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The Gravity of Weight

Chocolate: Glorify or Demonize?

A bittersweet look at this most commonly craved food.

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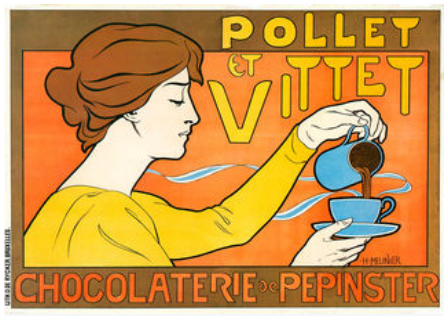
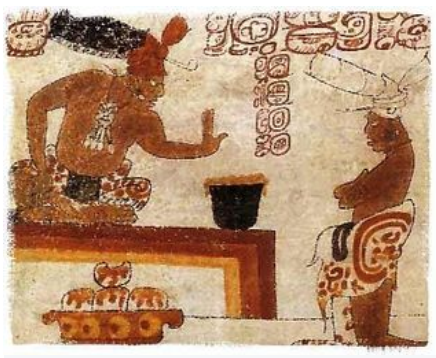
Willy Wonka tells the children who are fortunate enough to tour his factory, in Roald Dahl's classic *Charlie and the Chocolate Factory*, that he has "Supervitamin Chocolate" that contains all the vitamins from A to Z ("except for vitamin S, which makes you sick, and vitamin H, which makes you grow horns") and the most magical vitamin of them all—vitamin Wonka." Clearly Willy Wonka has manufactured his own fantasied concoctions, but what do we know about the origins of chocolate, how it is made, and whether it is as healthy as some would have us believe?



An 1896 Art Nouveau poster for the hot chocolate drink from Pepinster in Belgium.
Source: Alamy/used with permission



A Mayan lord with a container of frothed chocolate. Ancient Mayan texts describe cocoa as having a divine origin.
Source: Wikimedia Commons/Public Domain

Cultivation of the cocoa bean originated in Mesoamerica, possibly 1000 years BC, (Rusconi and Conti, *Pharmacological Research*, 2010), and was used later by both the Mayan and Aztec civilizations. According to one myth, cocoa came from the blood of an Aztec princess, who chose to die rather than betray her kingdom's wealth. (Gianfredi et al, *Nutrition*, 2018) In another, it was discovered by the gods in the mountains. (Dillinger et al, *Journal of Nutrition*, Supplement, 2000.)

One of the first Europeans to mention a bitter drink made from the cocoa bean was Hernando Cortés, who landed on the eastern area of Mexico and described how Aztec emperor Montezuma used it as an aphrodisiac. (Dillinger et al, 2000; Lippi, *Nutrition*, 2009) It was the Swedish naturalist Linnaeus, in 1753, who used a Mayan word in his scientific description and called cocoa, *Theobroma cacao*, "Food of the gods." This early Mayan drink was made by dissolving dried cocoa beans in water with cinnamon and pepper. (Verna, *Malaysian Journal of Pathology,* 2013). Others described cocoa as having "as much nourishment as a pound of beef" (Quélus, 1719) or even that it was a "universal medicine," (Lavedan, 1796) which was literally used to treat hundreds of ailments, from wasting diseases to hypochondria and even hemorrhoids. (see Dillinger et al, 2000)

Typical 17th century scene that demonstrates the preparation of chocolate.(Under the History of Chocolate in Spain in Wikimedia. Creative Commons Attribution 3.0 unported.)
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Though anecdotal evidence of the healing powers of cocoa has existed for centuries, it was not until later in the 20th century that researchers appreciated that cocoa beans are one of the richest sources of polyphenols, which are antioxidants that trap dangerous free radicals in the body and prevent them from destroying cells and tissue. (Oracz et al, 2015, *Critical Reviews in Food Science and Nutrition*.) Cocoa beans, whether fresh or processed, contain more polyphenols (and give the beans their bitter, pungent taste) than coffee, black or green tea, or wine. Flavonoids, the largest group of polyphenols, are believed to have anti-inflammatory, anti-allergic, and anti-bacterial properties, among others. (Oracz et al, 2015) Cocoa beans are the seeds of the tree, and each seed contains 40 to 50% fat as cocoa butter (Rusconi and Conti, 2010). These seeds are"embedded in mucilaginous pulp," within pods that come from cocoa trees. The trees grow in moist, hot regions in a belt around the Equator. (Kongor et al, *Food Research International,* 2016) There are three main varieties of cocoa trees, with the most common being Forastero. The concentration, though, of polyphenols, depends on the genetics of the bean, but also environmental conditions, such as soil, sun exposure, rainfall and even storage time. (Oracz et al, 2015)

Cocoa beans, from which our chocolate products originate, looked like almonds to 16th century Europeans.
Source: Wikimedia Commons/Public Domain

Today, 70% of our cocoa beans comes from Western and Central Africa, with Ghana, the primary producer of high-quality cocoa. (Oracz et al, 2015) Cocoa is a major crop and is grown by 5 to 6 million farmers throughout the world, (Kongor et al, 2016) with the demand for cocoa growing. There is even a prediction that by 2020, there may be a world shortage. (Wickramasuriya and Dunwell, *Plant Biotechnology Journal,* 2018.)

Chocolate, from the cocoa bean, is a highly processed substance. Cocoa liquor, which contains non-fat cocoa solids and cocoa butter, is a paste that comes from the bean. Cocoa butter contains both monounsaturated (mostly oleic acid) and saturated fatty acids (stearic and palmitic). Cocoa powder results when some of the cocoa butter is extracted from the liquor. Chocolate is a combination of cocoa liquor, with cocoa butter and added sugar. (Magrone et al, *Frontiers in Immunology,* 2017) Nibs are cocoa beans without the outer shell. (Di Mattia et al, *Frontiers in Immunology,* 2017) Milk chocolate contains not less than 20 to 25% cocoa. (Verna, 2013) White chocolate contains cocoa butter, sugar, milk powder, and vanilla. (Verna, 2013) When chocolate develops a whitish and opaque "lacy" appearance, there is nothing wrong with it: part of the cocoa butter has solidified or recrystallized and come to the surface, a phenomenon known as "chocolate bloom," and can be prevented by storing it in a cool place. (Aguilera, *Edible Structures: The Basic Science of What We Eat,* pp. 126-7, 2017)

The processing of chocolate involves many steps. The first, which can take from 5 to 10 days and reduces the bitterness, is fermentation of the pulp surrounding the cocoa beans. Next, the beans are sun-dried, following which they are roasted, which can give the beans their typical color, aroma, and taste and texture. Then there is conching, in which the beans undergo an agitation process at high temperatures, and finally, tempering. At every step, there is considerable loss of the polyphenol content. (Di Mattia et al, 2017) For example, after 8 days of fermentation, polyphenol levels drop by as much as 58%. (Oracz et al, 2015) For the most thorough general discussion of the effects of processing on our food supply, see Gyorgy Scrinis' book *Nutritionism* (2013), as well as his recent article on ultra-processed foods, (Scrinis and Monteiro, *Public Health Nutrition*, 2017.)

Chocolate Jar, made in Puebla, Mexico, ceramic. Gift of Mrs. Robert W. de Forest, 1911.
Source: Metropolitan Museum of Art, Public Domain

Aztec woman pouring chocolate to generate foam, circa 1553, from the Tudela Codex, a pictorial religious document, now in Madrid, from the Aztec culture.
Source: Wikimedia Commons/Public Domain

Despite the substantial loss of polyphenols during the multi-steps involved in processing, cocoa has been touted in recent years as a food that has almost magical powers. Chocolate, and particularly dark chocolate, with a cocoa content of at least 70%, has gone from being blamed for obesity and type II diabetes only a few years ago, to a food that is considered actually beneficial to health. (Verna, 2013) There are positive effects even on mood, behavior, and cognition, (Tuenter et al, *Planta Medica,* 2018) as well as "an extensive range of benefits" on blood pressure, insulin resistance, cardiovascular disease, and even body weight. (Kord-Varkaneh et al, *Critical Reviews in Food Science and Nutrition*, 2018.) The exact mechanisms for these positive benefits are not completely understood as, for example, why cocoa decreases platelet aggregation and reduces platelet adhesion. Cocoa may cause vasodilation of blood vessels by increasing levels of nitrous oxide, which, in turn, may affect mitochondrial functioning. Increased levels of uric acid, detrimental and painful to those suffering from gout, may also have a role here. (Latif, 2013; Ludovici et al, *Frontiers in Nutrition*, 2017) Cocoa may also improve the barrier function in the gut by changing the gut's microbiome. (Strat et al, *Journal of Nutritional Biochemistry*, 2016)

Scientific investigation, though, on cocoa suffers from many of the same difficulties as seen in much of nutritional research, and results are often inconsistent regarding actual benefits. For example, subjects are often not blinded because it is hard to mask the typical characteristics of chocolate. Further, there are often methodological differences among studies that

make meta-analyses challenging: participants may vary in terms of their BMI, age, initial health status, and kind of intervention (e.g. what type of cocoa was used), whether it was in liquid or solid form, or even how long or how much cocoa was given. Further, when cocoa is mixed with other substances—the so-called "food matrix"—results may vary. (Elllinger and Stehle, *Nutrients*, 2016; Di Mattia et al, 2017) For example, in some but not all studies, the addition of milk interferes with the absorption of the antioxidants and may negate any potential health benefits. (Lotito and Frei, *Free Radical Biology & Medicine,* 2006) Often, as typical of may nutrition studies, researchers use food frequency (i.e., self-reporting) questionnaires that can be inaccurate or not even distinguish among different kinds of chocolate. (Latif, *The Journal of Medicine*, 2013) Further, sometimes studies are sponsored by chocolate manufacturers so that conflicts of interest must, at least, be considered. (Latif, 2013)

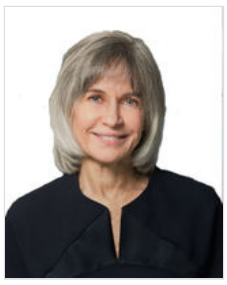
Paul Gavarni, "Woman Chocolate Vendor," between 1855 and 1857, Walters Art Museum, Baltimore, Maryland.
Source: Wikimedia Commons/Public Domain

There is, though, a bitter reality to chocolate cultivation, particularly in Western Africa in the countries of Ghana and Côte d'Ivoire, where most of the cocoa for the major companies (e.g. Mars, Nestlé, Cadbury, Hershey) comes. Apparently, because cocoa farmers live in poverty, they have exploited children, often resorting to overt slavery, to maintain competitive prices. (Food Empowerment Project, Chocolate Industry, 2014) Conditions for many of these children are unsanitary and unsafe: at least until recently, most are not allowed to attend school. They are fed poorly, work from sunrise to sunset, climb the high cocoa trees, cut the cocoa bean pods with a machete, and are exposed to toxic chemicals used to control insect infestation and disease. One report noted that "virtually" all children have scars all over their bodies from accidents with the machetes. Rarely, if ever, have these children even tasted any chocolate products. (Food Empowerment Project, 2014). For a discussion of some recent attempts to protect these children and mandate school attendance, see the article in *Fortune Magazine* by Brian O'Keefe, March 1, 2016.

Jean-Étienne Liotard (1702-1789), Turkish painter, A "Lady Pouring Chocolate."
Source: Wikimedia Commons/Public Domain

Bottom line: Throughout the years, chocolate and the cocoa from which it is made, have been both glorified and demonized. In recent years, cocoa has been seen as having many health benefits, particularly because of its antioxidants, but study results are not always consistent. And all researchers acknowledge the dangers to health of overeating highly caloric chocolate concoctions laden with sugar and other food additives.

About the Author



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