

Module 4

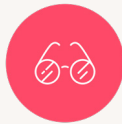
CACAO

4.1 Origins & Benefits

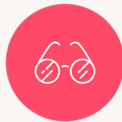
The word “cacao” is often used to refer both to the tropical tree native to South America known as *Theobroma cacao*, as well as its beans, the fatty seeds of the cacao tree.

This tree has grown in Mexico and South America for centuries. It is cultivated in what is also known as the “bean belt” - within 20 degrees north and south of the Equator. It grows in wet, hot, humid climates - over 70 % of the world's cacao production comes from West Africa, particularly Nigeria, Cameroon, Ivory Coast and Ghana.

Cacao is also considered a very important superfood, as it has numerous health benefits.



Although further research is needed, the scientific evidence published in the last two decades suggests that flavanols, a subclass of flavonoids, are the compounds of interest in cocoa. Flavanols improve the antioxidant capacity, limit inflammatory pathways, improve vascular dilation and blood pressure and reduce insulin resistance among others (1). In addition, cocoa beans contain a variety of minerals like potassium, calcium, magnesium and copper, with potential effects in reducing cardiovascular risk (1).



Chocolate is a manufactured solid product containing varying percentages of cocoa liquor, cocoa butter, sugar and/or milk. Manufacturing process reduces the concentration of flavanol (2), decreasing the properties of cocoa. On the other hand, refined sugars that use to be added to commercialized chocolate contain minimal antioxidant activity (3).

Cacao Paste & Butter

Both paste and liquor refer to the product obtained by the mechanical disintegration of cacao beans, without removing or adding any component.

Cacao paste therefore contains all the benefits of the fruit, since it hasn't been subjected to any refining process (which can raise its temperature considerably).

Cacao butter, however, is the fatty part usually extracted from the cacao beans by cold pressing. It's a healthy fat, and it happens to be the only vegetable fat that remains solid at room temperature. Cacao butter is responsible for the silky texture that makes chocolate melt in your mouth. It has six crystalline structures, all of them with different hardness and melting temperatures. Making butter crystallize properly is the key to achieving a smooth, shiny and crisp finish.

During the manufacturing process, conventional butter is heated to very high temperatures thus reducing many of its properties. Similarly, cacao butter is often mixed with different oils, thus devaluing its nutritional worth. Buying raw or pure cacao butter will ensure a final product with all its nutritional benefits intact.

Cacao Varieties

There are three main cacao varieties. It's not essential for you to distinguish them, but knowing their characteristics can help you decide what's the best choice, depending on the circumstances and the intended use.

- **Forastero:** The most widely used bean, making up around 80 % of global production. Forastero trees are much easier to cultivate but can often yield a bland-tasting chocolate. For this reason, much of the cacao from Forastero beans is roasted and mixed with sugar to create a stronger flavor.

- **Criollo:** The rarest bean, making up just 5 - 7 % of global production and the highest quality cacao with better taste and aroma. It is hard to grow because of its sensitivity to environmental factors, and the final quality is tightly linked to those factors.
- **Trinitario:** A hybrid of the above originated in Trinidad. Robust and aromatic, it comprises 14 % of global production.

Commercial Chocolate & its Percentages

The greater its purity (the percentage of cacao paste and cacao butter) the healthier the chocolate and the higher its quality.

As a general rule, percentages on bars indicate the pure cacao content, or the percentage that comes directly from the bean.

So what does it mean for a bar to contain 75 % cacao?

It means that for every 100 grams of chocolate, 75 grams are made of cacao paste and butter, and the remaining 25 grams are a mix of sugar, vanilla, and sometimes emulsifiers.

With milk chocolate bars, for instance a percentage of 35 % indicates that the cacao content is 35 %, while the remaining 65 % is milk, sugar and vanilla.

White chocolate has no percentages, since it does not contain cacao paste. However, it does contain cacao butter, and its content must be at least 20 %. The rest of the ingredients in conventional white chocolate bars are sugar (the most abundant ingredient), milk, vanilla and emulsifiers.

Here you can see a comparison of ingredients that contain 100 grams of four types of chocolate from a prestigious Swiss chocolate brand:

Dark chocolate 85 % cocoa:

- Ingredients: cacao paste, fat-reduced cacao, cacao butter, sugar, vanilla
- 14 g of sugars
- 56 g of fat

Dark chocolate 70 % cocoa:

- Ingredients: sugar, cacao paste, cacao butter, vanilla
- 29 g of sugars
- 41 g of fat

Dark chocolate 50 % cocoa:

- Ingredients: sugar, cacao paste, cacao butter, milk fat, emulsifier (soy lecithin), vanilla
- 45 g of sugars
- 36 g of fat

Milk chocolate:

- Ingredients: sugar, cacao butter, powdered milk, cacao paste, lactose, skimmed milk
- 55 g of sugars
- 32 g of fat

White chocolate:

- Ingredients: sugar, cacao butter, vegetable fats, powdered milk, skimmed milk powder, emulsifier (soy lecithin), aromas
- 44 g of sugars
- 36 g of fat

As you can see, dark chocolate with a higher percentage of cacao has a higher fat content and a lower content of added sugar. This is the healthiest option.

Both milk and white chocolate have high amounts of sugar and fat, coming not only from cacao butter but from vegetable fats (usually palm oil, which is the most widely consumed fat in the world and the most harmful).

Keep in mind that most commercial brands use cacao paste and butter which have been subjected to very high temperatures, thus decreasing the beneficial properties of the fruit.

4.2 How Is Chocolate Made?

Cacao is grown in some of the world's most underdeveloped countries, so it is important to purchase from someone who has ensured a sustainable supply chain. If you can, it is always good to purchase from a "bean to bar" seller, as they usually deal with the cacao farmers themselves.

That said, the chocolate-making process is generally as follows:

- 1. Harvesting:** Ripe cacao pods are cut from the trees and the sticky beans are removed. On average, each cacao pod contains around 40 beans. Cacao trees are only harvested twice a year, and they are suitable for harvest for only 3 weeks! Every single cacao pod is harvested by hand, using a machete. It is important that they be harvested at peak ripeness, so that they've fully developed their aromas and flavors. The pods are usually opened using a wooden club, which splits the pod in half and ensures no damage to the beans inside.
- 2. Fermenting:** The beans are grouped together and left to ferment in wooden containers covered with plantain leaves. The fermenting process greatly influences the flavor of the chocolate - the microbes in the air, the farmers, even how often they are turned will have an impact on the final flavor. Cacao beans usually ferment for about a week. During this crucial period they must be monitored to ensure that no contamination occurs.
- 3. Drying:** After fermentation, cacao beans are generally dried in the sun for a week. This involves placing them in a single layer outside, and turning them regularly to ensure an even dry. It is crucial that the beans be completely dry after this process, since this is the point when the beans are shipped to manufacturers who continue the process. Moisture in the beans could cause mold growth. In more muggy, wet climates, beans may be artificially dried using a convection heater, or placed close to a fire to dry them out.
- 4. Roasting:** This is done for a few reasons: it helps to separate the husk from the bean, and it helps eliminate germs. Roasting usually takes place at the manufacturers' facilities, not on the plantation. Beans are roasted for around 10-15 minutes, but every chocolate-maker is different. Some will vary the temperature, some will vary the technique; it is a very precise process which is individual for each business. Sometimes the beans are divided into sizes too, as a small bean will roast at a different speed than a large bean.
- 5. Cracking and winnowing:** At this stage the cacao still has its papery skin, which is usually easier to remove after it has been roasted. Beans are cracked and shells removed using a "winnowing." This machine essentially blows the cacao skin away, leaving behind the peeled cacao bean.
- 6. Conching:** The peeled beans are then placed in a stone grinder, and ground until they become "cacao mass" or "cacao liquor." This mass contains both cacao solids and cacao butter, and it is at this stage that the butter can be pressed out of the mass to separate the two. Nowadays, cacao butter is used in the cosmetics industry so it is often sold on, meaning many cheaper chocolate brands replace cacao butter with vegetable oils in their product. The mass is then transferred to a conching machine, where it is further refined. Conching completely refines the chocolate, shrinking the size of the cacao molecules to yield a smoother, silkier chocolate. Different cacao varieties will conch for different times. All of these variables contribute to the quality of the end result.
- 7. Tempering:** Before it is packaged and shipped, the finished chocolate must be tempered. This involves heating, cooling, then reheating the chocolate within set temperature ranges, in order to alter the structure of the cacao butter crystals and stabilize them. Tempered chocolate has a satisfying "snap," a glossy shine and is not fudgy or grainy.
- 8. Molding:** The chocolate is now poured into molds, allowed to cool and unmolded before being packed and shipped.

Differences Between Raw & Regular Chocolate

What we consider "regular" chocolate is made using roasted cacao beans. Like coffee, cacao benefits from roasting because it deepens the chocolate's flavor and aroma.

Raw, unroasted chocolate is made using only fermented and naturally dried beans. By keeping the cacao raw, its vitamins, antioxidants and minerals are preserved.

Most raw chocolate brands use organic products, unrefined sugars, and no emulsifiers: that is why raw chocolate is a healthier option. In addition, most raw chocolate is vegan.

Throughout the course we will prepare chocolate from raw cacao butter and raw cacao paste. It is important to make sure we do not heat the chocolate above 46 °C (115 °F) when tempering, in order to preserve all the benefits of the fruit.

Store-bought Raw Chocolate vs Homemade

Homemade raw chocolate will generally have a slightly different texture from purchased chocolate. Especially if you use unrefined granulated sugar (e.g. coconut sugar), the end result can sometimes be slightly gritty. This is because unrefined sugar – even if blended – doesn't melt completely during tempering.

Regular store-bought chocolate is generally extremely smooth, owing to a long conching process (some companies conch their chocolate for up to a week), using machines that for obvious reasons we can't have at home.

4.3 Cacao Glossary

Cacao pods - Large, oval, and colorful fruits that grow on a cacao tree.

Cacao beans - The whole bean found inside the cacao pod. Normally refers to the fermented and dried bean.

Cacao butter - The fat extracted from the cacao bean. If the cacao butter is marked as raw, the process is usually done through cold pressing.

Cacao paste / liquor - The pressed cacao bean or cacao nib. Cacao paste is a thick mass that can sometimes be grainy.

Cacao nibs - Small, crushed pieces of cacao beans, after the bean has been fermented, dried, cleaned, cracked and shelled. Cacao nibs are perfect to be add to many chocolate confections. They are crunchy and have a nutty, bitter, strong flavor.

Cacao powder - Made from pressing the nibs and drying the paste after the fat is removed. The mixture is sifted, leaving behind a pure, natural and strong powder with no added sugars.

Cocoa powder - Usually refers to the roasted, processed version of cacao powder. Cocoa powder also sometimes contains added sugars, fats or anti-caking agents.

Couverture chocolate - Pre-tempered high-quality chocolate, as it has at least 32 % butter content. Commonly used by chocolatiers for their gourmet confections owing to its good shine and snap, and silky-smooth mouthfeel. "Ultra-couverture chocolate" has an even higher quantity of cacao butter, making it ideal for very shiny bars and ganaches.

Dark chocolate - With at least 50 % cacao content required to be considered "dark", the rest of ingredients are sugar and vanilla. The higher the percentage of cacao, the purer the chocolate.

Milk chocolate - Chocolate content around 25 % and 40 % with sugar (which usually is the main ingredient), cacao butter and milk.

White chocolate - Made from cacao butter, sugar, milk and vanilla. It does not contain any cacao solids.

Compound chocolate - Although it's usually sold as chocolate, it is not the real thing: cacao butter has been replaced totally or partially by vegetable fats.

Dutch process - Process of adding an alkali to chocolate, thus altering its color and flavor. Dutching also balances the acidity of chocolate, extending the shelf life. Usually used for baking, ice-cream making or chocolate drinks.

Enrobed chocolates - When the center of a ganache or praline is pre-made, then "enrobed" (i.e., dipped or covered) in tempered couverture chocolate. They are then decorated. Can also refer to candied fruits, honeycomb or biscuits.

Molded chocolates - When the shell is poured into a mold before filling.

Slabbed - Usually refers to a ganache that has been poured onto a slab before being cut into squares.

Fudge - A classic American sweet mainly made with sugar, butter, milk and chocolate.

Ganache - An emulsion generally made from chocolate and cream. In our case, it refers to a cream or butter made from nuts or seeds.

Gianduja - A classic European-style candy made with chocolate and hazelnuts.

Related Scientific Articles

1. Fernández-Murga et al. *The impact of chocolate on cardiovascular health*. Maturitas 69 (2011) 312-321
2. Payne MJ et al. *Impact of fermentation, drying, roasting and Dutch processing on epicatechin and catechin content of cacao beans and cocoa ingredients*. J Agric Food Chem 2010; 58:10518-27
3. Phillips KM et al. *Total antioxidant content of alternatives to refined sugar*. J Am Diet Assoc. 2009; 109(1):67-71