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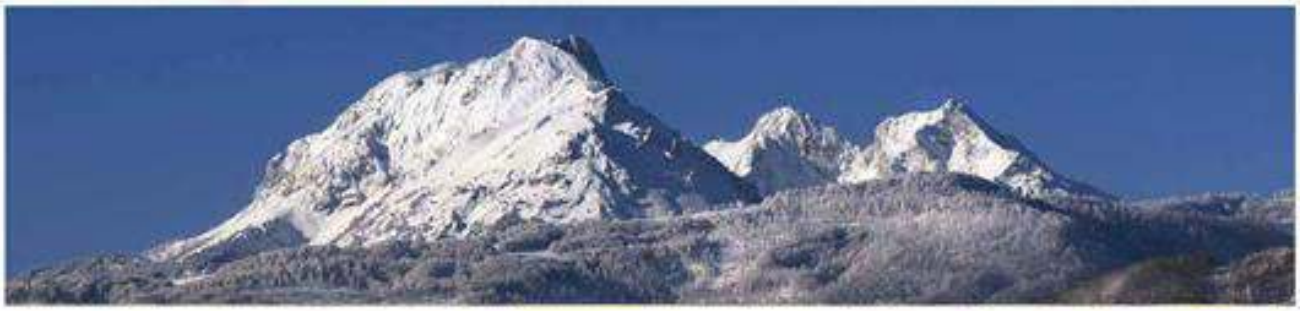

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Article

Changes in Physico-chemical Characteristics of Beaten Cheese during Manufacture

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Abstract: In our country consumers' interest in traditionally obtained cheeses is increasing, and milk processing capacities are making efforts to industrialize their production process. The most commonly requested traditional cheeses include beaten cheese. Beaten cheese is a dairy product, whose technology of production and consistency approximates the technology of hard cheese, while according to the method of ripening and storing it is one of the types of cheeses that ripen in brine. The subject of our research was to determine the quantitative changes that occur in the ripening of industrially obtained Beaten cheese by analyzing the physicochemical parameters (pH, titration acidity, percentage of NaCl, moisture and dry matter) characteristic of it. From the obtained results it can be seen that during the ripening there are noticeable changes of the analyzed parameters that condition the ripening process, i.e. the decrease in pH and the percentage of moisture content, and the increase in titration acidity and the percentage of dry matter, result in a decreased intensity of the ripening process. In addition, the continuous increase in NaCl content is a result of the salting mechanism.

Keywords: traditionally produced beaten cheese, acidity, NaCl, moisture, dry matter

1. Introduction

Beaten (bieno) cheese is an authentic product for our area, whose qualitative and sensory characteristics vary depending on whether it is obtained in an industrial or traditional way (Talevski, 2012). In the past, the traditional beaten cheese was made from sheep's milk, but nowadays, with the industrialization of the production process, it is obtained from cow's milk (Dimitriovska *et al*. 2017). In general, beaten cheese obtained traditionally has a firmer texture, more cavities, more pronounced yellow color, intense salty taste and salty smell (Risteska , 2015).

The salty taste of the cheese comes from the dry salting of the cheese and salting in brine (Guinee and Fox 2004). In addition to obtaining the expected taste, salting affects the regulation of water content, microbiological processes and a number of other physico-chemical processes that take place during maturation of the cheese (Johnson *et al*. 2009). The role of salting in controlling the water content stems from the salting mechanism, i.e. when the cheese comes in contact with the saline solution, the difference in concentrations between the cheese, the water phase of the cheese and the brine cause the salt to diffuse into the cheese and move the water phase to the brine (Presilski, 2004).

In general, structural features (texture, cavities) are the result of the cheese maturation process, which involves a series of microbiological and biochemical changes (Pagthinathan and Nafeese 2015). The biochemical changes of the organic components of cheeses give it specific organoleptic and aromatic properties, characteristic of qualitative differences of individual types of cheeses (Presilski, 2004).

2. Materials and Methods

The subjects of analysis of our research were samples of beaten cheese obtained in an industrial way of production that was taken from a dairy in the Pelagonia region. Samples for analysis were taken every three days after cheese maturation. The first sample was taken on day 5 (dry salting), day 8 (dry salting), day 11 (brine salting), day 14 (brine salting) and day 17 (brine salting) from production.

The cheese samples (50 g) were taken from the inside of the pie, placed in plastic cups and transported to the laboratory where the tests were performed. The pH value was determined by a stabbed pH meter (model MD120FK Mettler-Toledo, Greifensee, Switzerland), while titration acidity by the Soxhlet-Henkel method. The percentage representation of NaCl was determined by the Mohr method. MJ33 Mettler Toledo was used to determine the percentage of moisture and dry matter.

3. Results and Discussion

The quantitative changes that occurred in the examined parameters during the dry salting (5 days - 8 days) and the salting in brine (11 days - 17 days) are shown in Table 1.

During ripening, the active acidity (pH) in the tested cheese samples decreases continuously (Table 1), i.e. on the 5th day of the analysis it is 8.07, and on the 17th day 6.13. On the other hand, titration acidity is continuously increasing (Table 1), from 50 SH on day 5 to 64 SH on day 17 of the analysis. Our results are similar to those of Talevski, (2012), where changes in active and titration acidity resulted in a reduced intensity of the maturation process. According to research by Sulejmani *et al*. (2014), if we followed these two parameters for 60 days we would notice that the titration acidity would continuously increase, while the active one would decrease to 20 days, and then increase. The increase in active acidity in the middle of the ripening process in beaten cheese is often correlated with the added starter culture during production (Ramazan *et al*. 2010).

Table 1. Table view of the obtained results from the examined parameters during the maturation of the traditional beaten cheese during the first 17 days

Sampling time for analysis	Active acidity (pH)	Titration acidity (^{0}SH)	NaCl (%)	Moisture (%)	Dry matter (%)
5thday	8.07	50	9.02	34.97	65.03
8thday	7.70	54	9.21	34.08	65.92
11thday	6.80	56	10.20	31.78	68.22
14thday	6.75	60	10.68	28.93	71.07
17thday	6.13	64	11.30	27.09	72.91

The continuous increase of the percentage of NaCl (Table 1) from 9.02% on the 5th day of the analysis to 11.30% on the 17th day is a result of the dry salting (day5-8) and the salting in

brine (day11-17). The value obtained on day 17 (11.30%) is significantly higher than that recorded in Talevski, (2012) on day 20 of the analysis, indicating that the percentage of NaCl in beaten cheese is a variable parameter (Simonovska *et al*. 2016). In general, the percentage of NaCl in beaten cheese should range from 5% to 10% (Dubrova Mateva *et al*. 2008) and it depends on the initial salt concentration in the cheese, the type of salt used, the concentration of brine and pH value of the cheese (Sulejmani *et al*. 2014). Additionally, the increase in the percentage of NaCl in cheese is followed by a decrease in moisture content as a result of the salting mechanism (Presilski, 2004). In parallel, with a continuous decrease in moisture (Table 1) from 34.08% on the 5th day of analysis up to 27.09% on the 17th day, followed by the continuous increase of dry matter (Table 1) from 65.03% on the 5thday to 72.91% on the 17th day of the analysis. The recorded decrease of moisture (from 34.97% to 27.09%) results in a slower maturation process (Talevski, 2012). Sulejmani *et al*. (2014) came to a similar conclusion. In general, the percentage of dry matter is one of the most important factors influencing the course of ripening, i.e., according to research by Dubrova Mateva *et al*. (2008) in cheese, which has a higher percentage of moisture, the ripening process takes place with faster intensity.

According to our results (Table 1) and the results of other authors who have worked on the same problems, we can conclude that the course of the maturation process is conditioned by pH, titration acidity, percentage of NaCl, moisture and dry matter, i.e. changes in their values (decrease or increase of the same), as well as other physical-chemical parameters that were not the subject of this research.

4. Conclusions

The results obtained from this study indicate that during ripening process of beaten cheese quantitative changes occur in physicochemical parameters (pH, titration acidity, percentage of NaCl, moisture and dry matter). Also, microbiological and biochemical changes in the cheese result in the development of the flavor and texture. As a result of a number of factors, the course and period of maturation of industrially obtained beaten cheese is different. However, most often it reduces the active, and increases the titration acidity, percentage of NaCl, and dry matter, which is followed by a decrease in moisture. Further studies may be useful to determinate the changes that occur during ripening process.

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