RESEARCH ON THE QUALITY OF THE SALTY CHEESE OBTAINED IN THE MICROUNIT PRODUCTION FROM UASVM IASI

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Abstract

Taking into account the fact that at present the population is in a continuous fight against the food additives, part of the dairy products has started to be indispensable. The quality of the cheeses is mainly outlined by defining the sensory and physical-chemical characteristics, these being the defining ones in the consumers' decision. To obtain superior dairy products we need a very good quality raw milk. Therefore, through this paper we set out to analyze the stages of the technological flow of obtaining salty cheese as well as of the sensory and physico-chemical analyzes on the finished product but also on the raw material. Regarding the quality of the analyzed milk, the average values calculated were 4.01 ± 0.03% for the fat content, and 1.030 ± 0.001g / cm^3 for the density. For the final product, salty cheese, sensory analyzes and physico-chemical determination were performed in order to establish the qualitative parameters. Also analyzed were the stages of the technological flow by monitoring the parameters, all of which lead to obtaining a product that can be marketed within USAMV-Iasi.

Key words: raw milk, technology, analyzes, quality

According to statistics, the livestock sector together with the agricultural sector, represents a very important branch in the country's economy, managing to provide the raw material for both the feeding of the population and the processing area. For a good development of the agricultural sector, the development of the livestock sector is strictly necessary.

Of all the agricultural products, milk is considered one of the most important products, it occupies the second place, in importance, in the agricultural sector in Romania, after meat.

Milk is considered to be one of the main foods intended for all age groups, but it is also the raw material for a wide range of products, used in the food industry as well as in the industrial one (Bondoc I., 2007).

In terms of production and consumption of milk and dairy products, these have been growing steadily, both globally and at European level. If we refer to the global level, the highest growth was reported in the United States of America, and at the European level, the countries of the European Union have sovereignty.

Quantitatively, world milk production currently reaches about 560 million tones, of which Europe makes approx. quarter.

As a result, in France, in 2000, 22.6 million tons of milk were collected from 4.5 million cows (FAO). In Romania, the annual average in milk production is 5 million tones; for this quantity, cattle participate with about 87% of the total milk production, the average production per animal exceeding 3000 liters per year (Georgescu Gh., 2000).

Regarding milk processing, cheese is considered to be one of the most sought after foods, being found worldwide and in as many forms as possible. Cheeses are produced with very good digestibility, being considered some of the most complex food products. Regarding the sorting range, this differs greatly, especially when we refer to the sensory and physico-chemical factors. From several points of view, cheeses are considered to be the ideal foods, they are very nutritious, flexible in use and application, quite safe, being in a varied assortment range (Angheloiu M., 2015).

As a definition, cheeses are fresh or matured products, obtained from the elimination of whey from the clot formed at the end of milk (whole, partially skimmed or skimmed), cream, whey or a mixture of all these products (Usturoi M.G., 2012).

Whether we talk about cheese made from cow's milk, or from milk obtained from other mammals (sheep, buffalo, goat, reindeer or camel), cheese is an important source of calcium and fat needed for the functioning of the body, as they are

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food. with a very high nutritional value, this is mainly due to the high content of proteins, lipids, mineral salts and vitamins (Usturoi M.G., 2012).

Another advantage conferred by cheeses derives from the rather large storage period, so cheese producers can sell the goods in economic conditions that are favorable to them, in some profile markets the aged cheese assortments are preferred, which have much higher selling prices. , exactly the opposite of the conventional situation registered for other foods, which are desired as fresh as possible.

Cheeses with a lower fat content, such as cow and barley cheese, have a dietary character, and they are especially recommended for people who do not tolerate products with a high fat content. The energy value of cheeses is directly influenced by their fat content.

In addition to proteins, cheeses also contain significant amounts of essential vitamins, such as vitamins A, B2, B12 and D, but also minerals. In the cheese is found synthesized the highest amount of calcium but also high amounts of zinc and phosphorus. Calcium found in cheese is of particular importance in the development of children (Diaconescu A, 2006).

As for the assortments of goat cheese, they are a natural source of vitamin B12 (2 micrograms / 100 grams); a fact that recommends it in the treatment of stress, anxiety, which helps to concentrate better (Usturoi M.G., 2012).

The same source reports that ,,urda" has a great nutritional value, because it incorporates, through heat precipitation, the very valuable serum proteins of milk (lactalbumin and lactoglobulin), which have a high content of amino acids necessary for the human body.

In terms of fat content, cheeses can be fat (contain more than 40% fat), half-fat (between 20-40% fat) and low (less than 20% fat).

Taking into account the factors mentioned above, we can say that cheese can be considered ideal foods, which can be consumed by all age groups.

For these reasons, through the present process we set out to create within the Milk Processing Workshop - USAMV-Iași, an assortment of salty-type cheeses, strictly following the stages of the technological flow, but at the same time the qualitative parameters of milk as well as the finished product.

MATERIAL AND METHOD

The quantity of milk processed in the processing workshop was 500 L. The raw material milk was brought from the Rediu Farm, in stainless steel containers with a capacity of 100 L.

Regarding the qualitative reception, analyzes were performed on milk of raw material to determine the acidity (˚T) by the Thorner method, the density (g / cm^3) by the aerometric method and the fat content (%) by the Gerber method.

200 ml of milk were collected from each container, with an average sample, of which six were made.

The quantitative reception of the milk is performed volumetricly with the help of the galactometer *(figure 1.a)* positioned in the immediate vicinity of the intermediate milk receiving vessel *(figure 1.b)*.

Figure 1 **Milk reception plant**

The operation of cleaning the milk of possible mechanical impurities is carried out by means of the filters mounted at the bottom of the intermediate receiving tank *(figure 1.d)*. The milk is extracted from the stainless steel containers by means of the centrifugal pump *(figure 1.c)*, the milk having to pass through two filters provided with metal screens. The receiving system is provided with an electrical control panel *(figure 1 e)*, through which both the centrifugal pump and the cooling system start / stop.

Temporary storage of raw milk. If the raw milk is not processed immediately, cooling is carried out, by passing the milk through the plate cooler *(figure 2.a)*, up to +4ºC and storing it in a buffer tank, provided with a double jacket. and stirrer for homogenization *(figure 2.b)*.

Figure 2 **Temporary storage of raw milk**

Pasteurization of milk. It is carried out using the plate pasteurizer *(figure 3)*, an operation that requires heating the milk to 74ºC, maintaining it at this temperature for 15 seconds, followed by a sudden cooling to 10oC. The capacity of the plate pasteurizer is 1000 l /h.

Figure 3 **Pasteurizer whith plates**

Fat separation. The result of this operation is sour milk and sweet cream. The centrifugal separator found in the Milk Processing Laboratory is part of the hermetic centrifugal separators category, with milk feedstock being made through the pipe mounted on the top of it *(figure 4).* the separation of the two fractions is achieved by means of two pipes mounted at the top of the separator. The fat separator capacity is 1000 l / h.

Figure 4 **Centrifugal separator**

Homogenization of milk. It is realized with the help of the mechanical pressure homogenizer with two stages of homogenization *(figure 5 a.).*

Homogenization is the operation to stabilize the milk fat emulsion, thus avoiding the separation of milk fat, by passing the milk through 2 homogenization valves, through which the milk under pressure overcomes the resistance of the homogenization valves, thus reducing the fat globules. The homogenizer has the following technical specifications: flow rate - 1500 l / h, maximum pressure - 25 MPa, normal working pressure - 0 ... 20 MPa, engine power - 6 kW. After homogenization, the milk is stored in a buffer tank *(figure 5.b*).

Figure. 5a
Homogenizer for milk

Figure 5b **Buffer tank**

Preparation of milk for curing. The homogenized milk is directed to the fitting valve, which is provided with a double jacket (the heating agent is steam) *(figure 6)*. The milk in the pan is heated to 35ºC, at which point the shell (selected cultures) is added. The coagulation process lasts between 50 and 70 minutes, depending on the quality of the milk and that of the selected cultures, until the milk passes into the liquid phase becomes

an elastic, gelled mass.

Figure 6 **Milk closing valve**

Coagulation processing. After the clamping occurs, the processing of the clot is performed in the valve in which the clamping was performed. The processing of the clot involves operations of shredding the coag, by dividing it with the pound *(figure 7)* (mounted inside the closing valve), until a grain of the size of the pea grain (2 - 5 mm) is obtained. During the coagulation processing the temperature in the valve is maintained at 35ºC.

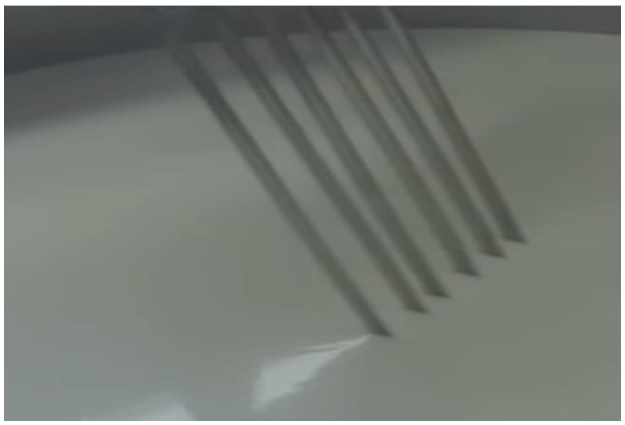

Figure 7 **Splitting the curd with the pound**

Pressing and forming the cheese. After obtaining the grain of cheese, the mass of cheese and whey formed is transferred to the ridge *(figure 8.)*, after which the seat has been previously placed. Coagulation processing requires seat binding and self-pressing operations for 20-30 minutes *(figure. 9).*

The operation of pressing the clot involves the following actions:

- ✓ placing the metal frame over the formed table;
- ✓ loosening the seat and uniformizing the cheese mass;
- ✓ setting the metal frame and pressing for 15 - 20 minutes (20 kgf), then increasing the pressing force.

The duration of the pressing operation is between 130 - 160 minutes, being considered completed when the acidity of the cheese is about 60˚T, and the water content has values between 63 and 65%.

Figure 8 **Transfer of the coagul into the ridge**

Figure 9 **Cheese pasteurization**

Cheese cracking. The cheese thus formed is placed on the ridge, in a single row, for the purpose of breeding. This operation takes 20-30 minutes.

Immersion in brine. Brine is obtained in the installation provided for this purpose, which is provided on the inside with an arm for homogenization (figure 10). The brine has a concentration of 22 - 24% NaCl, 20-30˚T acidity and a temperature of 10-20˚C. From this installation, the brine is sent through the pump and pipes into the wet salt basin *(figure 11).* After winding, the logs are placed in the brine for 16 - 20 hours, and then left to spray on a ridge. Here, the dry salting operation can be carried out, optionally, by pressing over the cheese with coarse salt.

Figure 10 ***Brine production facility***

Figure 11 ***Basin for wet salting of brine***

Salty cheese ripening. The duration of the ripening process is about 40 days in the ripening room, which has a temperature of 12 - 15˚C.

Vacuum packaging. The matured layers of cheese are packed in the packing machine, individually, in special polyethylene bags *(figure 12.).*

Figure 12 **Vacuum packing machine**

After packing, the products are labeled (*figure 13)* and stored in the specially arranged room.

Figure 13 **The label of the finished product realized within USAMV-Iași**

Regarding the quality conditions for the finite product, determinations were made in order to determine the US content (%) and water (%), determining the protein content (%), the fat content (%), the salt content (%) and acidity (˚T).

The water content was made by drying the samples in the oven and the dry one was by difference:

US (%) = 100 - water.

The determination of the protein content was performed by the Kjeldahl method, where the principle of the method consists in the conversion of nitrogen from organic combinations into ammonium sulphate, by heating with concentrated sulfuric acid, in the presence of a catalyst in our case, copper sulphate. By adding a strong base, the ammonia becomes free, and by distillation it is captured in a defined amount of acid with a known normality. The excess acid is titrated with a basic solution having the same normality, the total nitrogen quantity being determined by difference.

The fat determination was performed by the acid-butyrometric method, with the Van-Gulik butyrometer, the principle of the method consists in delimiting the fat from butyrometers, by dissolving the protein substances with sulfuric acid in the presence of isoamyl alcohol followed by centrifugation.

The determination of sodium chloride has as its principle, the precipitation of chlorides in cheese (in this case, salty cheese) with silver nitrate, using as an indicator the potassium chromate.

The acidity determination was performed, as in the case of milk raw material using the Thörner method, where the acids in the cheese composition are neutralized. A sample volume of sodium hydroxide (NaOH) is titrated, in which case a color indicator such as phenolphthalein is also required.

Regarding the physical-chemical examination of the cheeses, five determinations were made for each qualitative parameter.

Also, on the finished product a sensory examination was also carried out, using the points method.

RESULTS AND DISCUSSION

Regarding the fat content of milk registered in the samples analyzed by us, the average value was 4.01 ± 0.03%, the minimum being 3.90% and the maximum of 4.10%. The studied character presented a very good homogeneity, the value of the coefficient of variation being 1,119 *(table 1).*

Table 1

Physico-chemical properties for the raw milk

Specification	Standard	N	$\bar{X} \pm s_{\bar{X}}$	CV%	Minimum	Maximum
Fat (%)	min 3	6	4.01±0,03	1.19	3.90	4.10
Acidity (°T)	15-19	6	16.19±0,30	3.60	15.00	17.00
Density (g/cm^3)	min 1.029	6	1.030±0.001	0.06	1.029	1.031

Regarding acidity, the values indicated by the standard vary between 15 and 19°T, the average obtained on the milk analyzed by us being 16.19±0.30°T. The studied character also presented a very good homogeneity, the value of the coefficient of variation being 3.60%.

Regarding the density of the raw material milk subjected to the analyzes, the average calculated by us was 1,030±0,001 g/cm^3, the minimum being 1,029 g/cm^3 and the maximum 1,031 g/cm^3. The coefficient of variation obtained was also this time a very small one, of 0.06%, which indicates a very good homogeneity in the analyzed group.

For the finished product, a first parameter analyzed was the water content, where the average value was 56.51±0.05%, the variation limits being between 56.30% and 56.64%, values that have led to a very homogeneous character, the value of the coefficient of variation being 0.08% *(table 2).*

Table 2

Physico-chemical properties for the salty cheese

Specification	Standard	N	$\bar{X} \pm s_{\bar{X}}$	CV%	Minimum	Maximum
Water (%)	max. 57	5	56.51±0.05	0.08	56.30	56.64
DM (%)	min. 43	5	43.49±0.07	0.12	43.36	43.70
Fat/DM (%)	max. 42	5	40.65±0.02	0.20	40.52	40.76
Protein (%)	min. 16	5	16.95±0.04	0.44	16.87	17.02
Salt (%)	2.5 - 4	5	3.05±0.04	3.69	2.94	3.10
Acidity (°T)	max. 150	5	132.0 ±0.25	1.22	145	149

Regarding the water content, the quality standard indicates a maximum value of 57%, the average value obtained by us being less than 0.49%. The difference up to 100% was represented by the content in dry matter where the minimum value was 43.36% and the maximum reached a level of 43.70%. Regarding the average value, it was 43.49 ± 0.07% *(table 2).*

Another qualitative parameter analyzed was the fat content reported on the dry matter, where the average value was 40.65±0.02%, the minimum being 40.52% and the maximum value reaching the limit of 40.76%. The studied character also presented a very good homogeneity in this case, the value of the coefficient of variation being 0.20%.

Regarding the protein level in salty cheese, the standards indicate a minimum value of 16%, the average value calculated by us being 16.95 ± 0.04, 0.95% higher than the minimum required.

The salt content of salty cheese registered an average level of 3.05±0.04%, the minimum being 2.94% and the maximum value reaching a level of 3.10%. The studied character presented a very good homogeneity, the value of the coefficient of variation being 3.69% *(table 2.).*

For the salt level of the product analyzed by us, the quality standard indicates a minimum value of 2.5% and the maximum allowed is 4%; the salty cheese on which the research was carried out was within these limits, the average being 3.05±0.04%.

A final parameter analyzed was the acidity value, where the calculated average was 132.0±0.25˚T, lower by 18˚T than the maximum indicated in the quality standards. The studied character also presented a very good homogeneity, the value of the coefficient of variation being 1.22%.

For the sectoral examination, the group consisting of the six tasters followed the outward appearance, the color, the appearance in the section, the smell, the taste and the consistency.

For example, in the case of the external aspect, the average score was 4.83 points, five of the six tasters giving a maximum score, namely 5 points, for this feature, and as a result of the weighting, a value of 1.93 points was obtained. In the case of color, the average score obtained was 5 points, all six tasters giving maximum score to this feature, the weighted average score being 2.00 points in this case. The analysis of the aspect in the section led to an average score of 4.66 points and a weighted score of 3.73 points. Another characteristic pursued was consistency, where the tasters gave marks of 5, 4 and 3 points, the average score being 4.5 and the weighted one of 3.6 points.

For the average obtained from the determinations it was 5 points, each one of those who analyzed the product giving a maximum score, which resulted, after the weighting to a value of 2 points.

Table 3

Summary sheet of the results obtained by the scoring method

No.	The name of the taster	Individual score					
		Exterior appearance	Color	Appearance in section	Consistency	Smells	Taste
1	Taster 1	5	5	5	5	5	5
2	Taster 2	5	5	5	5	5	5
3	Taster 3	5	5	5	5	5	5
4	Taster 4	5	5	4	3	5	5
5	Taster 5	5	5	5	5	5	5
6	Taster 6	4	5	4	4	5	3
Average unweighted score		4.83	5.00	4.66	4.5	5.00	4.66
Weighted average score		1.93	2.00	3.73	3.6	2.00	5.59
Tota weighted score		**18.85**					

The last characteristic analyzed, perhaps the most important, was the taste, where five of the six tasters gave a maximum score, and one granted a 3-point turnaround which led to an average value of 4.66 to obtain it. 5.56 points weighted value.
The summation of the results obtained by weighting led to a final score for salty cheese of 18.85 points, placing the assortment analyzed by us in the "VERY GOOD" category *(table 3).*

CONCLUSIONS

In order to have a very good quality finished product, it is necessary, in particular, to use a higher quality raw material therefore, the analyzes carried out were also on milk the raw material used in processing.

Regarding the qualitative parameters obtained from the determinations made on the raw material as well as on the finished product, we mention that the results were compared with the values mentioned by the quality standards.

Regarding the unfolding of the technological flow, the temperature parameters as well as the times used in the various operations were taken from the specialized literature, wishing finally to obtain a product with superior sensory and physico-chemical qualities.

➢ *Conclusions drawn from the analysis of milk raw material*

- the fat content of milk registered a higher average value with 0.81% compared to the minimum of 3.2% as stipulated in the standard;
- for acidity, the variation limits indicated in the standard vary between 15°T and 19°T, the average value obtained by us being 16.19±0.30° T;
- milk density, has a minimum value of 1,029 g/cm^3 the average obtained by us being 1,030g/cm^3.

➢ *Conclusions drawn from the analysis of the flow of technologies*

Being the first batch of processing on the milk micro-production workshop within USAMV-Iași, the good operation of the equipment, the manufacturing recipe as well as the operating parameters were monitored in particular. The temperature was further monitored to determine if the equipment provided was functioning properly, but also the fat content was determined following the separation step to verify that the stored milk reaches a level of 0.1% in terms of fat.

In conclusion, we can say that the equipment works at optimal parameters, thus, in the future, we can try to process new assortments of cheese.

➢ *Conclusions regarding the finished product - salty cheese*

- from the sensory point of view, it was in the category of very good products, the analyzed features receiving scores near the maximum limit;
- from the physical chemically point of view, the first parameter analyzed was the water content, this being 0.49% lower than the maximum indicated by the standard;
- for U.S. content the standard value was min. 43% the average obtained by us being higher by 0.49%;
- the fat / DM content indicated a lower average value by 1.35% than the maximum allowed by the standard;
- for the protein level, the average obtained by us was higher by 3.95% than the minimum limit imposed;
- the salt level of the product registered an average value of 3.05 ± 0.04%, which is within the limits imposed by the standard;
- the acidity registered an average value of 132oT, this being lower by 18^{o}T than the maximum indicated by the standard.

The good functioning of the equipment as well as the high quality of the products that are obtained in the workshop with the help of the students of USAMV Iași obliges us to recommend the processing of a larger quantity of milk and the commercialization of the obtained products.

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