

SCI LECTURE PAPERS SERIES

CHOCOLATE, CHOCOLATE FATS AND THE NEW EU CHOCOLATE DIRECTIVE: IMPLICATIONS FOR CHOCOLATE MANUFACTURERS IN EUROPE

**Philip Yates
Barry Callebaut (UK) Ltd
Banbury
Oxfordshire
OX16 3UU**

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Introduction

Chocolate is one of a small number of foods that is covered by “vertical” legislation. This legislation gives compositional standards for products under the reserve description and some labelling requirements for the particular product. Reserve descriptions are given for a number of products, including chocolate, milk chocolate and white chocolate and also cocoa products.

When the UK, Denmark and Ireland joined the European Economic Community, issues were raised because of the different chocolate standards these countries had in relation to the existing member states.

The main contentious issues were

- The minimum amounts of milk and cocoa solids and how these products were labelled.
- The use of non-cocoa vegetable fats and the labelling implications.

Every chocolate manufacturer from the various countries would want standards that would benefit them. For consumers it was about having choice and still being able to have the products that they liked and had grown up with. The issues were difficult to resolve and became very political. In some ways the issues were made more difficult by inaccurate reporting in the press. Over the years there have been many reports that have confused the issues, for example, saying that if vegetable fat was used in chocolate the product would have to be called “Family milk chocolate”. Would the average consumer really know, understand – or care about the difference?

Compositional requirements

In order to understand the “vertical” legislation it is important to understand the basics of compositional requirements.

Cocoa solids

Total cocoa solids = sum of non-fat cocoa solids and cocoa butter.

It is important to remember that total cocoa solids includes the natural fat from the cocoa bean, the cocoa butter. When looking at milk chocolate, the milk components are also important.

Milk solids

Total milk solids = sum of non-fat milk solids and milk fat (butter oil).

The legislation gives the intention that milk components should be added in their natural proportions.

Milk chocolate

In legislation there are two sets of rules for milk chocolate – the 25:14 and 20:20 rules.

| Existing Legislation | | Existing Legislation | |
|---|-----------------------------|---|-----------------------------|
|  | Milk Chocolate 25/14 |  | Milk Chocolate 20/20 |
| Combination of cocoa and sucrose With or without the addition of extracted cocoa butter Not less than 25% total dry cocoa solids Not less than 2.5% dry non fat cocoa solids Not less than 14% milk solids Including not less than 3.5% milk fat Not more than 55% sucrose Not less than 25% total fat | | Combination of cocoa and sucrose With or without the addition of extracted cocoa butter Not less than 20% total dry cocoa solids Not less than 2.5% dry non fat cocoa solids Not less than 20% milk solids Including not less than 5% milk fat Not more than 55% sucrose Not less than 25% total fat | |

In the 20:20 milk chocolate, at the legal limits, there is less cocoa and more milk present. In practice, however, there are a lot of products that actually meet both sets of legislation. Which of these products is better? To me there is not a simple answer. Each has its merits. The way we view products tends to come from familiarity. There are clear differences in the taste of milk chocolate from different countries. These differences and the associated prejudices have been the major problem.

In designing a milk chocolate formulation it is important to understand where variations in flavour come from. Obviously, the source and quantity of cocoa is key, along with the particle size and the process conditions. For milk chocolate, the type of milk solids used is crucial in determining the flavour of the end product.

The source of the milk solids gives a different flavour and contributes to the performance of the product.

| Milk Solids | Criteria to be considered |
|--|---|
| <ul style="list-style-type: none"> ▶ Spray Dried Full Cream Milk Powder ▶ Roller Dried Full Cream Milk Powder ▶ Skimmed Milk Powder ▶ Milk Fat ▶ Chocolate Crumb <ul style="list-style-type: none"> • Sugar • Full Cream Milk Powder • Cocoa Mass | <ul style="list-style-type: none"> Cost of the ingredient Impact on flavour How will the chocolate be used Texture Rheology Subsidy - Intervention Milk Fat <ul style="list-style-type: none"> • Biscuit / Bakery |

By using different milk components, a product can be made for a particular application, for example, using a higher level of milk fat can give a softer cutting milk chocolate.

Lets look at a UK style milk chocolate and compare it to one from Belgium.

| Milk Chocolate - UK | Milk Chocolate - Belgian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--------------------------|---|-----------------|------|--------------|----|-------|------|------------|-----|----------|------|----------|---|----------|---|----------------|--|--|--|---|-------|----|--------------|------|------------------------|------|------------|------|----------|---|----------|---|-------------------|--|
| <table border="1"> <thead> <tr> <th></th> <th>%</th> </tr> </thead> <tbody> <tr><td>Chocolate Crumb</td><td>60.5</td></tr> <tr><td>Cocoa Butter</td><td>22</td></tr> <tr><td>Sugar</td><td>9.62</td></tr> <tr><td>Cocoa Mass</td><td>6.5</td></tr> <tr><td>Milk Fat</td><td>0.75</td></tr> <tr><td>Lecithin</td><td>+</td></tr> <tr><td>Vanillin</td><td>+</td></tr> <tr><td colspan="2">+ less than 1%</td></tr> </tbody> </table> | | % | Chocolate Crumb | 60.5 | Cocoa Butter | 22 | Sugar | 9.62 | Cocoa Mass | 6.5 | Milk Fat | 0.75 | Lecithin | + | Vanillin | + | + less than 1% | | <table border="1"> <thead> <tr> <th></th> <th>%</th> </tr> </thead> <tbody> <tr><td>Sugar</td><td>42</td></tr> <tr><td>Cocoa Butter</td><td>23.4</td></tr> <tr><td>Full Cream Milk Powder</td><td>22.4</td></tr> <tr><td>Cocoa Mass</td><td>11.6</td></tr> <tr><td>Lecithin</td><td>+</td></tr> <tr><td>Vanillin</td><td>+</td></tr> <tr><td colspan="2">+ is less than 1%</td></tr> </tbody> </table> | | % | Sugar | 42 | Cocoa Butter | 23.4 | Full Cream Milk Powder | 22.4 | Cocoa Mass | 11.6 | Lecithin | + | Vanillin | + | + is less than 1% | |
| | % | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Chocolate Crumb | 60.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cocoa Butter | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sugar | 9.62 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cocoa Mass | 6.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Milk Fat | 0.75 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Lecithin | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vanillin | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Lecithin | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Vanillin | + | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| + is less than 1% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

These recipes give products with very different taste profiles. When the recipes are compared from the legal aspect, there are only small differences between them.

| Comparison - UK / Belgian | UK | Belgian |
|---------------------------|-------|---------|
| Declaration | 20/20 | 25/14 |
| Total Cocoa Solids | 32.6 | 35 |
| Non Fat Cocoa Solids | 4.76 | 5.31 |
| Total Milk Solids | 22.12 | 21.86 |
| Milk Fat | 6.72 | 6 |
| Sugar | 44.38 | 42.3 |
| Total Fat | 34.6 | 35.7 |

Both of these products could be a 25:14 or 20:20 milk chocolate. The calculation of the milk and cocoa solids is done on a dry basis – moisture content of the ingredient is deducted for the calculation. In the calculation it is fundamental to understand the concept of the “chocolate” part of the product – the so-called “noble” ingredients.

| | |
|--|--|
| <p>Calculation of Cocoa and Milk Solids</p> $\frac{\text{Sum of dry solids}}{\text{Sum of Noble ingredients}} \times 100$ | <p>Ingredients</p> <p>Noble Ingredients</p> <p>Cocoa, Sugar, Milk</p> <p>Optional Ingredients / Edible substances</p> <p>Any edible substance (other than flour or starch) Vegetable fat Total maximum 30% (indiscernible) Maximum for each component 5% (labelling) No animal fat other than milk fat No flavours which mimic the taste of chocolate or milk fat</p> |
|--|--|

As well as the noble ingredients, other edible substances can be added. The calculation of the dry milk and cocoa solids is done as a percentage of the noble ingredients. If, for example, whey powder is added as an optional ingredient, the whey powder itself, although derived from milk, does not contribute towards the sum of the milk solids.. Let's look at an example:

| <p>20:20 Milk Chocolate</p> <table border="0"> <thead> <tr> <th></th> <th style="text-align: right;">%</th> </tr> </thead> <tbody> <tr> <td>Chocolate Crumb</td> <td style="text-align: right;">30</td> </tr> <tr> <td>Sugar</td> <td style="text-align: right;">21.77</td> </tr> <tr> <td>Cocoa Butter</td> <td style="text-align: right;">20.7</td> </tr> <tr> <td>Cocoa Mass</td> <td style="text-align: right;">9.1</td> </tr> <tr> <td>Full Cream milk powder</td> <td style="text-align: right;">8</td> </tr> <tr> <td>Lactose powder</td> <td style="text-align: right;">4.9</td> </tr> <tr> <td>Whey powder</td> <td style="text-align: right;">4.9</td> </tr> <tr> <td>Lecithin</td> <td style="text-align: right;">0.6</td> </tr> <tr> <td>Vanillin</td> <td style="text-align: right;">0.03</td> </tr> </tbody> </table> | | % | Chocolate Crumb | 30 | Sugar | 21.77 | Cocoa Butter | 20.7 | Cocoa Mass | 9.1 | Full Cream milk powder | 8 | Lactose powder | 4.9 | Whey powder | 4.9 | Lecithin | 0.6 | Vanillin | 0.03 | <p>Calculation of Milk & Cocoa solids</p> <p>Noble ingredients = 89.57% Mass, Sugar, Full cream milk powder, Cocoa butter, Crumb.</p> <p>Dry cocoa solids = $\frac{31.67 \times 100}{89.57} = 35.36\%$ Mass, cocoa butter, mass in crumb</p> <p>Dry milk solids = $\frac{18.29 \times 100}{89.57} = 20.42\%$ Full cream milk powder, milk in crumb</p> |
|--|-------|---|-----------------|----|-------|-------|--------------|------|------------|-----|------------------------|---|----------------|-----|-------------|-----|----------|-----|----------|------|--|
| | % | | | | | | | | | | | | | | | | | | | | |
| Chocolate Crumb | 30 | | | | | | | | | | | | | | | | | | | | |
| Sugar | 21.77 | | | | | | | | | | | | | | | | | | | | |
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| Lecithin | 0.6 | | | | | | | | | | | | | | | | | | | | |
| Vanillin | 0.03 | | | | | | | | | | | | | | | | | | | | |

The recipe contains chocolate crumb. All the components of chocolate crumb are noble ingredients. Summarized on the next slide are the most important changes with the new

| | |
|---|--|
| <p>New EU Directive</p> <ul style="list-style-type: none"> ▶ Minimum for Cocoa and Milk Solids stays the same <ul style="list-style-type: none"> ▪ Milk Chocolate 25/14 ▪ Family Milk Chocolate 20/20 ▶ No 5% rule for Optional Ingredients ▶ No Maximum for Sugar ▶ Ingredients such as lactose, glucose are now considered as noble ingredients, not optional ingredients ▶ Minimum 25% Total Fat in Milk Chocolate and Family Milk Chocolate (only cocoa butter and milk fat) | <p>Calculations under new regulations</p> <p>Noble ingredients = 94.47% Mass, Sugar, Full cream milk powder, Cocoa butter, Crumb, Lactose</p> <p>Dry cocoa solids = $\frac{31.67 \times 100}{94.47} = 33.52\%$ Mass, cocoa butter, mass in crumb</p> <p>Dry milk solids = $\frac{18.29 \times 100}{94.47} = 19.36\%$ Full cream milk powder, milk in crumb</p> |
|---|--|

EU directive in relation to milk chocolate.

When the calculations are done under the new rules, because lactose is no longer considered an optional ingredient, the product is no longer legal as a 20:20 milk chocolate. In order to meet the new legislation, a slight change in formulation would be needed, which could have implications on price. To complete the section on milk chocolate, the last slide summarizes the main changes in labelling requirements under the new directive.

 New Directive - labelling

- ▶ 20:20 Milk chocolate, English only, UK and Ireland
- ▶ 20:20, multilingual, Family milk chocolate in English
- ▶ UK and Ireland, an indication of milk solids content
- ▶ Choice between declaring the legal or the actual minimum % of milk solids
- ▶ Labelling directive now applies

The use of vegetable fat in chocolate

The other main contentious issue has been in relation to the use of non-cocoa vegetable fat in chocolate. Legislation gives minimum levels of fat in chocolate products. There appears to be little logic in this, as the fat levels are different for chocolate, milk chocolate and white chocolate.

 Fat levels in chocolate

Inconsistency in legislation for fat level in products

| | |
|-----------------|---|
| Chocolate | Minimum 18% Cocoa Butter |
| Milk Chocolate | Minimum 25% Cocoa Butter & Milk Fat (3.5% or 5%) |
| White Chocolate | Minimum 23.5% Cocoa Butter & Milk Fat (3.5%) |

It is difficult to understand why the minimum for chocolate is 18%, as it is not possible to make a product at this very low level of fat.

Other than compositional requirements, why is the fat phase important? Chocolate is effectively a suspension of solid particles distributed in a fat phase.

Why is fat phase important?

Important for quality of product

- ▶ Rheology suitable for application
- ▶ Tempering / cooling
 - Gloss
 - Contraction
- ▶ Melting behaviour
- ▶ Flavour release

The new directive will permit the use of vegetable fats in chocolate products in all member states subject to certain criteria and labeling requirements. The legislation is specific to chocolate and chocolate products and introduces new labelling requirements.

The use of vegetable fats

- ▶ The new directive will permit the use of Vegetable Fat in
 - Chocolate
 - Milk Chocolate
 - White Chocolate
- ▶ In all Member States
- ▶ Maximum 5 %
- ▶ Must be Cocoa Butter Equivalents (CBE)
- ▶ National authorization for use of coconut oil

Specific labelling rules - CBE

- ▶ Product label must be supplemented by a conspicuous and clearly legible statement

"Contains vegetable fats in addition to cocoa butter"

This statement must :-

- ▶ be in the same field of vision as list of ingredients
- ▶ be clearly separated from the list
- ▶ be in lettering at least as large and in bold
- ▶ with the sales name nearby

Claims on the absence of vegetable fats are authorized but care should be taken with the wording used. In some countries initiatives have been taken, for example in Belgium, with the introduction of the Ambao label. In October 2000, the Belgian Minister of Economy registered the Ambao label. The Belgian government entrusted the brand name and management to the Traditional and Quality Chocolate Association. Several criteria have to be met to use the Ambao brand, one of which is that the product should contain no non-cocoa vegetable fat.

Why have vegetable fats been used?

 Why use vegetable fat in chocolate?

- ▶ Cost reduction
- ▶ Compensation for natural variation
- ▶ Supply situation
- ▶ Softer chocolate
- ▶ Harder chocolate
- ▶ Bloom stability

A key driver in potential use of vegetable fat is the cost of cocoa ingredients, in particular cocoa butter. Changes in cocoa butter prices due to market fluctuations and changes in ratios, gives attractive cost saving opportunities for introducing vegetable fat into chocolate products within the legal limits, to replace cocoa butter. Also important is the actual product. If chocolate is used as an ingredient to make another product, the labelling requirement for the additional statement “contains vegetable fat in addition to cocoa butter” is not needed. However, it is recommended that the presence of vegetable fat in the chocolate is made clear in the ingredients list.

Even within the new directive the calculation of the percentage of vegetable fat in the chocolate is not clear. It appears to treat the vegetable fat as an addition and also as an ingredient. The generally accepted method of calculation is shown below:

 Calculation of % of vegetable fat

“ . . . that addition may not exceed 5%”

“ . . . after the deduction of the total weight of any edible matter”

“ . . . without reducing the minimum content of cocoa butter or total dry cocoa solids”

$$\frac{\% \text{ Vegetable fat}}{\% \text{ Noble Ingredients} + \text{Vegetable fat}} \times 100$$

Care needs to be taken to ensure the new directive is met and existing recipes containing vegetable fat may need to change because of this new method of calculation. Another consideration in the recipe formulation of milk chocolate is the total fat%. In existing regulations, as mentioned earlier, there is a minimum total fat content of 25%. This is currently the sum of all the fats present. In the new directive the minimum total fat percentage stays at 25% but can only be the sum of the cocoa butter and milk fat, expressed as the percentage of the noble ingredients. This has an impact for low fat formulations, as significantly less than 5% of vegetable fat can actually be added.

Summary

Flavour variation in milk chocolate is achieved by use of different ingredients and process parameters, not from the inclusion of vegetable fats. The new directive will certainly have an impact on chocolate producers in Europe.

Formulations of chocolate products, will need to:

- increase the level of milk solids
- change from lactose to whey powder
- increase percentage of whey powder
- maximize sugar addition.

Packaging changes will be needed:

- to meet labelling legislation
- to include a different ingredient list
- for “Family” milk chocolate
- to include an additional statement when vegetable fat is used.

Increased use of vegetable fats in chocolate will be seen to achieve cost reduction.

Recipes will change to reduce the level of vegetable fat addition, due to the new method of calculation.

Internal complexity will increase to handle different vegetable fats.