Healthy Chocolate Science Update
2009

Healthy Chocolate Science Update Q1, 2009
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Cocoa in World History

There is no denying that cocoa has played a major role in the development of both Mesoamerican and European History. Even today, fortunes are won and lost on the price fluctuations of this highly sought-after commodity, as traders bet on the moves of cocoa futures. Cocoa is produced in mass amounts in only a handful of countries around the world, many of which are not always politically or economically stable.

Recent discoveries in Honduras showed traces of cocoa on cups and plates dating back to 2000 B.C. Between 200 and 900 A.D., the Mayan culture celebrated cocoa as a central part of their agriculture, economy, medicine and religion.

Still used today, the word "cacao" is derived from ancient Olmec and subsequent Mayan languages ("kakaw"), while the term "cacahuatl," also related to the root origin of cacao, is from ancient Aztec.

In 1737, Swedish scientist Carolus Linnaeus named the tree that produces these unsightly, yet highly prized cocoa bean pods "Theobroma cacao"—literally meaning "cocoa, food of the gods," in a reference to the mythical history of the tree among ancient Mesoamericans.

Cocoa as Medicine

While cocoa was a celebrated and valued part of ancient Mesoamerican society, ancient records have also revealed more than 150 uses of cocoa for medicinal purposes.

Europeans were first introduced to cacao by the Spanish conquistadors around 1505 A.D. By the mid-1600's, European healers were "prescribing" cacao as a medicine to stimulate the health function of the spleen and digestive tract, as well as a cure for all manner of ailments and diseases. Cacao was valued as a means to heal colds and coughing attacks, enhance mental acuity, fight inflammation, and improve overall nutrition. In the rest of this paper, we will refer to cacao as cocoa, implying the unprocessed form of this amazing food.

Some Noted Mentions of Cocoa in History

Thomas Jefferson: *"The superiority of chocolate, both for health and nourishment, will soon give it the preference over tea and coffee in America which it has in Spain"* (1).

William Clark (famed explorer): *"I felt my Self [sic] very unwell and derected [sic] a little Chocolate which Mr. McClellan gave us, prepared of which I drunk about a pint and found great relief…"*

Baron Justus von Liebig (German chemist): *"Chocolate is a perfect food, as wholesome as it is delicious, a beneficent restorer of exhausted power. It is the best friend of those engaged in literary pursuits."*

Jean Anthelme Brillat-Savarin (lawyer, politician): *"It has been shown as proof positive that carefully prepared chocolate is as healthful a food as it is pleasant; that it is nourishing and easily digested... that it is above all helpful to people who must do a great deal of mental work."*

Other Historical References

Deanna Pucciarelli and Louis Grivetti from the University of California, Davis recently published a paper titled, "The Medicinal Use of Chocolate in Early North America." This paper discussed the long history of medicinal chocolate in North America dating back to the 16th century (2). The paper suggested that medicinal chocolate was very prominent in many of the remedies prescribed for an assortment of illnesses, referring to advertisements of the day, including the following: "Always on hand pure cocoa and Homeopathic Chocolate, without any admixture of spices, are to be had, by the single cake or by the box of 25 pounds each."

In 1849, the Scientific American Journal in 1849 published the statement, "During last summer, those individuals who were habitually using chocolate or broma, neither had attacks of cholera or dysenteric affections, while other in the same families, taking their daily potations of tea, coffee, or simple cold water, were suffers."

Dr. Albert Bellow suggested that "Cocoa differs from tea and coffee in that it is rich in nutritious food, and having in it no tannin or other deleterious elements, its theobromine, or characteristic property, being connected with albumen – a muscle-making element."

Cocoa products were considered "well-known [as] valuable foods, since they [act] as respiratory excitants."

Advertisements in the late 1800's touted cocoa's benefits for patients with asthma, bronchial, and lung trouble.

The famous physician Dr. Benjamin Rush wrote, "Chocolate differs considerably from both [tea and coffee], possessing no exhilarating virtue, or only in a small degree, but is more nutritive, and in South America constitutes a considerable part of the food."

In his treatment for yellow fever, Dr. Rush recommended, "As soon as the pulse is reduced, I indulge them in weak chocolate." He recommended chocolate for gout, yellow fever, and many other diseases at the time.

Cocoa was a common medicine included in the well-known "house call" medical bags carried about by doctors during the 19th century.

One medical book from the time said this about treating whooping cough:

> Let the child live on a light diet, little or no meat, cake, pastry, or heavy food, but an abundance of mucilaginous drinks... [such as] chocolate

Cocoa was a mainstay in medical recommendations throughout Europe, North and South America until the third decade of the 19th century.
A copy of Dr. Pucciarelli and Dr. Grivetti's paper can be found at the World Cocoa Foundation website (worldcocoafoundation.org).

Post-Industrial Chocolate: From Good to Bad

With the coming of the Industrial Revolution, chocolate manufacturers found themselves in regional and global competition for consumers.
At the same time that chocolate was being served in liquid form as a medicine for the sick, it was also being produced with added fats and sugars as a cheap candy.
The mid- to late-1800s saw the creation of a tremendous market for chocolate penny candy, as well as for fancy boxed chocolates that have since become synonymous with love and courtship.

By the 1950s, chocolate had completely lost its association with health and healing. Many of today's most famous chocolate companies got their start during the Great Depression, known to those in the business as the "hungry thirties" due to the popularity of this cheap diversion from the doldrums of everyday life during the economic crisis. Are we experiencing the "hungry 2000s" today?

Modern Living, Modern Diseases

Pollution. Global Warming. Stress. Lack of sleep. Poor dietary habits. In today's society, we are at greater risk than ever for health problems. In fact, the majority of Americans already suffer from some kind of preventable (or addressable) health problem: obesity, heart disease, diabetes (or "pre-diabetes").

According to the American Heart Association, more than 910,000 Americans will die of heart disease this year. As a matter of fact, by 2010, heart disease will be the number one killer across the world. More than 70,000,000 Americans live every day with some form of "heart disease" (high blood pressure, cardiovascular disease, stroke, angina (chest pain), heart attack or congenital heart defect).

An epidemic of Type 2 diabetes continues to sweep across the United States; an estimated 24,000,000 Americans struggle with the disease—up more than 3,000,000 people since only 2005. With Type 2 diabetes, either the body does not produce enough "insulin" or the cells "ignore" the insulin. Insulin (a hormone) is needed by the body in order to maintain blood sugar levels (or glucose) for energy. Lack of exercise and excessive weight are key contributors to Type 2 diabetes. And, naturally, there is an inevitable wave of illnesses and disabilities that are brought on by diabetes: heart disease, stroke, blindness, limb amputations, kidney disease

and nervous system damage, to name several.

In modern societies, keeping up with a fast-paced lifestyle seems to have taken precedence over healthy living. One simple solution is to pay more attention to what we put in our bodies. Fruits and vegetables are a rarity on fast food menus, yet they are rich sources of antioxidants—a key to maintaining a healthy body.

Only in the past few years has cocoa been reexamined as a health food and a nutritious source of antioxidants, anti-inflammatories, vitamins and minerals. In 2008 alone, over 50 different studies were conducted on the health benefits of cocoa. There have even been human epidemiological studies and dietary trials with cocoa that have yielded interesting results.

Fight Disease with Antioxidants

We mentioned antioxidants earlier. Antioxidants are chemicals that combat the free radical molecules that are created every day inside our bodies—molecules that damage our systems. Three of the most important and effective sources of antioxidants might surprise you, and products that contain two or three in combination could very well change many of the commonly held beliefs about nutrition:

1. The acai berry
2. Blueberries
3. Unprocessed cocoa

Most of us have only an improper diet to blame for our obesity, low energy, mood swings and other health problems. Of course, this can be corrected by changing what we eat, and by consuming more of the foods listed above.

The acai (ah-sah-EE) berry is an excellent source of vitamin A, which is vital for good vision, growth, skin health and reproduction. 100 grams, or roughly 3.5 ounces, of acai has an ORAC rating of about 5,500 units. ORAC, (Oxygen Radical Absorbance Capacity) is the unit by which antioxidants are measured. The recommended daily consumption of Antioxidants is between 4,000 and 5,000 ORAC units.

Consuming 5,000 ORAC is the equivalent of eating seven to 10 servings of any combination of fruits and vegetables. . Acai is far ahead of the other fruits in its capacity to absorb free radicals in the human body.

Dr. Nicholas Perricone, a clinical and research dermatologist, named the acai to the top of his famous Superfood List. The unusually high levels of phyto-nutrients (nutrients that are

beneficial to your health) and antioxidants are what make the acai berry stand out from all other fruits. Found primarily in the Northern Regions of Brazil, the acai is such an important source of nutrition, that individuals in the region drink almost as much acai juice as they do water. The acai fruit is also a complete protein, which means it contains every essential and non-essential amino acid.

Jiu-jitsu fighters and soccer players in Brazil often have a large meal of acai berry pulp before a competition. Why? Aside from being a perfect source of nutrition and carbohydrates, the high levels of antioxidants in the acai berry provide a dramatic increase in energy levels and stamina. Taken on a regular basis, the acai berry strengthens the immune system to the point where the body easily handles infections and disease. This frees up even more energy for other uses.

The acai berry contains a natural combination of antioxidants, essential fatty acids, amino acids and phytosterols. Amino acids work together to help your body function better, process food more easily, and burn fat more efficiently. It is literally one of the best things you can put into your body to keep it healthy. And when your body is healthy and well-balanced, it is much easier to reach an ideal body weight.

The acai berry contains enzymes and other vital nutrients that aid in the digestion process. A healthy digestive system is not plagued with such challenges as acid reflux and other similar ailments. Acai also contains a significant amount of fiber, which helps your digestive tract process food.

Packed with antioxidant phyto-nutrients called anthocyanins, blueberries neutralize free radical damage done to the collagen matrix of cells and tissues—unchecked, this damage can lead to cataracts, glaucoma, varicose veins, hemorrhoids, peptic ulcers, heart disease and cancer. Anthocyanins, the blue-red pigment found in blueberries, improve the integrity of support structures in the veins and the entire vascular system. Anthocyanins have been shown to enhance the effects of vitamin C, improve capillary integrity, and stabilize the collagen matrix (the ground substance of all body tissues). They work their protective magic by preventing free-radical damage, inhibiting enzymes from clinging to the collagen matrix, and directly cross-linking with collagen fibers to form a stable collagen matrix.

While wine, particularly red wine, is touted as a cardio-protective substance (a good source of antioxidant anthocyanins), a recent study found that blueberries deliver 38% more of these free radical fighters than red wine.

In this study, published in the August 2003 issue of the Journal of Agriculture and Food Chemistry, researchers found that a moderate drink (about 4 ounces) of white wine contained .47 mmol of free radical absorbing antioxidants. Red wine provided 2.04 mmol, and a wine

made from high-bush blueberries delivered 2.42 mmol of these protective plant compounds. (October 1, 2003)

Pterostilbene, (pronounced TARE-oh-STILL-bean), a powerful antioxidant compound found in blueberries—already known to fight cancer—may also help lower cholesterol.

In a study using rat liver cells, scientists at the USDA Agricultural Research Service compared the cholesterol-lowering effects of pterostilbene to those of ciprofibrate (a lipid-lowering drug) and to those of resveratrol. Resveratrol is an antioxidant found in grapes that has a chemical structure similar to pterostilbene, and has been shown to help fight cancer and heart disease.

The USDA based their comparison on each compound's capacity to activate PPAR-alpha (short for peroxisome proliferator-activated receptor alpha). The PPARs are a family of receptors on cells all throughout the body that are involved in the absorption of compounds into cells for use in energy production. PPAR-alpha is crucial for the metabolism of lipids, including cholesterol. Pterostilbene was as effective as ciprofibrate and outperformed resveratrol in activating PPAR-alpha (January 14, 2005). The take-away message: Turn up your cholesterol burning machinery by eating more blueberries, grapes and cranberries.

In animal studies, researchers have found that blueberries help protect the brain from oxidative stress, and may reduce the effects of age-related conditions such as Alzheimer's disease or dementia. Researchers found that diets rich in blueberries significantly improve both the learning ability and motor skills of aging rats—essentially reversing the cognitive aging process.

In addition to powerful anthocyanins, blueberries contain another antioxidant compound called ellagic acid. Ellagic acid blocks metabolic pathways that can lead to cancer. In a study of 1,271 elderly people in New Jersey, subjects who ate the most strawberries (another berry that contains ellagic acid) were three times less likely to develop cancer than those who ate few or no strawberries. In addition to containing ellagic acid, blueberries are high in the soluble fiber pectin, which has been shown to lower cholesterol and to prevent bile acid from being transformed into a potentially cancer-causing form.

Cocoa is King

Believe it or not, dark chocolate can be one of the healthiest foods you will ever eat. The key is that it must be processed correctly to be beneficial.

Cocoa powder is rich in the polyphenols, mainly flavonoids—flavan-3-ols, flavonols (epicatechin and catechin), and procyanidins. Cocoa is from the plant Theobroma cacao.

Cocoa butter accounts for 50% of the weight of the cocoa bean, with the main fatty acids being stearic and palmitic (saturated fats), oleic (the one in olive oil, a monounsaturated fatty acid) and linoleic acid (polyunsaturated).

Even though we are taught that saturated fats are harmful to the cardiovascular system, the saturated stearic acid fat from the cocoa bean does not elevate blood cholesterol like other saturated fatty acids. Fat from cocoa butter is not absorbed well by the intestinal tract, and is considered "neutral" in terms of its effect on weight gain and impact on cholesterol. Research shows that these cacao fatty acids may modify LDL-C, making it more resistant to oxidation.

The cocoa bean also contains some insoluble and soluble fiber, which contributed to lower cholesterol levels. Fiber is extremely beneficial in lowering colon cancer rates, improving sugar metabolism and preventing constipation.

The cocoa bean contains several minerals and vitamins which are useful. Dark chocolate contains magnesium, which is necessary for muscle relaxation, nerve conduction, energy production and bone and teeth development and overall health. Magnesium deficiencies intensify the effects of PMS (premenstrual syndrome). Copper—found in rich supply in dark cocoa—is involved in many of the chemical processes in the body.

Dark cocoa also contains high levels of potassium, which is vital for cardiovascular health.

The flavonoids in cocoa are the flavan-3-ols, flavonols (catechin and epicatechin; procyanides), and proanthocyanidins. Pound-for-pound, dark chocolate has the highest concentration of these flavonoids of any food—even more than acai or blueberries. Cocoa is loaded with a variety of phyto-nutrients, making it very high in antioxidants.

Cocoa rates as one of the highest whole foods on the ORAC scale—even higher than green tea, acai, blueberry and red wine, which have all been shown to be very effective antioxidants.

Cocoa can stop the oxidation of the LDL-C cholesterol as discussed previously, resulting in reduced cardiovascular damage. Cocoa flavonoids can also increase the production of good cholesterol (HDL), which mops up the harmful fats from the blood vessels. Cocoa flavonoids discourage platelets from forming harmful clots and damaging heart muscle blood vessels. The flavonoids in cocoa help the blood vessels dilate more easily, allowing more blood flow to the heart (nitric oxide (NO) activation). This same principle is applicable to insulin-stimulated blood sugar uptake, resulting in improved diabetic control. Cocoa has been found to have anti-inflammatory properties, stopping the inflammatory process (cytokines) from damaging the body.

In several studies, dark chocolate has been shown to decrease blood pressure, which in turn

decreases the damage to heart vessels. Cocoa is thought to be a renin-angiotension enzyme inhibitor, which is the same principle on which many blood pressure pills work (ACE inhibitors).

There have also been studies showing that dark cocoa can help reduce dental cavities, decrease the plaque on teeth, and prevent gum disease.

Research in dementia has shown that the progression of the condition can be combated by the same antioxidant principles we have been discussing. Several vitamins, particularly vitamin E and certain B-vitamins, have been used to help with dementia. As noted previously, cocoa has the same capacity to decrease free-radical damage, limiting dementia and improving memory.

Dark chocolate improves the body's ability to use insulin and stops the insulin-resistance condition that can lead to diabetes. Cocoa can increase nitric oxide levels to help with insulin-stimulated uptake of blood sugars. The increase in nitric oxide also improves the health of the blood vessels, limiting the damage of diabetes on the small vessels.

Cocoa has been found to help with liver damage, and can repair liver cells after long-term exposure to alcohol.

What exactly is in cocoa that provides so many benefits? To hear one tout its benefits, cocoa almost sounds like "snake oil" sold in traveling caravans. The truth is that cocoa is a complex food. There are over 300 different chemical components found in cocoa. The cocoa bean is the fruit of the Theobroma cacao tree, and the beneficial effects are wholly determined by how it is grown, handled, and processed.

In general, cocoa contains Cocoa butter (a neutral fat consisting of oleic, stearic, and palmitic fatty acids), minerals (copper, magnesium, potassium, iron, zinc, and calcium), theobromine and trace amounts of caffeine, and mood-enhancing chemicals (PEA, tyramine, tryptophan, and serotonin). This is just an abbreviated list of the chemicals found in cocoa.

In addition to the main chemicals which provide a majority of the health benefits, cocoa also contains polyphenols. Polyphenols are a large class of compounds that provide the antioxidant and anti-inflammatory benefits of fruits and vegetables. One of the most important classes of polyphenols are flavonoids. Flavonoids can be further broken down into smaller families –flavanones, flavones, flavonols, flavanols (flavan-3-ols), anthocyanins and isoflavones.
Within the flavanol family exist powerful stand-alone ("monomeric") chemicals known as epicatechins and catechins, as well as compound chemicals ("oligomeric") known as procyanidins. These substances are the true backbone of the health properties derived from cocoa.

Epicatechin is the predominant polyphenol in cocoa, and accounts for a majority of the health benefits that scientists attribute to this wonderful food. Cocoa is one of the most polyphenol-rich foods available on Mother Earth. However, the processing and manufacturing of the cocoa bean has an enormous impact on the levels of these substances that are actually contained in the final product.

Chocolate Science Update

In this whitepaper, I will examine the influence of manufacturing on the availability of the flavanols, as well as present the most recent research conducted in 2008 on cocoa, and cocoa's effects on health. I will also relate the University of Utah results on Xocai™ products with other pertinent studies.

A 2008 study completed by researchers in Spain examined the impact of manufacturing processes on cocoa powder. The researchers found that "dutching" (or alkalinization) of cocoa powder resulted in a 60% loss of total flavonoid capacity. While dutching might make cocoa more palatable by removing the natural bitterness, it also robs cocoa of most of the beneficial properties associated with flavonoids.

Even the process of fermenting cocoa beans contributes to the loss of potent flavonoids.

This study also showed a 67% loss of the (-)-epicatechin, which is the main powerhouse flavonoid in cocoa.

Need more convincing? The researchers also discovered that dutching contributes to an 86% loss of the other important flavonol in cocoa—quercetin. Quercetin is a very potent antioxidant and free-radical scavenger that was not even reported to be found in cocoa before.

Pound-for-pound, unprocessed cocoa contains as much quercetin as broccoli, apples, or red grapes.

Conclusion: How cocoa is manufactured has a significant effect on the health benefits contained in the final product.

As recently as August 2008, a study reported the discovery of dietary resveratrol in cocoa powder (about half as much as an average California red wine), further bolstering the argument of cocoa as a beneficial food.

Why is the preservation (or even enhancement) of cocoa polyphenols of such great importance? The answer is two-fold: the obvious biological activity of polyphenols, combined with the limited absorption of polyphenols in the gut. This means the more potent the cocoa,

the more beneficial to the consumer. Epicatechin demonstrates the highest absorption in the blood, which is why it is important to maximize the amount available in the product.

Conclusion: Research is continuing to uncover new findings support the many dynamic health benefits of cocoa.

Several international studies have examined the absorption of flavanols into the bloodstream ("bioavailability"). These studies found that the gastric environment has little-to-no effect on polyphenols. Epicatechins and catechins are readily absorbed by the upper intestinal gut into the bloodstream. Epicatechin metabolites (glucuronide, sulfate, and methyl) are found in blood plasma very soon after being after hitting the intestinal gut. The larger molecules of flavanols not absorbed in the small intestine travel to, and are metabolized by, bacteria in the large intestine, producing other beneficial polyphenols. These valuable compounds can be found even up to six or 12 hours after the cocoa product has been ingested.

These studies also discovered epicatechin metabolites and quercetin in the brain bloodstream soon after the ingestion of cocoa.

Conclusion: Cocoa's workhorse molecules are absorbed effectively in the body.

Another important factor to consider is whether an increase of polyphenols increase antioxidant levels in the blood. Studies have found definite increases in blood ORAC levels associated with cocoa consumption, indicating that the flavonoids are being utilized by the body. The ORAC (oxygen-radical absorbance capacity) test measures the capacity of a compound to absorb or neutralize oxygen-free radicals, which are harmful to the body. An increased presence of antioxidants gives the body another weapon to fight damaging molecules that are created inside the body every day.

An increase of total serum glutathione, also shown in these studies, indicates that the flavonol molecules are actually doing their jobs inside the living body. Glutathione (a protein found inside cells) is essential for the function of immune cells and disease-fighting. Another interesting and informative test determines whether the metabolites, or breakdown products, of the flavonoids are found in the urine. Presence of metabolites in urine indicates that the molecules are being used by the body.

Conclusion: Research proves that flavonoids from ingested cocoa are being utilized by the body, and positively affect the body's immune system.

More International Studies, U of U Research

Now, let's take a look at the newest international studies on cocoa while comparing and contrasting these interesting findings with the results obtained from a cardiovascular study

performed at the University of Utah.

Professor David Kennedy is the director of Brain, Performance and Nutrition Research Center at Northumbria University in England. He recently led a group of researchers in exploring the effects of cocoa on the human brain ability to perform mathematical equations. Professor Kennedy, co-author of the study, concluded from the study that consuming chocolate could benefit people when performing mentally challenging tasks.

"For things that are difficult to do, mentally demanding things that maybe crop up in your work, [consuming cocoa] could help," Professor Kennedy said.

The researchers gave a flavanol-rich hot cocoa drink to 30 individuals, and then had them answer various mathematical questions. The cocoa used in the study contained 500 milligrams of flavanols—more than would normally be found in fruits and vegetables. Dark chocolate, as one of the three major sources of flavanols discussed above, contains higher quantities of flavanols than the highly processed chocolate we see in the candy aisle of the grocery store. Flavanols, as previously discussed, are part of a group of chemicals called polyphenols. They increase the level of cerebral blood flow, among many other health benefits.

After consuming the cocoa drink, the volunteers in this study were asked to count backwards in groups of three, beginning with a random number between 800 and 999 (generated by computer). The study showed that the subjects' mathematical performance was clearly affected by the drink, and suggests that students who binge on chocolate while studying for exams may actually benefit from doing so—at least in terms of mental acuity. Subjects accomplished the calculations more quickly and more accurately than the control group.

The findings were presented at the British Psychological Society annual conference at Brighton, and also showed that subjects were inclined to feel less tired and less mentally drained after answering the questions.

In the interest of full disclosure, the study also found that the same test subjects did struggle with more complex mathematical tasks.

Professor Kennedy stated, "The amount [of flavanols given in the study] is more than in the [normal] diet, but there is quite a lot of evidence that general amounts are protective against declining function. The more [foods you eat that are] high in polyphenols, the better it is for your brain in the long run."

Conclusion: High levels of flavanols found in chocolate can improve mental acuity when taken in the proper amounts.

One of the easiest molecules to check in urine is isoprostane—a molecule that damages the body. If antioxidants are absorbed and functioning correctly, there should be a reduced level of isoprostane found in urine. High levels of isoprostane are associated with increased risk for dementia.

The study performed in 2008 by the University of Utah showed statistically significant increases of ORAC levels in blood plasma, increases of glutathione levels in plasma, and decreases in isoprostane levels found in urine. University of Utah researchers found these results using both a standard dose of Xocai Active™ (one ounce, three times per day), as well as an increased dose (three ounces, three times per day). These findings confirmed other reports of increased serum ORAC levels, increased glutathione levels, and decreased isoprostane levels found in other "in-vivo" tests (tests performed in the human body) with dark cocoa powder.

Conclusion: Cocoa, specifically Xocai Activ™, contributes to decreased isoprostane levels in the body, proving the absorption of cocoa antioxidants.

It's no secret that cardiovascular diseases ("CVD") are the leading cause of death in the United States and many other countries around the world. Some projections have cardiovascular disease becoming the number one cause of death everywhere in the world by 2010.

It's also no secret that dietary changes and intake of flavonol-containing foods have been associated with improvements in cardiovascular diseases. The flavonoids and other compounds of cocoa have been clearly shown to reduce the risk of cardiovascular disease in humans. Many such studies have shown an improved endothelial (blood vessel) function, platelet function, insulin sensitivity, blood pressure, and decreases in chemicals causing inflammation in the body.

Conclusion: Flavonols improve the body's natural ability to fight CVD.

Here are some of the latest CVD statistics from the United States (and, unfortunately, coming to a country near you soon):

- *Cardiovascular disease (CVD), principally heart disease and stroke, is the Nation's leading killer for both men and women among all racial and ethnic groups.*
- *Almost 1 million Americans die of CVD each year, constituting 42% of all deaths.*
- *Heart disease is the leading cause of death for ALL Americans aged 35 and older.*

- *One out of every four Americans has some form of CVD; that works out to about 57 million people in the United States.*

- *Heart disease and stroke account for almost 6 million hospitalizations each year and cause disability in almost 10 million Americans aged 65 years and older.*

- *CVD costs America $274 billion each year when including health expenditures and lost productivity.*

- *A number of health-related behaviors contribute significantly to cardiovascular disease (e.g. tobacco use, lack of physical exercise, poor nutrition).*

Sources: National Center for Health Statistics, National Center for Chronic Disease Prevention and Health Promotion, Center for Disease Control and Prevention.

A study performed last year examined postmenopausal women, the total flavonoids consumed by that population, and their cardiovascular mortality. The study found that only a limited number of foods improved their condition: apples, pears, strawberries…and chocolate. There was no measurable reduction in cardiovascular mortality with any other fruits or vegetables.

Conclusion: Unprocessed cocoa can improve cardiovascular mortality rates.

In past reports, I discussed two large studies that showed the benefits of cocoa in reducing cardiovascular mortality—a major study in the Netherlands on elderly men and a study conducted on the Kuna Indian population of the San Blas Islands in Panama. These studies involved long-term observations that indicated improved cardiovascular benefit of cocoa consumption.

Conclusion: Ongoing consumption of cocoa promotes cardiovascular health.

A study conducted this year by the University of Illinois found that the consumption of flavonol-enriched cocoa bars resulted in significant reduction in systolic blood pressure (8.2% decrease) and diastolic blood pressure (8.2% decrease) compared to a placebo group. The improvement occurred within a four-week period, and continued throughout the entire study. These findings were very interesting, especially considering the fact that study participants had no pre-existing hypertension.

Conclusion: Eating cocoa daily can lower blood pressure.

A group of researchers from the United Kingdom reported in the American Journal of Clinical Nutrition regarding a meta-analysis of numerous studies completed on cocoa flavanols and blood pressure.

These researchers found forty-three different studies regarding the effect of chronic intake of flavonoids on blood pressure, and seven studies regarding the effect of acute intake. Black tea, red wine and grape juice demonstrated no significant effects on blood pressure. Cocoa, however, presented a 5.88mm reduction in systolic blood pressure, and a 3.33mm reduction in diastolic blood pressure—statistically significant findings.

Conclusion: Cocoa appears to be more effective than black tea, wine and grape juices in helping reduce high blood pressure.

Cocoa studies conducted this year found that cocoa increases vasorelaxation (dilates the blood vessel walls) in healthy subjects. Effects were also positive for patients with hypertension, coronary heart disease, the elderly, post-transplant heart patients, and patients with high cardiovascular risk.

Conclusion: Consuming cocoa can dilate blood vessels, allowing better blood flow throughout the body.

The University of Utah study found that basically healthy patients experienced a decrease in systolic and diastolic blood pressure by 5mm within two weeks of a program eating unprocessed cocoa (a product produced under the Xocai™ brand). These findings corroborated other studies, and delivered the same success you would find with weight loss, dieting, and even some blood pressure medications.

It is widely accepted among medical professionals that even a small drop in blood pressure translates to a marked reduction in heart attacks, strokes, and other cardiovascular diseases.

Conclusion: Consuming unprocessed cocoa can lower blood pressure and contribute to weight loss.

This year, a group of researchers from Yale found that acute ingestion of both solid dark chocolate and liquid cocoa improved the blood vessel function and lowered blood pressure in overweight adults. Sugar-free or low glycemic products aided in further improvements in

blood pressure.

Research has uncovered the fact that the dilation of blood vessels is achieved via an NO-dependent (nitric oxide) mechanism. A decrease in NO is associated with increases in arteriosclerosis and cardiovascular risk. After consuming a flavanol-rich beverage, test subjects experienced an increase in NO, generated by NO synthase. Cocoa stimulates this mechanism to create even higher levels of NO in test subjects.

Conclusion: Cocoa lowers blood pressure through stimulation of nitric oxide levels in the body.

We also see some notable evidence that cocoa also acts like an angiotensin converting enzyme (ACE) inhibitor, further lowering blood pressure.

Researchers in Switzerland found that within two hours of consumption of flavanol-enriched cocoa, subjects experienced a significant reduction of serum oxidative stress, improved coronary vessel function, and decreased platelet adhesion. Researchers also noted an increase in serum epicatechin levels at the same time.

Conclusion: Yet another way cocoa lowers blood pressure is by decreasing oxidative stress.

This year, a group of researchers from the University of California, Davis found that flavonoids can protect myocardial (heart) tissues during damaging events. They found that epicatechins confer cardioprotection to the heart muscle during short- and long-term ischemia reperfusion myocardial injury. In lay terms, the epicatechins protected the heart muscles after a heart attack caused decreased blood flow to the heart.

Conclusion: The epicatechins in cocoa can protect the heart muscles after a heart attack.

Within the last year, two other studies found minimum results using dark cocoa. However, a review of the studies found that the first used only approximately 300mg of total flavonoids per day, which is far below the therapeutic amount of 600mg to 900mg to total flavonoids. The second study used 900mg of total flavonoids, but only administered twice per day, which the researchers themselves thought may have contributed to decreased results.

Cocoa molecules are short-lived in the blood stream; at least three times per day appears to be the necessary frequency to enjoy continued results.

A second range of studies examined the conditions of insulin resistance related to impaired glucose tolerance, or "prediabetes," which increases the risk of cardiovascular events, diabetes, decreased endothelial NO (level of nitric oxide in the blood vessels) bioavailability, and increased oxidative stress.

Several studies this year examined the impact of flavanol-enriched cocoa ingestion on the oral glucose tolerance test (OGTT), endothelium-dependent vasorelaxation (TK), blood pressure, and serum C-reactive protein (CRP=a measure of inflammation) in adults with hypertension and impaired glucose tolerance.

A study by researchers at Tufts University and the University of L'Aquilla used 1008mg of total flavonoid cocoa product divided into 3 daily doses, compared to a flavonoid-free cocoa product.

These researchers found that flavonols increased the bioavailability of NO and decreased the formation of oxygen- and nitrogen-free radicals. They also found that flavonols and resveratrol inhibit IκB kinase, and downregulate nuclear factor- κB (an oxidation pathway that causes blood vessel damage and increases fat-induced insulin resistance). This study confirmed other research that flavonol-rich cocoa improved the dilation capacity of blood vessels, and reversed the dysfunction of blood vessels in prediabetics and smokers.

These scientists concluded that high-dose flavanol cocoa improved insulin sensitivity, increased B-cell function (cells that produce insulin), decreased blood pressure, and increased the flexibility of the blood vessel walls. They also found an increase in the QUICKI (quantitative insulin sensitivity check index), which correlates to improved insulin sensitivity, as well as improved scores in the oral glucose tolerance test.

In their study, the University of Utah also found a statistically significant increase in QUICKI, as well as improved two-hour glucose tolerance test scores. U of U scientists also found that unprocessed cocoa powder did improve the function of the pancreas, and lowered diabetic risk. Cocoa was found to be as effective in increasing insulin sensitivity as weight loss, exercise, medications and other dietary supplements.

Conclusion: Research points to the fact that unprocessed cocoa powder improves the function of the pancreas and lowers diabetic risk. Cocoa has also been observed to be as effective as weight loss, exercise, medications and other dietary supplements in increasing insulin sensitivity.

A 2008 study examined the effects of flavonoid-rich cocoa on the cerebral (brain) blood flow in healthy elderly humans. The study used 900mg of flavanols, and measured blood flow in the middle of the cerebral artery (one of the main arteries in the brain) after cocoa ingestion. As the researchers hypothesized, they found a significant increase in cerebral blood flow for those subjects ingesting the cocoa. They also noted that nitric oxide (NO), a critical regulator of brain perfusion, was more available. More nitric oxide (NO) pathways were activated after consuming the Cocoa. Researchers did not an initial, momentary decrease in (NO), but they

attributed this to trace levels of natural caffeine (theobromide) in the cocoa powder. NO levels stabilized immediately thereafter.

Other studies have found that flavonoids improve spatial memory, and decrease brain edema, as well as neuronal death in the hippocampus—a part of the brain that controls mood.

Conclusion: Ingestion of cocoa leads to an increase in cerebral blood flow up to four hours after ingestion. Increased brain blood flow can contribute to decreased risk of dementia, stroke, or other vascular cognitive impairment.

Oxidative stress, inflammation, and accumulation of iron and protein aggregates all increase the risk of neuro-degenerative diseases such as dementia and Parkinson's. These conditions lead to neuronal (brain cell) death. The neuro-protective components in cocoa, categorized into three activities below, can reduce these risks:

1 - Antioxidant activities

2 - Anti-inflammatory activities

3 - Potent iron-chelating activities

The antioxidant activity, anti-inflammatory activity and potent iron-chelating activity of cocoa provides a neuroprotective component. Researchers have found that epicatechin reduces the toxic effects of amyloid-C, a component of the senile plaques in the brain associated with dementia. We have even come across some information showing that cocoa can slow down nigrostriatal dopaminergic cell loss in Parkinson's disease. The mechanism seems to be connected to mitogen-activated protein kinase signaling pathways that are involved in brain cell survival, regeneration and cell death.

Conclusion: Cocoa can help slow the effects of Parkinson's.

Epidemiological studies suggest that consuming flavonoid-rich foods such as cocoa can delay the onset of dementia and Alzheimer's dementia. Researchers have found that epicatechin reduces the toxic effects of amyloid-C, a component of the senile plaques in the brain associated with dementia. We have even come across some information showing that cocoa can slow down nigrostriatal dopaminergic cell loss in Parkinson's disease. The mechanism seems to be connected to mitogen-activated protein kinase signaling pathways that are involved in brain cell survival, regeneration and cell death.

Conclusion: Cocoa may delay, or even prevent, dementia.

Another important area of health benefits from unprocessed cocoa is the reduction of inflammation.

In her review article this year, Karen Cooper examined the last 10 years of research on cocoa and health. She believes that a simple antioxidant mechanism driving the benefits of cocoa is not likely. Rather, it is the inhibition of inflammatory pathways that lead to the reduced risk of chronic diseases.

A 2008 study performed in Italy examined the connection between inflammation and regular consumption of dark chocolate. Like Cooper, the researchers here concluded that cocoa's capacity to decrease inflammation is what provides most of the health benefits to the body. They hypothesized that dark chocolate consumption is inversely related to the level of C-reactive protein (CRP), a marker of inflammation that is considered an independent indicator of coronary heart disease.

Inflammation and nitric oxide (NO) production play a major role in the development of arterosclerotic plaque. The Italian scientists found that flavonoid-enriched cocoa did indeed decrease serum CRP in a large population of Italian patients.

Other groups have returned with similar results after monitoring the effects of a flavonoid rich cocoa on inflammation. A Baltimore group studied women who consumed approximately 700mg of flavonoids each day. Similar to the Italian group, these test subjects also experienced a reduction in CRP, and a decrease in inflammation.

Recently, a group of researchers from the University of California, Davis and Italy examined the anti-inflammatory impact of cocoa flavanols. This group discussed how the production of inflammatory chemicals (cytokines) increases the risk of heart disease, such as hardening of the arteries and congestive heart failure. If the inflammatory pathways can be altered, they argued, then there would be a reduction in heart disease.

Nuclear factor-kappaβ (NK-κβ) is one of the factors that control inflammatory response, cellular proliferation (growth), and cellular adhesion. Studies have shown that epicatechin and catechin molecules reduce NK-κβ activation, and consequently reduce inflammation cytokines.

Cocoa also demonstrates a significant effect on TNFα (tumor growth factor) which increases the body's anti-inflammatory ability. Cocoa flavanols also inhibit the formation of other inflammatory chemicals like IL-2 (interleukin).

Another chemical group, eicosanoids, which is produced through the arachidonic acid pathway, is another contributor to inflammation. Some of these chemicals promote platelet

aggregation, and can vasoconstrict blood vessels. Cocoa Flavanols block the arachidonic pathway similar to COX-1 and COX-2 inhibitors. These flavanols also block the production of lipoxygenase, which is a contributor to asthma.

As discussed earlier, when the blood vessel wall is damaged, the body produces a chemical that causes platelets to aggregate. This action only serves to further damage the blood vessel. Cocoa flavanols have been very effective in inhibiting the chemicals that active the platelets, reducing the formation of clots. This action is comparable to aspirin in the reduction of blood clots.

Researchers also found that the cocoa flavanols positively influence the immune system and decrease inflammation, promoting healing in the body.

Cocoa flavanols also protect the blood vessels by reducing the damage done by oxidized LDL (bad) cholesterol. Basically, flavanols prevent LDL cholesterol from becoming oxidized.

A group from Johns Hopkins found that after two weeks of taking highly flavanol-enriched cocoa, subjects experienced LDL level decreases of 6%, while HDL (good) cholesterol rose by 9%.

Another cholesterol factor important to examine is the production of Apo A-1 protein. Apo A-1 protein, a good cholesterol marker, helps clear cholesterol from arteries.

The University of Utah study found that unprocessed cocoa powder significantly increased the amount of Apo A-1 in the body. They also found that the cocoa flavanols increased the good cholesterol antioxidant (PON-paraoxanase), which is an HDL-associated enzyme that confers antioxidant activity on HDL-C, and also helps protect against atherosclerosis.

Interestingly, the University of Utah also discovered that cocoa flavanols increased lean body mass, which helps the body burn more calories and increases the function of muscles, bones, brain, liver and kidneys. The university researchers also found that flavanols increased adiponectin—a protein hormone that regulates blood sugar, breaks down fat, and suppresses the development of diabetes, obesity, atherosclerosis, and non-alcoholic fatty liver disease.

Memory and Aging

Cocoa flavanols are also important in many other areas. A Finnish study recently found that chocolate preference and consumption in elderly men was associated with better health, optimism, and better psychological well-being.

Medical professionals accept that oxidative stress and inflammation are major contributors to the behavioral and cognitive declines associated with aging. Cocoa flavanols, as discussed earlier, limit oxidative stress, and block inflammation, apparently helping improve memory and slowing down the aging process.

Depression is also a very common problem in our world. A recent study found that the addition of high-flavanol cocoa extract given to rats in a forced swimming test indicated that cocoa decreased depression. We know that tryptophan from cocoa is broken down into serotonin and other compounds that fight depression and elevates mood.

Other studies have shown that cocoa flavanols improve the overall immune system. Studying rats, one group of researchers found that the cocoa-fed rats experienced an improved Th1 immune system (this system helps kill bacteria and helps cells fight off infections).

Another related rat study found that cocoa intake improved intestinal immune response by increasing those antibodies that prevent bacteria from entering the body by fighting them in the gut.

A study conducted in November 2008 researched the benefits of cocoa flavanols on dioxins—lethal poison compounds. The researchers found that the intake of cocoa definitely suppressed the toxicological effects of dioxins in the body. In effect, the cocoa stopped the damage that this environmental poison does to the body by interfering with different pathways.

Conclusion

A surprising number of issues of obesity, low energy, mood swings and other health problems can be traced to an improper diet. We can correct these problems by changing our dietary habits, and incorporating more flavanol-rich foods—acai berries, blueberries and unprocessed cocoa, in particular—into our daily routine.

Flavanol-rich cocoa demonstrates impressive antioxidant and anti-atherosclerotic effects, increases HDL, improves insulin sensitivity and anti-platelet effects, increases nitric oxide production and vascular relaxation, exhibits anti-inflammatory effects, increases immune response and helps overall mood elevation.

Remember that to achieve these beneficial effects, unprocessed cocoa with low glycemic sweeteners and at least 1,000 total milligrams of flavonoids must be taken at least three times a day for maximum benefits.

Cocoa has indeed come full circle from a Mesoamerican medicinal drink to a modern-day functional food that provides significant health benefits. Reports continue to come in regarding the wide range of benefits from cocoa, including powerful protection against cardiovascular disease, diabetes, and neurodegenerative diseases.

Cocoa is the “long-lost secret” that represents a solution to so many health problems that the world’s population faces today.

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