundreds of studies on antioxidant nutrients are published, supporting the growing belief that the prevention of excessive free radical activity is absolutely vital to preventing most chronic and lifestyle diseases.

### Science Looks at Chocolate and Its Antioxidants

Chocolate has been proven to contain a number of antioxidant nutrients, from anthocyanins to catechins, and vitamins E and C. Scientists believe that such a broad spectrum of antioxidants allows chocolate to fight a range of health conditions and scavenge a wide array of free radicals.

A number of studies link the flavonoids in cocoa to a reduced risk of cardiovascular disease and other chronic or lifestyle conditions. A recent study performed at the Department of Food Sciences and Technology at Cornell University discovered that one cup of cocoa is rich in antioxidants. The lead researcher for the study, Dr. Chang Lee, says, "I was surprised to find that cocoa has more than twice the phenolic compounds as red wine and three times the amount in green tea." These results are similar to those found in hundreds of other chocolate-antioxidant studies.

A recent study published in *Free Radical Biology and Medicine* determined that a cocoa-based health beverage decreased blood levels of isoprostanes, which are thought to indicate the presence of stress-induced free radical damage in the body. The study's authors believe that cocoa's rich flavanol content is especially helpful in the fight against stress-induced free radical damage.

Researchers in Switzerland found that regular consumption of dark chocolate can protect smokers from free radical damage commonly found in their arteries. When cells lining the arteries and blood vessels become damaged by free radicals, the normally slick tissues become irritated and inflamed. The body responds to this damage by covering the damaged areas with a protective fatty deposit. As the irritation continues and these fatty deposits increase, the arteries harden and become more narrow, leading to heart disease, the No. 1 killer in the world.

This research, recently published in *Heart*, revealed that consistent use of dark chocolate "improved both endothelial and platelet function." The authors of the study believe the benefits were effective within just a few hours after eating the chocolate.

Another study published in a 2005 issue of the *American Journal of Clinical Nutrition* discovered that the antioxidant content of cocoa exhibited the ability to protect the heart and vascular system. The scientific evidence just goes on and on. Scores of studies confirm the value of chocolate's uniquely complete and potent mix of antioxidants.

Free radicals are truly one of the most serious and multifaceted health threats facing us today. Chocolate may be the one functional food complete enough to give us the protection we need. **BIH**