

Eric's Apple

Tuesday, January 15, 2013

Chocolate

Cocoa or dark chocolate may positively affect the circulatory system. Other possible effects under basic research include anticancer, brain stimulator, cough preventor and antidiarrhoeal activities.

Chocolate is a raw or processed food produced from the seed of the tropical *Theobroma cacao* tree. After fermentation, the beans are dried, then cleaned, and then roasted, and the shell is removed to produce cacao nibs. The nibs are then ground to cocoa mass, pure chocolate in rough form. The mass is melted to become the liquor. Chocolate liquor contains roughly 53 percent cocoa butter (fat), about 17 percent carbohydrates, 11 percent protein, 6 percent tannins, and 1.5 percent theobromine. Chocolate liquor is pressed to separate the cocoa butter from the cocoa solids. White chocolate contains cocoa butter, sugar, and milk but no cocoa solids.

Cocoa Butter

Cocoa butter, also called theobroma oil, is a pale-yellow, pure, edible vegetable fat extracted from the cocoa bean, has a cocoa flavor and aroma. Cocoa butter contains a high proportion of saturated fats, derived from stearic and palmitic acids. Unlike cocoa solids, it has no more than trace amounts of caffeine and theobromine. It is one of the most stable fats known, a quality that coupled with natural antioxidants that prevent rancidity, grants it a storage life of two to five years. The velvety texture, pleasant fragrance and emollient properties of cocoa butter have made it a popular ingredient in products for the skin, such as cosmetics, soaps and lotions.

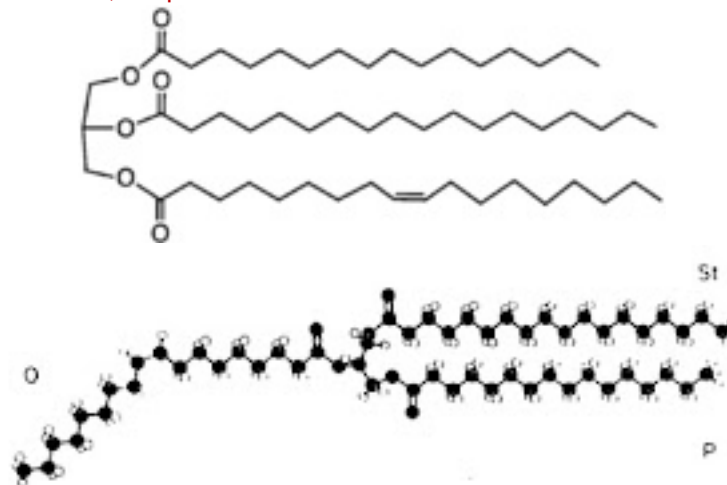


Figure 6.1 Structure of triglycerides. Nominally this is the *POSt* molecule in the β -form with all carbon zigzags similarly oriented and lying approximately in the plane of the molecule
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Cocoa Solids

Cocoa solids contain alkaloids such as theobromine and phenethylamine (PEA), which have physiological effects on the body. It has been linked to serotonin levels in the brain. In medicine, theobromine is used as a vasodilator (a blood vessel widener), a diuretic (urination aid), and heart stimulant. The presence of theobromine renders chocolate toxic to some animals, especially dogs and cats. Phenylethylamine functions as a neuromodulator or neurotransmitter in the mammalian central nervous system. Orally ingested phenethylamine is usually inactive because of extensive first-pass metabolism by monoamine oxidase (MAO) into phenylacetic acid. This prevents significant concentrations from reaching the brain.

Serotonin and tryptophan have been found in chocolate with varying cocoa contents. The highest serotonin content (2.93 ug g⁻¹) was found in chocolate with 85% cocoa, and the highest tryptophan content (13.27-13.34 ug g⁻¹) was found in 70-85% cocoa.

Serotonin or 5-hydroxytryptamine (5-HT) is a monoamine neurotransmitter. Biochemically derived from tryptophan, serotonin is primarily found in the gastrointestinal (GI) tract, platelets, and in the central nervous system (CNS) of animals including humans. Approximately 90% of the human body's total serotonin is located in the enterochromaffin cells in the alimentary canal (gut), where it is used to regulate intestinal movements. The remainder is synthesized in serotonergic neurons of the CNS, where it has various functions. These include the regulation of mood, appetite, and sleep. Serotonin also has some cognitive functions, including memory and learning.

Serotonin taken orally does not pass into the serotonergic pathways of the central nervous system, because it does not cross the blood–brain barrier. However, tryptophan and its metabolite 5-hydroxytryptophan (5-HTP), from which serotonin is synthesized, can and do cross the blood–brain barrier. Several classes of drugs target the 5-HT system, including some antidepressants, antipsychotics, anxiolytics, antiemetics, and antimigraine drugs, as well as the psychedelic drugs and empathsogens.

Because serotonin is a major gastrointestinal tract modulator, it may be produced by plants in fruits as a way of speeding the passage of seeds through the digestive tract, in the same way as many well-known seed and fruit associated laxatives. Serotonin is found in mushrooms, fruits and vegetables. The highest values of 25–400 mg/kg have been found in nuts of the walnut (*Juglans*) and hickory (*Carya*) genera. Serotonin concentrations of 3–30 mg/kg have been found in plantains, pineapples, banana, kiwifruit, plums, and tomatoes.

Tempering

In cocoa butter, there are six essential polymorphic forms. Uncontrolled crystallization of cocoa butter typically results in crystals of varying size. The uniform sheen and crisp bite of properly processed chocolate are the result of consistently small cocoa butter crystals produced by the tempering process. Type V crystals is the best for serving and storing.

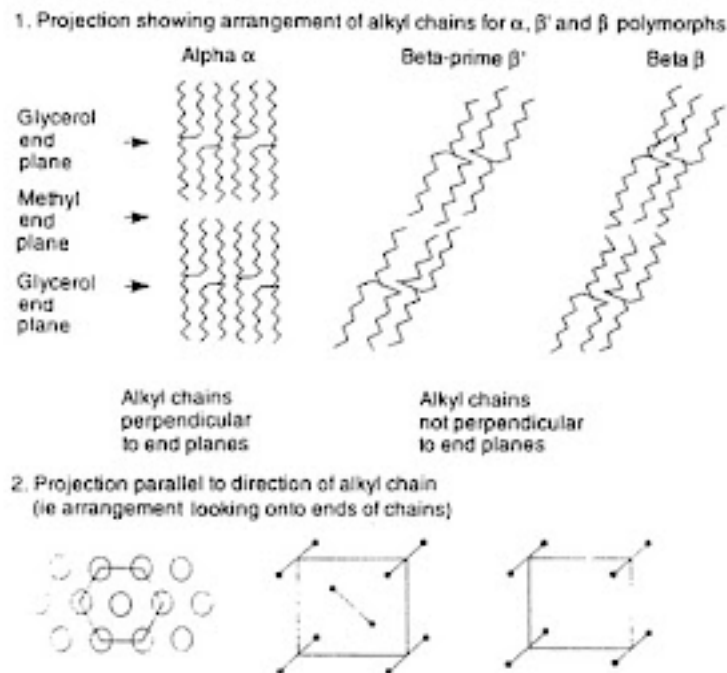
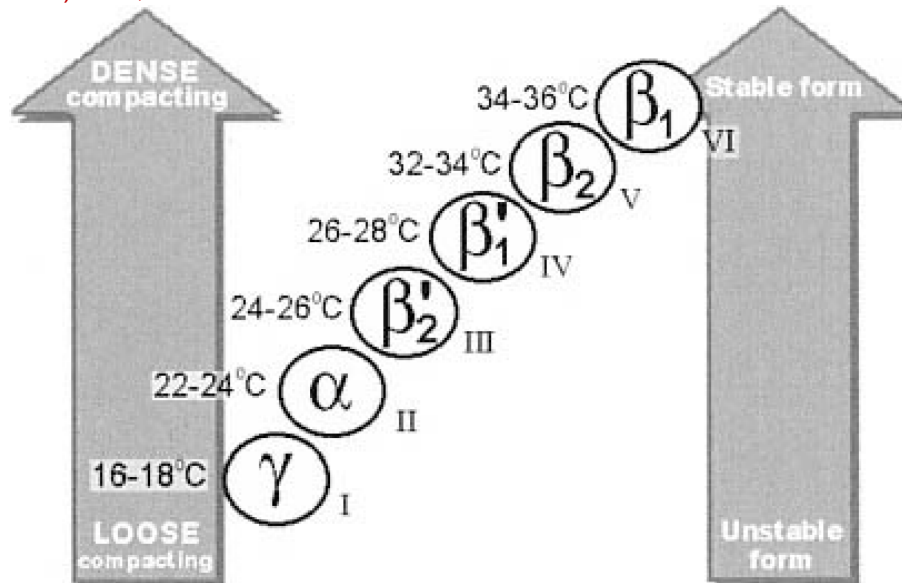


Figure 6.5 *Crystal packing of triglycerides. (1) Projection showing arrangement of alkyl chains for α , β and β' polymorphs; (2) projection looking onto the ends of chains (Reprinted with the permission of Loders Crokiaan)*

Crystal Melting temperature

- I 17 °C (63 °F) Soft, crumbly, melts too easily
- II 21 °C (70 °F) Soft, crumbly, melts too easily
- III 26 °C (79 °F) Firm, poor snap, melts too easily
- IV 28 °C (82 °F) Firm, good snap, melts too easily
- V 34 °C (93 °F) Glossy, firm, best snap, melts near body temperature (37 °C)
- VI 36 °C (97 °F) Hard, takes weeks to form



Six different crystalline forms of cocoa butter.

First, the chocolate is first heated to 45 °C (113 °F) to melt all six forms of crystals. Next, the chocolate is cooled to about 27 °C (81 °F), which will allow crystal types IV and V to form. At this temperature, the chocolate is agitated to create many small crystal "seeds" which will serve as nuclei to create small crystals in the chocolate. The chocolate is then heated to about 31 °C (88 °F) to eliminate any type IV crystals, leaving just type V. After this point, any excessive heating of the chocolate will destroy the temper and this process will have to be repeated.

Type V and VI are the most stable and are triple chain packing, whereas the other forms are all double.

According to polymorphic transformation theory, bloom occurs through the uncontrolled polymorphic transformation of cocoa butter from a less stable form (form IV or V) to the most stable form (form VI). In well-tempered chocolate, the production of form VI from form V does not always lead to bloom. The onset of transformation from form V to form VI crystals should be considered as an aspect of cocoa butter recrystallization that may result in bloom.

Handling Chocolate

A very small amount of moisture in chocolate will noticeably increase its viscosity, making it unacceptable for dipping or enrobing. When melting chocolate, be careful not to allow excess steam to develop, which will interface with the surface of the chocolate, moistening it and increasing the viscosity.

Because chocolate contains virtually no moisture, it has very low water activity level, and is not prone to bacterial spoilage during storage, resulting in a long shelf life. The factor limiting shelf life for chocolate is rancidity, the breakdown of fats than can create off flavors. Although cocoa butter is relatively resistant to rancidity, chocolate should be stored protected from exposure to oxygen, light, heat, and moisture (humidity), and when working with chocolate, do not expose it to reactive metals such as copper and iron.