

Training Module

Cake

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1. **INTRODUCTION**

Cakes are made in many varieties and are enjoyed all over the world. They are baked in different shapes and sizes, flavoured, coloured and possibly decorated to satisfy the individual's preference.

The old Romans knew already a type of cake (tortosa). Initially they were made by pharmacists, since they had most knowledge of sugar and a other raw materials available. Later on the pharmacists concentrated more on medicines and the work was taken over by pastry bakers/confectioners.

Skills, experience and craftsmanship are reflected in the quality of cakes. Proper balance in the recipes as well as an understanding of the function of raw materials is helpful in producing high quality cakes.

In this booklet we will look at these different aspects. We will discuss ingredients and processing methods and provide you with some hints and tips, which you might find useful in making high quality cakes.

2. **CLASSIFICATION OF CAKES**

Looking at the processing of cake batters, we could roughly divide them into three different types:

1. Cakes which depend on the **creaming of the margarine and sugar for their lightness** (like pound cake).

When creaming the margarine and sugar, an increase in volume is obtained. The air which is incorporated is surrounded by sugar and margarine in such a way that a honey-combed structure results. The other ingredients are added in such a manner that this airy structure of the mass is preserved. No leavening agent is needed, because the heat of the oven causes the air, that has been incorporated and the finely distributed moisture and solid ingredients to expand, thus causing the cake to rise.

2. Cakes which depend, at least partially, upon **leavening agents** for their lightness (like layer and loaf cakes).

Cakes in this class may depend upon any or all of the following factors for their lightness: creaming, leavening agents and beaten eggs. As a matter of fact most cakes depend, in some extent, on all three of these factors for their lightness and volume. The use of leavening agents (baking powders) imparts a characteristic open grain and texture, which varies with the amount of leaveners used. In many types of cakes this open grain is not as desirable as the open grain which is produced by properly creaming sugar and margarine. An open grained cake will seldom keep as well as a more close grained cake.

3. Cakes which depend on **beaten eggs** for a large part of their lightness (like sponge and angel food cakes).

The eggs are beaten first, often with the sugar and then the flour and other ingredients are carefully mixed in. Care must be taken in this process to be sure that the peculiar foamy structure of the beaten eggs is preserved when the other ingredients are

added.

As in case of type 1, expansion is achieved because of the air and moisture, which are included in each little cell or bubble, during baking. Typical of these types of cakes are angel food cake and sponge cake. The difference between these two varieties is that egg whites are used in angel food cake, whereas the whole eggs are used in sponge cake. Egg yolks contain approximately 30% fat, therefore angel food cake contains practically no fat whereas sponge cake has a higher fat content.

3. INGREDIENTS

3.1 Eggs

Eggs should not have an off-taste or smell. When we keep eggs too long, changes take place and the egg white (albumen) loses its capacity to be whipped.

The egg white can be whipped and provides the volume and structure in the batter.

The egg yolks provide good taste and a fine texture. The lecithin in the egg yolk has an emulsifying function, so the liquid from the egg is bound in the batter, which delays drying out of the baked product. Egg yolk contains also approximately 30% fat. The lecithin assures a fine dispersion of the fat through the batter. Because of this the air cells become smaller. Smaller cells (a fine texture) have the advantage that they dry out less quickly than bigger cells. If we add some extra egg yolk to a batter, the volume of the baked product will decrease a bit, but the product will have a very fine texture and will remain moist for a longer period.

Eggs also add colour, taste and smell to the cake and add to the nutritional value of the cake.

There are also various egg products available, like egg white and egg yolk powder or egg products in frozen condition or preserved with sugar. The cake recipe should be adapted following appropriate instructions.

3.2 Sugar

Sugar is available in different varieties: brown sugar, cane sugar, coarse granulated sugar, large crystal sugar and fine crystal sugar, icing sugar and sugar syrups of different origins. Fine sugar is the most commonly used in cake-making, because small crystals dissolve better than bigger ones. Sugar is added in the first place for taste, but in the second place to provide a better volume of the baked product.

The sugar forms with the liquids in the batter a syrup. This syrup surrounds the cell walls, which are formed by the proteins and strengthens the structure. Too hard or coarse sugars are more difficult to dissolve and reduce the aeration.

Sugar also contributes to the crust colour and increases the retention of moisture, improving the cake's eating and keeping properties.

3.3 Flour

The function of flour in the formula is to bind water and to provide a "skeleton" for the product. Cake flour should have a high water binding capacity to bind the liquids in the formula. The quality of the starch is therefore very important. If the binding does not go quick enough, the batter will collapse before the end of the baking process.

The flour must yield a soft gluten by using a medium quantity/quality protein level of the flour. The average protein level for cake flour is approximately 7%-9%.

There is **special cake flour** or **high-ratio flour** available. This type of flour can be used for types of cakes in which the ratio of sugar and milk to flour is very high. This type of flour is milled from the centre of high-grade wheats, the extraction rate being between 40%-50%. The gluten content is low, about 7%-8.5%, but of the highest quality. After milling the flour is chlorinated, destroying the coherency of the gluten and also increasing the acidity of the flour rendering the starch more soluble, increasing absorption and the retention of moisture.

If the flour used is too weak (protein content lower than 8%), this fault can often be overcome by a little extra beating after it has been added to the batter.

Flour with a high water binding capacity, usually also has a high content of proteins, which provides a strong gluten. This inhibits volume increase, because of the gluten and shrinking when heating up.

When flour is too strong (protein content higher than 13%), it can be weakened by partial replacement (maximum 20%) of flour by starch.

3.4 Starch

By adding starch the total amount of gluten in the recipe is reduced and the negative effects of too strong flour can be eliminated. Starch improves the water binding and therefore the moistness. It is often added in goods which require a very soft flour and fine texture.

3.5 Fats

The choice of shortening (no water containing) or margarine (approximately 16% water content) is of personal preference, but consistency of performance is the most essential.

The selection of a shortening or margarine must be based on particular requirements: high creaming ability, ability to emulsify, consistency, specific or neutral flavour/colour. The melting point of the fat should fall into the body heat area of 37°C (98°F) or slightly below, because of better mouthfeel/taste. The use of added emulsifiers to both cake margarines and shortening aid batter stability and increase cake volume.

As mentioned shortening and margarine have several functions in the cake-making process. When aerated they entrap air, forming small air bubbles. The more the bubbles and the smaller their size, the more air can be held in the batter and the smaller the chance of air escaping. During baking, the water vapour in the bubbles causes the cake to expand. The more air held in the batter, the larger the volume of the cake and the better the eating quality. Fats shorten the texture of the cake crumb, mellowing it and thereby improving the cake's richness and tenderness.

The emulsification capacity, determines how much liquid can be incorporated in a batter without curdling taking place. The more liquid in a cake batter, the more sugar the batter can hold dissolved in the liquid.

This is one of the principles of special cake margarines and shortenings which have a high emulsifying power. The advantage of emulsifying fats is the ease with which the ingredients are incorporated in the mix to give a fine, silky batter, typical for a thoroughly emulsified mix.

Cake margarine and shortening both have excellent creaming properties, the shortening tending to give a somewhat higher volume and the margarine contributing more to the characteristic flavour of the cake.

3.6 Milk

Milk provides moisture and as a low cost ingredient can influence the cost of the batter, according to its ratio in the total liquids. Milk can be increased at the expense of egg and this produces a lower batter cost. However, unlike egg, milk is a non-aerating ingredient and has the effect of closing the crumb.

Also the combination of milk powder with water can be used. Care should be taken, because of the greater moistening property of the latter. The substitution of an equal weight of water for milk often results in sad streaks at the base of the cake. If milk is replaced by water, then the quantity should be reduced by 10%.

3.7 Baking powder

Baking powder consists of gas releasing agents. It imparts additional aeration, improves the volume and improves eating quality. Too much baking powder can cause an off-taste or even over-aeration and the structural ingredients are then stretched beyond their elastic limit, causing a collapse.

The effects of excess baking powder are similar to those of excess sugar. When in doubt as to the correct diagnosis, taste the top crust of the cake. The cake with too much baking powder will be bitter while the cake with too much sugar will be too sweet.

3.8 Salt

Many batter recipes do not contain salt, with exception of products which get little finishing or no finishing at all, like cake. Some margarines contain already salt, in which case no salt has to be added.

The main purpose of using salt in cake is for its flavour. In addition to its own characteristic flavour, salt has the tendency to bringing out other flavours.

3.9 Flavours

To improve the taste or to create a specific taste, flavouring materials can be added. Care should be taken that not too much flavour is used. We can distinguish only four taste sensations: sour, sweet, salt and bitter. All of the other sensations we receive are due to our sense of smell. This being the case, the nose is a very great help in judging flavours.

Some of the commonly used flavours are:

- Lemon rasp or lemon extract
- Vanilla
- Cocoa powder

- Spices (cinnamon, ginger, clove, nutmeg, mace)

3.10 Fillings

In various recipes a filling is blended in after the batter is mixed. Such fillings usually consist of:

- Candied fruits (free from syrup), chopped
- Raisins and currants (washed)
- Nuts (hazelnuts, walnuts, almonds), chopped

4. **BALANCING THE RECIPE**

The use of a balanced recipe is essential for the proper control of production and quality. To understand a recipe, it is necessary to have some insight of what the function of the ingredients is.

The basic characteristic of a balanced recipe is that it maintains a correct relationship between its various ingredients. Ingredients may be divided into four groups according to their functions. Some ingredients appear in more than one group, because they have more than one function.

Group 1

Ingredients which provide the strength and structure on which the cake is built.

- Flour, imparts strength through the development of its gluten content.
- Egg, adds structure by the coagulation of albumen.

Group 2

Ingredients which do not provide strength and structure.

- Sugar
- Fats
- Milk

Group 3

Ingredients which have an opening or lifting effect.

- Sugar
- Baking powder
- Egg
- Fat

Group 4

Ingredients which have a closing effect and which restrict lightness, but improve moistness.

- Milk
- Other liquids as water, liquor, etc

A balanced recipe contains only such quantity of ingredients from Group 2 as can be successfully carried by the ingredients in Group 1.

There should also be a similar balance between the opening effect of the ingredients in Group 3 and the closing effect of the ingredients in Group 4.

Other factors effecting the recipe balance

Besides the ingredients, also some other factors can effect the balance of a recipe, like bakery conditions/temperature, oven and baking conditions, ingredient temperatures (ideally around 20°C/68°F) and mixing methods.

Basic Rules

For all type of good quality cakes the following can be noted:

- The fat should not exceed the egg level
- The fat should not exceed the sugar
- The sugar should not exceed the liquid

5. PROCESSING

There are several methods of making a batter/cake. The choice of method depends on the recipe formulation, ingredients used, machinery applied and personal preference. The four most commonly applied methods are:

5.1 Sugar batter method

This method is used for better quality cakes containing higher proportions of fat, sugar and eggs in relation to the weight of flour (like pound cake). It is commercially popular, because the materials can be assembled and the mixing completed in one operation.

The fat and sugar are first creamed during which air is beaten in and held by the fat. The eggs are beaten in a portion at a time and more air is incorporated. Finally the flour is carefully folded in and milk, if any, is added. Any filling (fruit, nuts, chocolate chips) is added last.

5.2 Flour batter method

This method is used for cakes of any quality and needs a careful lay-out of the recipe before commencing and the use of more equipment. It is useful for large scale production of cheaper quality cakes

The fat and an equal amount of flour are well beaten together. Any eggs, with an equal amount of sugar, are whipped to a half sponge and carefully mixed with the fat/flour mix.

Any balance of sugar is dissolved in the milk with the flavour added. Half is added to the mix, to be followed by the balance of flour and the rest of the sugar/milk solution. The baking powder (if any) is sieved with the flour. Any filling is added last.

5.3 Blending method

This method is mostly used for the production of cakes containing special cake flour and fat (like high-ratio cakes).

Firstly, all dry ingredients (flour, sugar, baking powder) are blended together. The margarine is added and mixed to a crumbly consistency, not forming a paste. Next, the eggs and the liquid are carefully blended in and beaten to a smooth batter. Mixing should be done at low speed, otherwise the cake will shrink during baking.

Advantage of the blending method compared to the sugar or flour batter methods is that it saves time (approximate half the time).

5.4 All-in method

This method is a very popular one, since it allows an easy and fast preparation of the batter. However, the recipe should contain an additional ingredient, a so-called "batter conditioner" or "cake emulsifier", otherwise the cake will not rise. Certain special cake margarines already contain this ingredient, simplifying production and improving performance.

As the method says, all ingredients are put into a bowl and mixed to a smooth batter. All-in or semi all-in methods are very suitable for industrial production using continuous or high speed mixers.

6. BAKING

After making a good batter, we still do not have a good cake. The baking is a very important stage of the cake-making process and must be done correctly and with understanding, otherwise the product will be sub-standard or at worst will be spoiled, so that time and materials are wasted.

The correct baking temperature and baking time depends on several factors, such as:

- Size
- Thickness
- Quality/type of recipe
- Density
- Oven loading
- Oven humidity

A cake has been baked when the heat has penetrated into the centre. The heat in the centre of the cake should be 92-93°C. Generally speaking the larger the cake, the longer it takes to bake, and the baking temperature must be of necessity lower. This, however, will depend to a certain extent on the thickness of the cake. A thicker cake has been baked when the heat has penetrated into the centre and then upwards to the centre of the crown. This is the last part to bake, because the temperature is kept down because of the escaping steam during baking. An underbaked cake will have a damp patch just under the crown.

The recipe of the cake is of great influence on the baking time. If the cake contains a high proportion of sugar, then the baking temperature must be reduced and baking time increased, because sugar will caramelize quickly at a high temperature, the crust will discolour, and there will be a bitter flavour.

A batter that is dense, is one containing a high proportion of sugar, fat, eggs and fruit, will need a lower baking temperature and an extended baking time, because heat penetration is delayed because of the increased density.

Oven loading must be taken into consideration, because the temperature of an oven full of cake will fall, depending on the type of cake being baked, and the size of the oven; therefore a higher initial temperature may be necessary. Humidity also is important because it delays crust formation until full expansion has taken place. A correct baking temperature with insufficient oven humidity will not produce a good cake.

If the cake is knocked, before it is completely baked, the structure of the cake will be damaged, according to the extent of the knock and the degree of baking at the time.

7. **PROBLEM CORNER**

Several ordinary cake faults are listed below, and some of the more common causes of these faults are stated. However, certain faults might have one or a combination of various reasons.

In striving to eliminate any of the following faults in cakes containing baking powder it is unadvisable to attempt to change all the possible causes at the same time. Each possible cause should be investigated separately until the exact reason for the trouble is located.

Faults in cakes come under two main headings, collapse in the middle, which can be described as the "**M-fault**", and collapse at the sides, which can be described as the "**X-fault**".

M-fault - Major causes are excess sugar, excess baking powder, insufficient total liquid and coarse particle flour. These are type or level of ingredients which cause collapse, open texture and crumb weakness.

X fault - Major causes are insufficient sugar, insufficient baking powder, excess total liquid and poor egg quality, low water absorption flour. These are type or level ingredients which cause collapse and close texture.

7.1 **External appearance**

a. Crust too dark

- Excessive amount of sugary agents used.
- Oven temperatures too high, especially top heat.

b. Cakes too small

Leavening action insufficient. This may be due to:

- Improperly balanced recipe. Mix too soft.
- Improper creaming and mixing.
- Too little baking powder, or baking powder of improper quality. Too much baking powder can cause collapse of cake.
- Inferior eggs.
- Wrong type of shortening or margarine.

- Curdling of batter.
- Creaming temperature too high or too low.
- Oven temperature too high.
- Mix too cool prior to baking process.

c. Crust too thick

- Too long baking at too low an oven temperature.
- Excessive amount of sugar in formula.
- Wrong type of flour, usually too soft.

d. Cakes burst on top

- Oven temperature too high.
- Over mixing.
- Insufficient liquid in mix.
- Flour too hard or too much flour.

e. Cake collapses during baking

- Over leavening. Either too much baking powder or excessive creaming.
- Eggs insufficient in amount or "weak" in body quality.
- Batter too rich. Excessive sugar or fat.
- Excessive jarring or moving of cake during baking process, especially prior to "setting" of batter.
- Flour too weak.
- Oven temperature too low.

f. Shrinkage of Cake

- Improper amount of sugar or fat in recipe. Excessive amounts of fat or sugar may cause cake to sag on top.
- Excessive leavening.
- Batter too slack.
- Batter too cold. Oven too hot.
- Flour too strong.

g. Specks on Cake surface

- Improper mixing.
- Insufficient liquid in batter.
- Insufficient blending of baking powder with flour.
- Not homogeneous mixed batter.
- Use of too coarse a sugar.

h. Cakes develop mould

- Contamination by mould spores. Some of the more common reasons for this are:
- Exposure to warm, humid air conditions after baking.
 - Exposure to dust.
 - Contact with or exposure to any stale goods which may be a carrier of mould spores.
 - Contact with equipment, hands or wrapping materials which are not scrupulously clean.

- Careless storage of wrapping and packing materials prior to use. Storage in a dark place.
- Wrapping or packing before cake is properly cooled.
- Under-baking.
- Too dense a grain together with excessive moisture of crumb.

7.2 Internal appearance

a. Coarse and irregular grain

- process. Curdling of batter. Improper mixing. Too high speed in creaming
- Uneven distribution of ingredients in batter.
- Baking powder not thoroughly blended with flour.
- Recipe not properly balanced. Mix too lean.
- Batter too stiff.
- Too much leavening.
- Careless or improper depositing in pan.
- Too low oven temperature .
- Use of too coarse a sugar.

b. Dense grain

- Insufficient leavening.
- Use of baking powder which is too quick acting and which expends any considerable amount of its strength in the batter prior to baking.
- Too much fat or too much sugar.
- Excessive liquid in batter.
- Faulty baking conditions.
- Wrong type of flour.
- Too much invert sugar.

c. Off colour in white cakes

- Improper mixing.
- Inferior egg whites.
- Baked too slowly.
- Flour not white enough.
- Use of fat off colour.
- Excessive amounts of invert sugar or malt syrup.

7.3 General faults

a. Poor flavour

- Inferior ingredients.
- Old or inferior shortening or margarine.
- Unbalanced recipe.
- Inferior flavourings.
- Excessive amount of flavourings used.
- Improper mixing.
- Too much soda.
- Improper leavening.
- Faulty baking conditions.
- Improper cleaning and greasing of pans.

b. Cakes tough

- Unbalanced recipe.
- Insufficient shortening or sugar.
- Flour too hard.
- Excessive mixing.
- Batter too stiff.

c. Lack of body in Cake

- Flour too weak.
- Insufficient eggs.
- Too much fat or sugar.
- Excessive leavening.
- Over-creaming.
- Insufficient liquid in mix.

d. Poor keeping qualities

- Insufficient fat or sugar (especially moisture retaining type).
- Over leavening.
- Inferior materials and unbalanced recipe.
- Not enough eggs.
- Too long a baking period.

e. Sinking of fruit

- Batter too slack.
- Flour too weak.
- Excessive amount of sugar.
- Fruit added to a mix immediately after washing, without allowing excess moisture to dry off.
- Excessive creaming.
- Excessive baking powder.

8. OTHER TRAINING MODULES

- Fermented Goods/Yeast Doughs TIS no.: E022192X
- How to handle Frozen Doughs TIS no.: E022229X
- Puff Pastry TIS no.: E022227X
- Deep Fat Frying TIS no.: E022210X