

## THE SIX PUZZLE PIECES OF DARK CHOCOLATE

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.

### PART #1 OF THE CHOCOLATE PUZZLE FLAVANOL AVAILABILITY



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.**



### PART #2 OF THE CHOCOLATE PUZZLE CACAO POSITIVELY AFFECTS HEALTH



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.**

### PART #3 OF THE CHOCOLATE PUZZLE INCREASES IN ANTIOXIDANTS



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.**



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.**

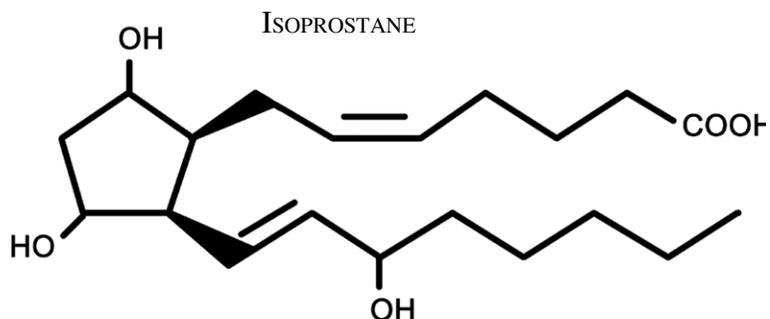
PART #5 OF THE  
CHOCOLATE PUZZLE  
THE REVEALING  
ISOPROSTANE MOLECULE



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:

-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.