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TECHNOLOGY OF MAKING CHEESE BASED ON THE COMPOSITION OF MILK

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Abstract. In this article, we will focus on the cheese-making process, i.e. the production of cheese. The processing of the milk takes about 24 hours, except for a few later operations, while the ripening of the curd, i.e. the maturing process, lasts from a few days to years. Figure 1 shows the general scheme of cheesemaking.

Introduction. Cheesemaking is divided into various stages that end with ripening. It is possible to draw a general outline of this process, bearing in mind that each cheese has its own peculiarities and differences.

Raw milk is a highly versatile raw material from which various dairy products and by-products can be obtained, with different characteristics and typicality; its use is therefore extremely broad. It is possible to understand the enormous potential of this product from Figure 1, which represents all the transformation processes to which raw milk can be subjected [1-3].

Material and methods. Milk. First of all, we start with the milk, which is placed in a boiler vat where the entire cheese-making process takes place. It should be noted that the milk used for this process can be of two types: raw or pasteurised. Raw milk (which we discussed in the article There is milk... and raw milk) is milk that has not undergone any kind of physical or chemical treatment before coagulation, and therefore retains different organoleptic characteristics to pasteurised milk, which is heated to 72°C for 15 seconds [1-2].

Addition of starter and rennet. One of the fundamental steps to start the cheesemaking process is to add to the milk either the microbial starter, composed mainly of lactic acid bacteria (in the form of natural lactic or serum starter cultures) or selected ferments; for more information see the article "Microbial starters for the dairy industry") and rennet, so that coagulation can begin, which can be presamic or acidic depending on the type of coagulant used (for more information see the article "Milk coagulation and types of rennet") [2-4].

Rupture of the curd. Once the curd has been obtained, the 'breaking' stage is carried out: the gelatinous mass that has formed is broken to facilitate the draining of the whey. The latter is separated from the curd, and can then be cooked to produce ricotta. The breaking operation produces granules of varying size depending on the type of cheese to be produced, and the climate. The grains of curd can be larger or smaller, about the size of a grain of rice or a walnut. The smaller the grains, the more conducive it is to purging the whey, which is preferable in hard cheeses, the opposite for fresh cheeses. But the size also depends on the climate; in summer, it is advisable to make a thicker curd, to avoid excessive acidification of the medium. To break the curd, a special tool called a 'spino-cutter' is used, consisting of steel wires or sharp sheets, keeping the mass stirring [3-4].

Then, once the curd has been broken, it is extracted and eventually cooked in order to stimulate acidification and further whey draining. Cooking takes place at a temperature of between 38°-60°C (38°-48°C for semi-cooked cheeses; 48°-60°C for cooked cheeses), with times varying from 15 minutes to an hour and a half: the shorter cooking time is used to produce semi-hard cheeses, while the longer cooking time is used for hard cheeses, which are therefore characterised by a greater consistency. It is important to emphasise that each type of cheese requires a strict and constant cooking temperature and time [4]. During cooking, the mass is kept stirring, thus completing the contraction and purging of the curd. Not all cheeses, however, require this treatment. The curd of so-called raw cheeses, in fact, does not undergo treatment above 40°C; these are cheeses such as Robiola or Crescenza [4-5].

Moulding. Next, the curd undergoes the 'moulding' process, i.e. it is placed in special moulds, i.e. moulds, which are placed on a table in such a way as to allow them to drain the remaining whey not previously removed; sometimes, to stimulate this process, the moulds can also be pressed. For the preparation of fresh soft cheeses, a period of stewing in a warm-humid room for several hours to a day can be carried out; this allows the whey to continue draining and encourages the formation of lactic acid. For hard cheeses, on the other hand, the cheeses are left to

rest, and it is precisely the increase in acidity that facilitates draining [5].

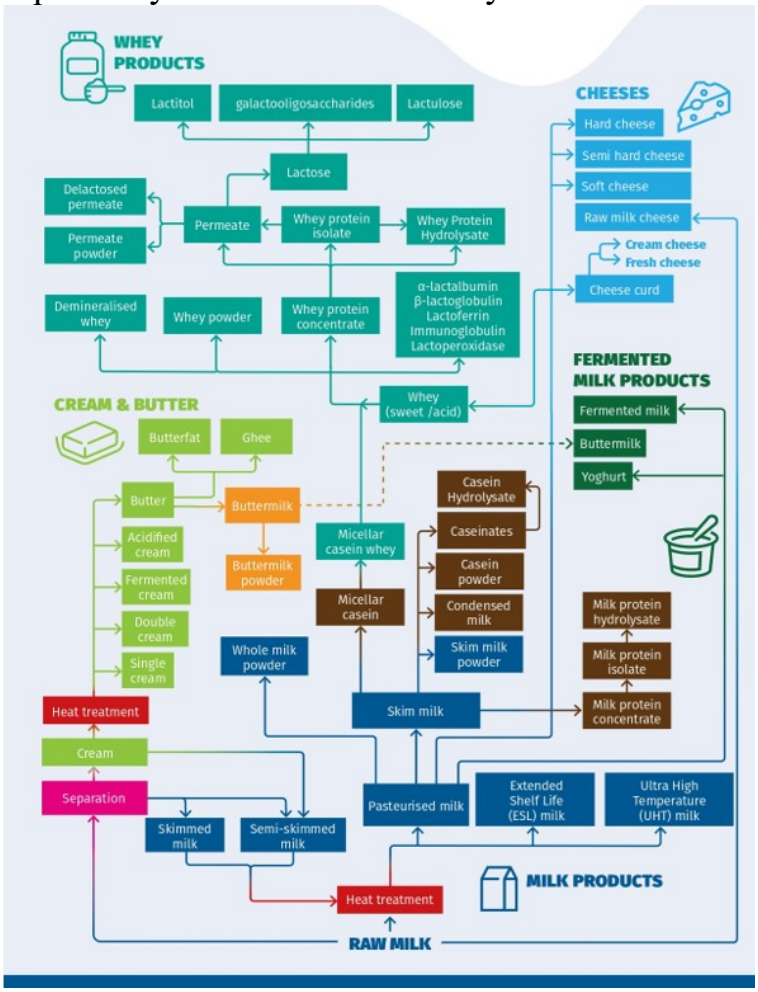

Figure 1. The milk tree - technology and use.

Salting. Following the moulding stage, the cheeses obtained are subjected to salting, which can be either dry or in brine. The objectives of salting are multiple, to impart flavour to the final product, complete the draining of the whey, promote the formation of the rind and increase the shelf life of the cheese by creating an environment unfavourable to microbial proliferation [6]. Dry salting consists of rubbing or sprinkling the surface of the cheeses with salt while the brine process is characterised by the immersion of the cheeses in 18-24% NaCl solutions for varying lengths of time depending on the type of cheese to be made. As far as fresh cheeses are concerned, the salting process is the last one they undergo before being sold, while ripened cheeses undergo a maturing process, which can be of variable duration (short, medium, long) depending on the final typical characteristics that the products must acquire [5-6].

Maturing. Maturing is that phase of the process that more than others determine the differentiation of cheeses. First of all, it should be specified that by maturing we mean the period from when the cheese comes out of the brine to when it is placed on the market, which can be very variable and last days, months or years. During this time, all those physical and chemical transformations take place that give the cheese its distinctive flavours, aromas, colour and consistency. Just as for wine, ageing, and the conteniture in which it takes place, is fundamental, so too

for cheese, ageing, and the surface on which it takes place, is decisive. In fact, a cheese matured on wood (we have talked about this particular type of maturing in The Use of Wood in Cheese Maturing) on plastic or metal will be different. Among the characteristics conferred by wood on the product we have, in addition to organoleptic ones, for example a lower possibility of being colonised by Listeria monocytogenes. More generally, wood imparts antimicrobial substances to products in contact with it; it also stabilises humidity and temperature in the environment, creating a favourable climate for ripening [5-7].

Maturation, as mentioned above, is variable, and by convention is divided into short, for fresh cheeses, and medium or long, for hard cheeses.

Results and discussion. If it is true that the properties and characteristics of the cheese come from the milk, it is also true that maturing allows these characteristics to be enhanced through specific reactions, such as the fermentation of galactose by propionic and butyric bacteria, as well as the fermentation of the very low percentage of lactose remaining by lactic starter bacteria, and enzymatic transformations by yeasts, filamentous fungi and Micrococcus; these are proteolytic and lipolytic activities. Proteolysis encompasses all those protein degradation reactions that lead to a different consistency and pH of the dough and a savoury sensation during chewing. Lipolysis includes all those activities that lead to the development of aromas and flavours, which are essential for cheese diversification [6-7].

Decisive for the different types of cheese that can be obtained, and for regulating the correct course of ripening, is the choice of place where this fundamental phase takes place. The environments or media on which ripening can take place are many; we have artificial and natural places [7]. Maturing cells are controlled and managed environments so as to have continuous and careful monitoring of the cheese, and can be made with sandwich panels or masonry; sandwich panels have an outer covering of fiberglass, plastic material or metal sometimes covered with plastic film, and internally are made of insulating material [8]. Masonry walls, however, have an internal insulation layer and, above all, excellent cladding materials that are not subject to wear and tear [10-11]. Natural rooms (cellars and maturing caves) are certainly the most folkloristic, it must be remembered that they must comply with hygiene and health regulations, so the choice of the natural environment must be carefully considered as there may be variations in climate (depending on the outside climate), humidity, or the walls may have cracks that facilitate an imbalance in temperature and the entry of unwanted animals [6-8].

Table 1 The components of milk

Composition of the milk (data in mass%)	
Water	87-88
Dry matter	12-13
- Grease	3-5,
- Fat-free dry matter	8-9

- Lactose	4,6-4,7
- Casein	2,8-3,2
- Whey proteins	0,5-0,6
- Inorganic salts	0,7-0,8

For proper ripening, the temperature and humidity of the ripening rooms must be carefully regulated. For long ripening cheeses, the appropriate temperature is around 10°C (Grana, for example, must be kept at 12°C with a relative humidity of less than 90%) [10]. Soft cheeses, on the other hand, which have a maturation period of around 60 days, must be kept at a lower temperature: 2-8°C in rooms with a humidity of more than 90%. Adjusting the humidity level is necessary for the proper development of the rind; a low humidity level leads to a cheese with a strong and compact rind, the opposite is the case if the humidity is kept high. The rind of the cheese is essential for the preservation of the product itself, it provides the characteristic appearance and flavour and makes each type of cheese recognisable, just think of the special rind of flowered rind cheeses [9-11].

Conclusion. Maturation control is necessary so that the quality of the cheese is optimal, and all the aromas, the right colour and perfect consistency are developed. This is because defects can occur during ripening. The most common alterations concern the paste and are early swelling: this is a typical defect of soft cheeses, it consists of holes that develop within 24 h of production caused by an excessive proliferation of Enterobacteriaceae; late swelling: typical, on the contrary, of cheeses with a long maturation period, consisting of eye formation caused by bacteria of the Clostridium strain.

The cheese defects that can occur are manifold, which is why careful control of the wheels and room parameters is necessary.

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