



Chocolate Composition & Limitations to Reformulation

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Plan

- **Composition criteria imposed by vertical regulation**
- **Which ingredients in cocoa and chocolate products ?**
- **Which nutrient composition ?**
- **Which possibilities of optimisation in cocoa and chocolate products ?**

Cocoa and chocolate products



- defined in directive 2000/36/EC

CHOCOLATE =
COCOA (dry cocoa solids + cocoa butter)
+ SUGARS
+ Eventually others ingredients

- 10 categories of products with specific composition criteria (percentages minima of total dry cocoa solids, cocoa butter, dry non-fat cocoa solids, ...)

Example : Chocolate regulated criteria in 2000/36/EC



SALES NAMES	COCOA		
	total dry cocoa solids	dry non-fat cocoa solids	Cocoa butter
CHOCOLATE	≥ 35 %	≥ 14 %	≥ 18 %
CHOCOLATE + information or descriptions relating to quality criteria	≥ 43 %	≥ 14 %	≥ 26 %
CHOCOLATE « VERMICELLI » or « FLAKES »	≥ 32 %	≥ 14 %	≥ 12 %
CHOCOLATE « COUVERTURE »	≥ 35 %	≥ 2,5 %	≥ 31 %
CHOCOLATE « COUVERTURE » + information or descriptions relating to quality criteria	≥ 35 %	≥ 16 %	≥ 31 %

Example : Milk Chocolate regulated criteria in 2000/36/EC



SALES NAMES	COCOA			MILK		TOTAL FAT
	Total dry cocoa solids	Dry non fat cocoa solids	Cocoa butter	Dry milk solids	Milk fat	(cocoa butter and milk fat)
MILK CHOCOLATE	≥ 25 %	≥ 2,5 %		≥ 14 %	≥ 3,5 %	≥ 25 %
MILK CHOCOLATE + information or descriptions relating to quality criteria	≥ 30 %	≥ 2,5 %		≥ 18 %	≥ 4,5 %	≥ 25 %
FAMILY MILK CHOCOLATE	≥ 20 %	≥ 2,5 %		≥ 20 %	≥ 5 %	≥ 25 %
MILK CHOCOLAT "VERMICELLI" or "FLAKES"	≥ 20 %	≥ 2,5 %		≥ 12 %		≥ 12 %
MILK CHOCOLATE "COUVERTURE"	≥ 25 %	≥ 2,5 %		≥ 14 %	≥ 3,5 %	≥ 31 %
CREAM CHOCOLATE	≥ 25 %	≥ 2,5 %		≥ 14 %	≥ 5,5 %	≥ 25 %
SKIMMED MILK CHOCOLATE	≥ 25 %	≥ 2,5 %		≥ 14 %	≤ 1 %	≥ 25 %
WHITE CHOCOLATE			≥ 20 %	≥ 14 %	≥ 3,5 %	

Example : Filled chocolate and praline a minimum amount of chocolate



- **Filled chocolate, chocolate with ... filling, chocolate with ... centre**

- ▶ filled product, the outer part of which consists of chocolate, milk chocolate or white chocolate and shall constitute not less than 25 % of the total weight of the product
- ▶ the inside can be a confectionary product (but not bakery products, pastry, biscuit or edible ice).

- **A chocolate or a praline, in single-mouthful size, consisting of:**

- ▶ filled chocolate, or
- ▶ a single chocolate or a combination or a mixture of chocolate (classic, milk or white) and other edible substances, provided that chocolate constitutes not less than 25 % of the total weight of the product.

=> Some products with chocolate are not defined in the directive 2000/36/EC :

- ▶ With less than 25% of chocolate,
- ▶ Of which the inside is bakery products, pastry, biscuit or edible ice
- ▶ Cocoa and chocolate spreads.

Which ingredients in cocoa based products and chocolate ?



- **Fats :**
 - ▶ **mainly cocoa butter**
 - ▶ **and/or milk fats**
 - ▶ **and/or eventually other tropical vegetable fats limited to 5% of the finished product**
 - ▶ **and / or fats contained in other ingredients used (nuts, inside of filled chocolate, ...)**
- **Sugars**
 - ▶ **Sugar**
 - ▶ **And / or lactose from milk**
- **Eventually other ingredients as inclusion of nuts, fruits, ...**

The main fat used : Cocoa butter

- Fat in cocoa and chocolate products is mainly provided by cocoa butter (more than 70%).
- It is obtained from cocoa beans or parts of cocoa beans
- Its properties :
 - ▶ Support chocolate technology and conservation.
 - ▶ make it possible chocolate to be hard and breakable at ambient temperature, but to melt entirely in the mouth.



- Composition of fermented cocoa beans :
 - ▶ Proteins : 9 %
 - ▶ Fats : 48 à 57 %
 - ▶ Carbohydrates : 5 à 7,7 %
 - ▶ Fibres : 13,1 %

Specific fatty acids composition of cocoa butter



- **Fatty acids composition of cocoa butter :**
 - ▶ 60 % SFA : **35 % stearic acid (32 to 36 %)** and 25 % palmitic acid (24 to 27 %)
 - ▶ 35 % MUFA, particularly **oleic acid (33 à 37 %)**
 - ▶ 5 % PUFA : 3 % linoleic acid and 2 % alpha-linolenic acid
 - **Particularity : Stearic acid is quickly desaturated in the body into oleic acid (which is known to have health benefit in olive oil).**
 - **Kris-Etherton et al. demonstrated that consumption of stearic acid elicits a neutral cholesterolemic response, in that it has no impact on total cholesterol and does not adversely affect platelet function and appears to play no role in the thrombogenic events that can lead to heart disease.**
- => In the body only a third of fat from cocoa butter could be considered as real saturated fat.**

Which nutrient composition for chocolate ?

- 500 to 560 kcal/100g
 - 20 to 75% carbohydrates
 - 15 to 49% lipids
 - 4 to 10% proteins
 - up to 6g of fibers
 - Some minerals, polyphenols ...
 - Very small amount of water
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- ▶ Values depending on the type of chocolate products
 - ▶ Consumed in smaller amount than 100g : average consumption of consumers : 10 to 15g/day

Very few possibilities to reformulation for chocolate



- **Regulatory constraints (directive 2000/36/CE) :**
 - ▶ fat contents depending on the regulatory minima for cocoa, cocoa butter, milk fat, ...
- **Nutritional Relevance :**
 - ▶ as chocolate is a dense products (very small amount of water), there is an inverse relationship between fat and sugar content
 - ▶ if fat content is reduced, sugars content will be increased : the sugars content is not fixed but is inversely correlated to the fat content
- **Acceptance by consumer**
 - ▶ Chocolate primarily as a food "pleasure"
- **Some very few possibilities :**
 - ▶ The sugar substitution can be done with polyols, sweeteners, fibers.
 - ▶ The fat substitution is restricted : it is not allowed to go below 25% fat (which would be already a challenge for the consumer's acceptance !) and will increase the proportion of sugar

Some possibilities of optimisation for filled products and products not covered by the directive



- **Work on simple sugars reduction and on optimisation of fat quality (SFA, TFA) for filling, bars, or spreads**
 - ▶ **Difficult because of technological and sensorial constraints and necessity of particular texture**

- **Nevertheless already much reformulation particularly to minimize TFA contents**
 - ▶ **For products containing exclusively cocoa butter, TFA is not a relevant criteria**
 - ▶ **For others products (filled products, chocolate bars, cocoa spreads, ...) much reformulation has already taken place :**
 - In France in a study on 100 products : nearly all (99%) contain now **less than 1 g of TFA /100g, and even 88% less than 0,5 g/100g**
 - These residual content are linked to the natural content of milk ingredients.

Conclusion on chocolate products



- based on cocoa, cocoa butter and sugar.
- have minima of different ingredients and so regulatory requirements for fat content
- mainly cocoa butter, presence of stearic acid which has not saturated fat physiological effect
- brings 500 to 560 kcal/100g : dense products
- main limitation to reformulation : if fat content is reduced, sugars content will be increased
- for products containing not exclusively cocoa butter or milk fat, much reformulation has already taken place in order to minimize trans fatty acids contents.