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Healthier lives through education in nutrition and preventive medicine

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Cocoa Polyphenols

Flavonoids are a group of polyphenolic compounds that occur widely in fruit, vegetables, tea, red wine, and chocolate. Cocoa and chocolate products have the highest concentration of flavonoids among commonly consumed food items. Over 10% of the weight of cocoa powder consists of flavonoids, catechin and epicatechin.

Flavonoid-Content

As with most plants, genetic and agronomic factors can markedly influence the contents of phytochemicals available at the time of harvest. Postharvest handling also plays a critical role, because most cocoas undergo fermentation steps, which subject flavonoids in the cocoa to heat and acidic conditions. Subsequent processing steps, such as roasting and alkali treatment, can also reduce the flavonoid content. Lastly, the actual recipe for the finished food or beverage product determines the amount of a given cocoa (and flavonoid) added. In addition, many sources of cocoa polyphenols are foods high in fat and calories.

Antioxidants value of foods

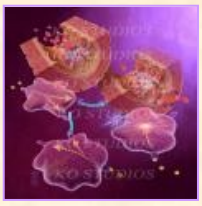
Interestingly, cocoa powder and cocoa extracts have been shown to exhibit greater antioxidant capacity than many other flavanol-rich foods and food extracts, such as green and black tea, red wine, blueberry, garlic and strawberry in vitro.

Antioxidant Capacity

A method to quantify the antioxidant capacity of foods is called Oxygen Radical Absorbance Capacity or "ORAC." The technique, developed by the National Institute of Aging and standardized by the USDA, measures how well a sample inhibits an oxidizing agent (or in other words, disarms free radicals) and how long it takes to do so. The agent used as a standard control for antioxidant activity is a non-commercial, water-soluble derivative of tocopherol called Trolox. The units of an ORAC value are expressed as micromoles Trolox equivalents per gram of a substance (mmole TE/g).

ORAC value of foods and chocolate:

Food	mmole TE/100 grams
Strawberry	~1,600
Blueberry	~2,200
Prunes	~5,700
Milk chocolate	~6,800
Dark chocolate	~13,000

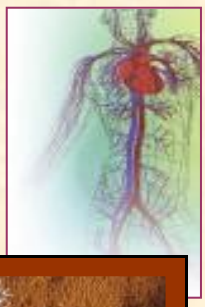


Numerous dietary intervention studies in humans and animals indicate that flavanol-rich foods and beverages might exert cardioprotective effects with respect to vascular function and platelet reactivity.

Research Studies

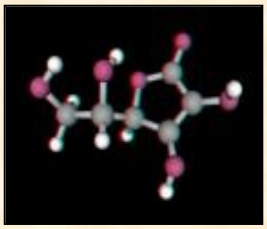
Phenolic antioxidants have been shown to inhibit the oxidation of low-density lipoprotein (LDL) cholesterol, and mounting evidence suggests that it is the oxidized form of LDL that leads to the buildup of fatty plaques in arteries. Extracts of cocoa powder have shown to significantly inhibit LDL oxidation in vitro. One study suggested that LDL oxidation was inhibited by 75% through cocoa phenols, whereas, red wine inhibited LDL oxidation by 37-65%.

However, no long-term studies have evaluated the effects of cocoa polyphenol compounds on the oxidative modifications of LDL in humans.



Because there is six to seven times more epicatechin than catechin in cocoa and chocolate, most studies have focused on epicatechin. Consistent with in vitro studies, human studies indicate that small doses of epicatechin are effective antioxidants. There is a statistically significant increase in plasma antioxidant capacity and reduction in lipid peroxides following cocoa and chocolate consumption.

Benefits



Epicatechin and other flavonoids not only have a direct antioxidant effect, but they may also have a sparing effect on other antioxidants such as Vitamin C and E.

Although flavanol-rich cocoa and chocolate have the potential to augment an individual's antioxidant defense system, there are other cellular mechanisms through which these flavanol-rich foods can affect cardiovascular health.

Other Mechanisms:
Inflammation, Platelets, Endothelium

Inflammation

Atherosclerosis, heart failure, hypertension and hypercholesterolemia can activate several proinflammatory enzyme systems, such as xanthine oxidase, NADH/NADPH oxidase, and myeloperoxidase. Once activated, these enzymes produce reactive oxygen species and other radicals that, can modify nitric oxide (NO) availability and LDL and contribute to endothelial dysfunction.

Flavanol-rich cocoa has been shown to stimulate NO production and to significantly reduce the activities of xanthine oxidase and myeloperoxidase after ethanol-induced oxidative stress. In addition, cocoa flavanols and procyanidins may modulate other mediators of inflammation.

Platelets

Platelets have a prominent role in the development and manifestation of acute myocardial infarction, stroke, and venous thromboembolism. Polyphenols seem to benefit cardiovascular health through regulation of platelet reactivity. Cacao inhibits platelet adhesion. Even a modest decrease in platelet reactivity can be of value because it reduces the probability of clotting.

Endothelium

Sheer stress, ischemia and reperfusion, inflammation, and disease states, such as atherosclerosis, diabetes mellitus, and hypertension, can disrupt endothelial function. This then leads to an inability to regulate vascular tone, and an overall shift toward the prothrombotic state. Antioxidant compounds such as flavanols improve endothelial function through the prevention and possible reduction of oxidative damage by prostacyclin and leukotriene.

Although many emerging risk factors are favorably affected by cocoa polyphenols, as yet, there are no trials demonstrating a protective effect of cocoa polyphenols on cardiovascular disease.

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