

Discover the health benefits of cocoa and dark chocolate

Executive Summary:

- ❑ The use of cocoa dates back to ancient civilizations when it was used as a gift to the Gods.
- ❑ Many studies suggest that cocoa and dark chocolate are associated with numerous health benefits that may reduce risk for cardiovascular disease, including decreases in blood pressure and improvements in lipid profiles.
- ❑ Emerging research indicates that the health benefits of cocoa flavanols may extend beyond their action on the cardiovascular system alone and may also elicit improvements in insulin sensitivity and cognition.



Cocoa and chocolate are natural sources of potassium (one tablespoon of cocoa powder providing 2% of the RDA), which studies have shown to be a key factor in affecting blood pressure and stroke risk.

Cocoa: An ancient fruit with contemporary health benefits

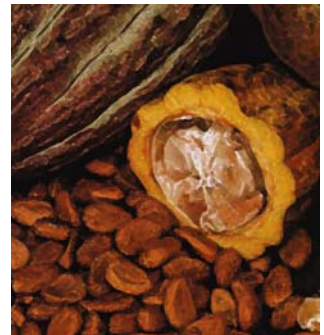
While cocoa beans were once used as a form of currency and an offering to the Gods in ancient civilizations, cocoa powder and the chocolate products made from cocoa beans are now a generally recognized treat by many. Cocoa powder and chocolate are made from the seeds of the fruit of the *Theobroma cacao* tree. Cocoa was first consumed more than 2,000 years ago by the Olmec, Mayan and Aztec cultures as a bitter drink.

Although ancient people valued cocoa for its life-giving properties, modern research on the health benefits of cocoa and chocolate has been going on for only the past 30 years. Being of plant origin, cocoa and chocolate are natural sources of many phytonutrients, including flavanols, which are believed to confer vascular health benefits.

¹Hollenberg NK, et al. *Hypertension* 1997; ²Chevaux KA, et al. *J Food Comp Anal* 2001; ³McCullough ML, et al. *J Cardiovasc Pharmacol* 2006; ⁴Buijsse B, et al. *Arch Intern Med* 2006; ⁵Mink PJ, et al. *Am J Clin Nutr* 2007; ⁶Djousee L, et al. *Clin Nutr* 2011; ⁷Djousee L, et al. *Clin Nutr* 2011.

Some of the first epidemiologic studies showing an association between cocoa and health involved the Kuna Indians of Panama. The Kuna have lower than expected rates of age-related hypertension and diabetes which can be attributed to high intake of cocoa in the traditional Kuna diet.^{1,2,3} Data from the Zutphen Elderly Study which followed 470 elderly men for 15 years showed cocoa intake to be inversely related with blood pressure as measured at baseline and 5 years later.⁴ Cocoa intake is also inversely associated with 15-year cardiovascular and all-cause mortality. Another large epidemiological study, the Iowa Women's Health Study, using a population of postmenopausal women (>30,000), also saw a borderline significant inverse association between chocolate intake and CVD mortality.⁵ More recently, an analysis from the

National Heart, Lung, and Blood Institute Family Heart Study showed an inverse relationship between chocolate consumption and coronary plaques and coronary heart disease.^{6,7}



Cocoa powder and chocolate are made from the seeds of the fruit of the *Theobroma cacao* tree.

Hypertension? ... Cocoa and dark chocolate deserve mention!

Many of the potential health benefits of cocoa and dark chocolate may be due to their protective effect on the blood vessels of the circulatory system. Cocoa has been shown to improve endothelial function and to reduce blood pressure, i.e. the levels of stress to which the blood vessels may be exposed.

Even a small amount of cocoa appears to have a benefit. Long-term consumption of 6.3g of flavanol-rich dark chocolate (30 kcal/d — roughly equivalent to 1.5 Hershey®s Kisses®

Brand Special Dark® Mildly Sweet Chocolates) for 18 weeks reduced blood pressure in a mildly hypertensive population.¹

The consumption of larger amounts (-100g/dark chocolate per day) of flavanol-rich dark chocolate over a 15-day period also decreased daytime and nighttime blood pressure, decreased serum LDL cholesterol, reduced insulin resistance and improved nitric oxide-dependent vasorelaxation in hypertensive adults.^{2,3}

Several meta-analyses on studies investigating the effects of dark chocolate on blood pressure have been published recently. The most recent included 15 trials and found that statistically significant changes were observed in more than half of the studies and that the mean decrease in systolic blood pressure (more than 3 mmHg) is of importance to clinical and public health.⁴

¹Taubert D, et al. *JAMA* 2007; ²Grassi D, et al. *Hypertension* 2005; ³Grassi D, et al. *Am J Clin Nutr* 2005; ⁴Reid K, et al. *BMC Med* 2010.

The HERSHEY CENTER FOR HEALTH & NUTRITION sponsors cutting-edge research on the health benefits of cocoa, chocolate and nuts. The Center focuses on studying the chemistry and dietary components of various foods and food components that are key sources of nutrients. The Center directs scientific research to develop products and technologies providing consumers with health benefits in the areas of heart health, weight management, and mental and physical energy. The HERSHEY CENTER FOR HEALTH & NUTRITION is designed to be a significant source of new-product innovation as it draws upon clinical studies and scientific analyses.

Cocoa and Health: Emerging Frontiers

Skin health: Chocolate with high flavanol content may protect the skin against the harmful effects of UV rays. In one double-blind study, subjects were either given chocolate that was high (>600 mg) or low (<30 mg) in flavanol content. The study found regular consumption of 20 grams of high flavanol chocolate protected skin from harmful UV effects.¹ Another study found that when individuals consumed high flavanol (329 mg) cocoa daily for twelve weeks, there was decreased reddening of the skin following UV exposure. High flavanol cocoa also resulted in an increase in blood flow to cutaneous and subcutaneous tissues of the skin as well as decreased skin roughness and scaling.² (¹Williams S, et al. *J Cosm Derm* 2009; ²Heinrich U, et al. *J Nutr* 2006)

Cognition: Consuming cocoa or chocolate has measureable effects on the brain. Several studies show that either the amount of blood or oxygen in the blood flowing through the brain is increased in individuals who consume cocoa.^{1,2,3} These changes may partially explain why recent studies have reported that subjects score higher on mental acuity tests following cocoa consumption compared to following the consumption of a placebo.^{3,4} (¹Francis S, et al. *J Cardiovasc Pharmacol* 2006; ²Sorond F, et al. *Neuropsych Dis & Treat* 2008; ³Scholey A, et al. *J Psychopharm* 2010; ⁴Field D, et al. *Phys & Behav* 2011)

Other Cardiovascular Benefits of Cocoa and Chocolate

The consumption of cocoa and dark chocolate is associated with improvements in established and emerging risk factors for cardiovascular disease beyond blood pressure.

Endothelial Function:

Movement of blood throughout the body is highly dependent upon the health of the endothelial cells that line the insides of blood vessels. Endothelial cells produce substances that allow blood vessels to dilate and endothelial dysfunction correlates strongly with cardiovascular disease.¹ Studies investigating the effects of cocoa and dark chocolate on endothelial function have been reviewed recently^{2,3} and have concluded that endothelial function is significantly improved in healthy volunteers, in individuals at risk for cardiovascular disease and in smokers, and in individuals with hypertension and diabetes following both acute and chronic cocoa or dark chocolate consumption.

Insulin Sensitivity:

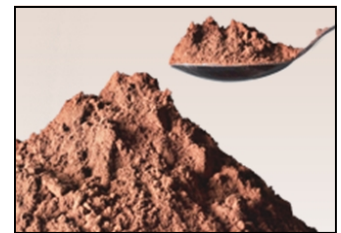
Insulin resistance results in impaired endothelial function and thereby contributes to cardiovascular disease in patients with diabetes. Several studies have now shown that prolonged consumption of dark chocolate or cocoa improves insulin sensitivity in both healthy and insulin-resistant individuals.^{4,5,6}

"Aspirin-like" Effects:

Low dose aspirin therapy is often prescribed for cardiovascular disease patients because it reduces platelet activity, and thus blood clot formation, and inflammation. While cocoa does not appear to be as potent as aspirin⁷, several studies have shown that flavanol-rich cocoa and chocolate inhibit platelet activation.^{8,9} Additional studies have demonstrated that cocoa reduces the production of proinflammatory signaling molecules known as leukotrienes¹⁰ and reduces inflammation of the blood vessel walls.¹¹

Cholesterol levels:

The fat in cocoa and chocolate does not appear to elevate blood LDL cholesterol¹² and several studies suggest that cocoa flavanols may improve cholesterol levels.^{2,3} Interestingly, elevated levels of oxidized LDL may be a better predictor of cardiovascular health than total LDL levels¹³ and numerous studies have shown that cocoa and chocolate decrease oxidized LDL levels.^{14,15,16}



One Tbsp of cocoa delivers nearly 7% of the US RDA of magnesium.

¹Vita J. *Circ* 2002; ²Bauer S, et al. *Curr Cardio Risk Rep* 2011; ³Katz D, et al. *Antiox & Redox Signal* 2011; ⁴Davison K, et al. *Int J Obes* 2008; ⁵Grassi D, et al. *J Nutr* 2008; ⁶Grassi D, et al. *Am J Clin Nutr* 2005; ⁷Pearson, et al. *Clin Dev Immunol* 2005; ⁸Rein D, et al. *Am J Clin Nutr* 2000; ⁹Hamed M, et al. *South Med J* 2008; ¹⁰Schramm D, et al. *Am J Clin Nutr* 2001; ¹¹Monagas M, et al. *Am J Clin Nutr* 2009; ¹²Yu S, et al. *Am J Clin Nutr* 1995; ¹³Ehara S, et al. *Circ* 2001; ¹⁴Baba S, et al. *Am J Clin Nutr* 2007; ¹⁵Mursu J, et al. *Free Rad Biol Med* 2004; ¹⁶Khan N, et al. *Nutr Metab Cardio Disease* 2011; ¹⁷Miller K, et al. *J Agric Food Chem* 2009; ¹⁸Kris-Etherton P, et al. *Metabolism* 1993.

Chocolate and Cocoa: FAQ

How much chocolate or cocoa should be eaten for heart health benefits?

Although there is no US RDA for flavanols (the compounds in cocoa beans related to heart health benefits) recent research indicates that consuming even small amounts of flavanol-rich dark chocolate or cocoa may improve markers of cardiovascular health. Studies that show cardioprotective effects have used between 6 and 100 grams of flavanol-rich chocolate or cocoa. Eating moderate amounts of dark chocolate as part of a healthy, balanced diet rich in fruits and vegetables may provide vascular health benefits.

Is dark chocolate better than milk chocolate?

Both dark and milk chocolate contain flavanols because cocoa beans are natural sources of flavanols. Research shows that in many available commercial cocoa and chocolate products, the amount of flavanols is directly related to the non-alkalized, non-fat cocoa solid content. Milk chocolate typically has less flavanols because non-fat cocoa solids are replaced by milk. White chocolate does not contain flavanols because it doesn't contain any non-fat cocoa solids.¹⁷ For the flavanol content of various chocolates and other foods visit www.nal.usda.gov/fnic/foodcomp/Data/PA/PA.pdf.

Do the fat and calories in chocolate negate the health benefits?

Much of the saturated fat in chocolate is stearic acid, which has a neutral effect on cholesterol levels (see Cholesterol levels above). In fact, one study had demonstrated that even the consumption of large amounts of chocolate (10 ounces/day for 26 days) does not elevate cholesterol levels.¹⁸ As with any food, calorie intake must be taken into consideration with calorie expenditure and balanced to maintain a healthy weight. Health professionals can help patients and the public understand how to develop a heart healthy diet that includes their favorite, great-tasting foods such as chocolate.

For further information, please visit our website at www.hersheys.com/nutrition-professionals/.