

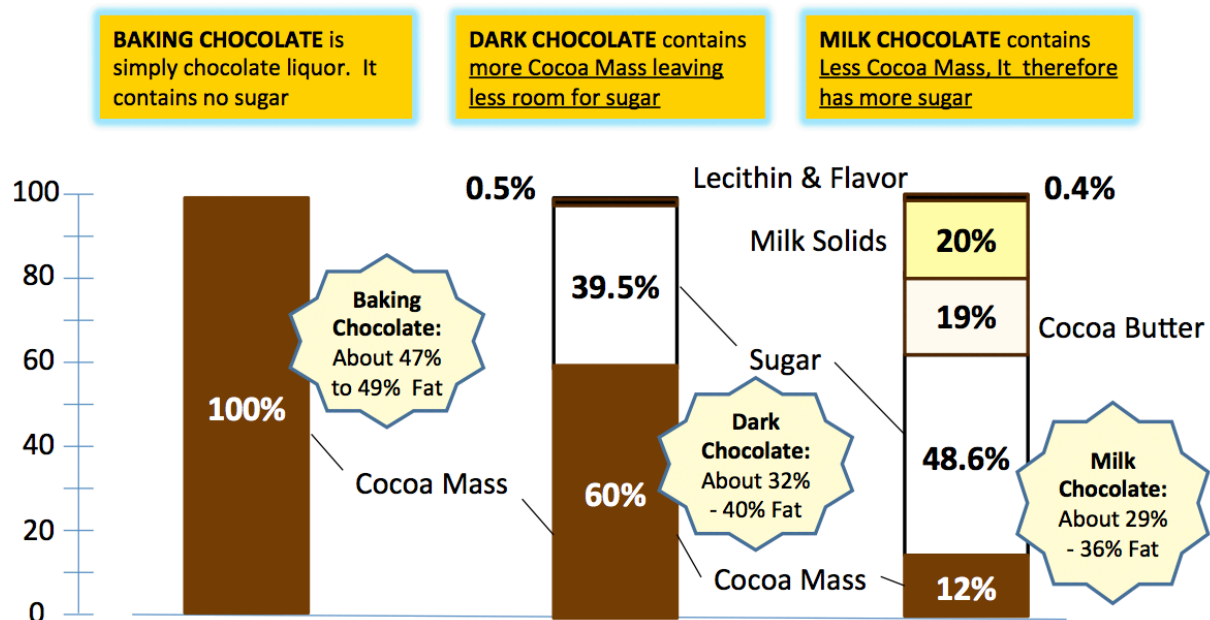
## How is chocolate “Put Together”?

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It’s no mystery that most people love chocolate, whether it’s milk or dark chocolate. But when people are asked “What is % cacao?” or “What is the difference between milk or dark chocolate?” they may be less certain. So to clarify things let’s go through the formulation of three chocolates that you are familiar with.

### Formulation of Chocolates



Source: Adapted from Beckett (1988) Industrial Chocolate Manufacture and Use

**BAKING CHOCOLATE:** The most basic form of chocolate is un-sweetened, baking chocolate. You may have some in your kitchen. As the name implies, there is no sugar added to this chocolate and, indeed, it is the purist form of chocolate. Baking chocolate consists of just one ingredient—chocolate (See image). By chocolate, we mean the roasted and de-shelled cocoa bean that has been finely ground. In the chocolate industry, chocolate is referred to by several synonyms: Chocolate; Chocolate liquor; Chocolate Mass. The terms mean the same thing. This chocolate is 100% cacao, meaning that this chocolate only contains cocoa bean ingredients. Baking chocolate is the hardest, most brittle type of chocolate that most people experience. Why? Because chocolate liquor has the highest cocoa butter content of all; typically ranging between 51 to 53% cocoa butter. It is the percentage of cocoa butter that makes chocolate hard or “snappy”. Baking chocolate is also the most bitter chocolate because it contains no sugar. Food scientists know that sugar tends to blunt or moderate the taste of bitter in foods and beverages. Other things that use sugar to blunt bitter taste are cranberry products and coffee. The formula of baking chocolate is shown in the image.



**DARK CHOCOLATE:** The next form of chocolate we will discuss is dark chocolate. This chocolate primarily consists of four ingredients, which will vary according how dark the chocolate is. These ingredients are chocolate liquor, sugar, vanilla flavoring (either as vanilla extract or vanillin), and an emulsifier such as soy lecithin. The formulation of a 60% cacao dark chocolate is shown in the image. One can see that the largest ingredient is chocolate liquor (60%), followed by sugar (39.5%). It is difficult to see but the lecithin is about 0.1 to 0.3% of the formulation and there are minute amounts of vanilla flavoring—the total of both of these last ingredients being no more than 0.5%. This 60% cacao dark chocolate will be about 31% cocoa butter which comes from the chocolate liquor. Because there is less cocoa butter in this chocolate, it will be less hard or snappy compared to baking chocolate. This chocolate will also be less bitter because there is less chocolate mass compared to baking chocolate and because there is added sugar. Dark chocolates will not have as much chocolate impact in the mouth, compared to baking chocolate, because there is less cocoa mass in their formulation. Depending on the % cacao in a dark chocolates, the amount of sugar will roughly decrease as the % cacao increases. Remember two things; the total of the ingredients will always add up to 100% and the amount of lecithin and vanilla flavoring are miniscule compared to the sugar and the chocolate liquor in the formula. So, an 85% cacao dark chocolate will have nearly 15% sugar, a 70 % dark chocolate will have roughly 30% sugar, a 50% cacao dark chocolate will have about 50% sugar.

**MILK CHOCOLATE:** This is the world’s most popular form of chocolate. The formulation of this chocolate, as its name implies, includes either whole milk or ingredients derived from milk, such as whole milk powder or butter oil. In Figure 1 is shown the formula of a typical milk chocolate. One can see that the chocolate liquor (12%) is much less in milk chocolate and that the amount of sugar (48.6%) is higher than what we saw in dark chocolate. There are also two new ingredients not seen in dark chocolate; milk solids (yellow) and cocoa butter (light yellow). The presence of milk solids in this example account for about 19% of the formula. The presence of the added cocoa butter in this example accounts for about 20% of the formula. Cocoa butter is added to milk chocolate to bring the % cocoa butter and milk fat up to about 30 to 33% of the formula. If there is not enough cocoa butter added, the resulting bar will be crumbly or powdery. So all typical milk chocolate bars in the marketplace will have a minimum of 30% total fat, much of which comes from the chocolate liquor plus the added cocoa butter. Milk chocolates tend to be the softest or have the least snap of all the chocolates described here. There are two reasons; first, these chocolates tend to have the least cocoa butter and secondly, because there is milk fat in the formula, which tends to soften cocoa butter crystals. Milk chocolates also are the least bitter chocolates of the three chocolates described here. Milk chocolates are less bitter because they are formulated with the least amount of chocolate liquor, because milk chocolates tend to have the most sugar and because milk protein in the chocolate tends to further reduce bitter taste. You notice this milk protein effect if you add milk to your tea or coffee—bitterness of these beverages is reduced by the addition of milk.

So there you have it, the explanation and a graphic representation of how chocolates are “Put Together”. But no matter how chocolates are formulated, make sure to savor the taste and smell, experience the snap and melt-down of your favorite chocolates.

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