

Sensory Evaluation and Microbiological Quality of Traditional ‘Bieno’ Cheese

Gordana Dimitrovska¹

¹Associate Professor, University “St. Kliment Ohridski”- Bitola, Faculty of Biotechnical Sciences - Bitola

ABSTRACT

The most significant attribute of traditional cheeses is the originality of the technology and the original raw material used in the production. The aim of the research is to determine the microbiological quality and sensory characteristics of three different production technologies (A, B, and C) of Bieno cheese at different stages of ripening (the curd, the cheese after dry ripening, cheese after dry salting, the 20th day of ripening and the 45th day of ripening). The microbiological quality of the three production technologies of Bieno cheese is determined on the 45th day of ripening according to the special requirements for food safety regarding the microbiological criteria. The sensory analysis is determined by the scoring method. As from the results it is observed that the best sensory characteristics are shown by the production series C with a weighted average value of 3.43, followed by the series A cheeses with 3.34, and the poorest results are observed in the production series B, with a real mean weighted value of 3.30.

Key words: cheese, quality, technology, evaluation, ripening

INTRODUCTION

The development of modern production conditions, the usage of modern procedures, equipment, and additives in dairy lead to significant deviations, i.e. withdrawing from the basic technology of products and loss of their authenticity. On the other hand, the liberal market and globalization in the dairy sector lead to a change in the habits and necessities of dairy consumers, so that more industrially produced dairy products are demanded and accepted, and the traditional dairy products

typical for our region are neglected, for instance, Bieno cheese. This type of cheese is a dairy product originating from the Mariovo region of our country and is produced in a specific way that is distinctive for the Balkan region.

The reasons for the occurrence of defects in cheese production are numerous, starting from the quality of the raw material, the quality of the cheese enzyme and starters, technological equipment, sanitary conditions during production and ripening, including the conditions of ripening, storage, and safety of the cheese (packaging), (Dimitrovska, 2000). According to the author, cheese can be contaminated with pathogenic microorganisms. The contaminated products pose a potential risk of toxic infections, especially in cheese made from unpasteurized milk.

Technological operations play a major role in determining the properties of a particular cheese, and microorganisms play a critical and important role in developing the unique properties of each cheese variety (Beresford et al., 2001). Microorganisms, with their metabolic activity, affect the changes in the organoleptic properties of cheeses during ripening.

The most common types of microorganisms in Bieno cheese according to Kakurinov (1997, 2002), are the following: *Lactococcus lactis* ssp. *lactis*, *S. salivarius* ssp. *thermophilus*. According to the author, the total number of bacteria in milk and cheese depends on the season, but also on the hygiene in the cheese processing.

As stated in some studies by (Lima et al., 2008) which are examining the microbiological quality of Brazilian cheese varieties, it has been found that the coliform bacteria which are initially identified have not been found after the ripening period and that the 60-day ripening process modifies the cheese and changes sensory features.

When it comes to sensory features, consistency, and other rheological properties, it is important to indicate that in the series of changes that occur in cheeses during ripening, the most significant are the changes in proteins and their decomposition products. The extent and depth of photolytic changes are closely related to cheese preparation technology, ripening conditions, and microbial activity (Jovanović et al., 2007). Twenty different volatile components have been identified in the examined products. The taste of cheese is concentrated in the water-soluble fraction (peptides, amino acids, organic acids, and amines), while the aroma is concentrated in the fat-soluble fraction (organic acids, aldehydes, amines, and esters), (Mikulec et al., 2010). Kirin, (2001), in their study found that during proteolysis and ripening, both natural plasmin and thermostable protease of the raw milk microflora act. Lipolysis of lipase fats from psychrotrophic bacteria in raw milk and other lipases in cheese also contribute to the bitter taste in the final product.

As from the mentioned factors, as well as the manner and technology of production, the microbiological quality, and sensory traits are especially important for the production of quality cheese, which is simultaneously the goal in this research.

MATERIALS AND METHODS

The production of Bieno cheese was made in three different locations in the Mariovo region, Republic of North Macedonia, each of them owing to a special production technology (A, B, and C). The technological procedure includes: filtering the milk and transporting it to the duplicator where reheating to a temperature of 35-37°C

has been performed. Then, a curdling with final coagulation of 45-60 minutes was performed. When the coagulum has become firm enough, it was processed for 2-5 min thus acquiring a grainy structure, and left to rest for 10-15 minutes. This was followed by beating again for 2-5 minutes and obtaining curds in the size of a grain of corn. There was a resting time to separate the whey, and at the end 2/3 of the whey was removed with a pump. In the next phase, the cheese mass was steamed for 30 minutes, processing of curd and heating of curd (by adding boiling water $t = 70-75^{\circ}\text{C}$) then the curd was separated at the bottom of the cheese bathtub, followed by kneading, and shaping of the cheese dough. The shaped cheese dough in a form of a ball was left to drain, i.e. self-pressing for a period of 16-18 hours. The self-pressing was left up until the next day. Further on followed the phase of dry ripening of the cheese. The formed blocks are placed in wooden molds, on wooden shelves in a ripening chamber, where $t = 26-28^{\circ}\text{C}$ and the relative humidity is 90-95%, for a period of 5-6 days, during which the cheese blocks get a wax-yellow color. After the completion of the ripening period of the cheese blocks, they are cut along their entire length into 5-6 cm strips and salting. (Figure 1,2,3)

Dry salting with coarse sea salt begins after 1-2 days, and subsequently, they are placed in bins while 20-22% salt is added. The cheese is stored at $t = 16-18^{\circ}\text{C}$ in a room where it is further matured for up to 45 days and finally stored.

The operations of this production technology are the same as for the produced Bieno cheese A, B, and C, however, there are differences in the used rennet. Bieno cheese from the production series A is produced in industrial conditions using chymosin-cheese powder, CHY-MAX with an intensity of 2080 imcv/g, while the production series B, C are produced in two different individual households with an indigenous technology applied, using microbiological rennet - "Kvasko" with an intensity of 1: 5000.



Figure 1: Ripening and salting of Bieno cheese (seria A)



Figure 2: Ripening and salting of Bieno cheese (seria B)



Figure 3: Ripening and salting of Bieno cheese (seria C)

The samples of cheese from the production series A, B, and C after the 45th day in brine, were taken to determine the microbiological quality and sensory evaluation.

The microbiological analyzes are performed according to the Rulebook on special food safety requirements regarding microbiological criteria (Official Gazette no. 78, 2008).

Sensory evaluation of the three variants of Bieno cheese (variants A, B, and C) was performed using the method of the corrected five-point grading system and ranking method (Radovanovic i Popov - Raljic, 2000/2011). Grades are given for appearance, cross-sectional appearance, consistency, odor, color, and taste (Appendix 1).

Appendix 1: The layout of the evaluation sheet (sample of the evaluation performed by the assessor)

Assessor:Date:						
Selected quality indicators	Product code		Product code		Product code	
Appearance						
Regular shape, smooth thin crust, pale yellowish color	5		5		5	
Regular shape	3	4	3	4	3	4
Irregular shape	2		2		2	
Changed appearance. Cracked cheese, undesirable color	1		1		1	
Cross-sectional appearance						
Improperly spaced lens-sized cavities	4	5	4	5	4	5
Improperly spaced cavities	2	3	2	3	2	3
Large cavities and cracks	1		1		1	
Consistency						
Dough bonded, hard	4	5	4	5	4	5
Too hard	2	3	2	3	2	3
Poorly connected, coarse dough, dry, crumbly, tough dough	1		1		1	
Odor						
Pleasant, inherent	4	5	4	5	4	5
Poorly expressed, poorly expressed foreign impurities	2	3	2	3	2	3
Altered odor, the smell of ammonia, fodder, uncharacteristic	1		1		1	
Taste						
Peculiar, moderately salty	5		5		5	
Insufficiently inherent	4		4		4	
Uncharacteristic, with foreign impurities, too salty	2	3	2	3	2	3
Altered, too many defects expressed (bitter taste, etc.)	1		1		1	
Color						
Uniformed, yellowish	4	5	4	5	4	5
Modified, too dark or too light	2	3	2	3	2	3
Completely uneven with spots, streaks, unacceptable	1		1		1	

RESEARCH RESULTS

Analysis of microbiological quality

To determine the safety of the indigenous production series of Bieno

cheese, a microbiological analysis was performed after the completed ripening processes, i.e. on the 45th day and the results are presented in Table 1.

Table 1: Microbiological quality of three production series of Bieno cheese

Sample	Enterobacteriaceae cfu/g	E. coli cfu/g	Coagulase-positive staphylococcus cfu/g	Listeria monocytogenes cfu/g	Salmonella spp. cfu/g
A-I	680	430	92	/	/
A-II	2000	1200	102	/	/
A-III	20	10	124	/	/
A-IV	1600	720	36	/	/
A-V	1150	300	180	/	/
B-I	1200	252	30	/	/
B-II	2000	840	112	/	/
B-III	1200	720	6	/	/
B-IV	3000	960	70	/	/
B-V	2000	1280	50	/	/
C-I	445	2	40	/	/
C-II	258	0	40	/	/
C-III	1800	440	16	/	/
C-IV	2000	220	5	/	/
C-V	269	16	6	/	/

The obtained results support the conclusion that the presence of *Listeria monocytogenes* and *Salmonella* spp. has not been reported. The presence of *Enterobacteriaceae* was found in all three series, most likely as a result of the production of Bieno cheese from raw milk. In occurrences when the cheese is made from raw milk, according to the Rulebook on microbiological quality, the presence of

coagulase-positive *Staphylococcus* is permitted. In our research, these values are much lower in all production series, in all repetitions of the experiment, which can be related to the fact that at the moment of steaming of the cheese dough at a temperature of 75-80 °C there is the destruction of coagulase-positive *Staphylococcus* that is also confirmed in studies by Lima et al., (2008) and Gomez-

Lucia et al., (1990). Unlike coagulase-positive *Staphylococcus*, *E. coli* (whose permissible limits are 10 to 100 cfu/g) is determined in four samples of variant A, in all samples variant B, and two samples of variant C.

According to the above, the best microbiological quality appears in the cheese from the production series B where the hygienic and sanitary norms were utmost respected in the production of indigenous Bieno cheese in the Mariovo region, as an authentic product, with proper

ripening and storage procedures undertaken and, according to the results prepared with milk of the best microbiological quality concerning the special requirements for usage of safe raw milk.

Sensory evaluation

Sensory analysis is considered a modern analytical science that contributes to the evaluation of food control and quality. The results of sensory testing of Bieno cheese production series are given in Table 2 and Figure 4

Table 2: Mean weighted values from the sensory evaluation of the three production series of Bieno cheese

Assessors	Production series A	Production series B	Production series C
	Mean weighted value	Mean weighted value	Mean weighted value
1	3,35	3,24	3,42
2	3,29	3,28	3,21
3	3,35	3,34	3,37
4	3,33	3,31	3,31
5	3,28	3,33	3,59
6	3,63	3,42	3,44
7	3,31	3,34	3,36
8	3,28	3,12	3,38
9	3,27	3,21	3,39
10	3,30	3,40	3,60
11	3,39	3,31	3,63
12	3,28	3,34	3,51
Real Mean weighted value	3,34	3,30	3,43

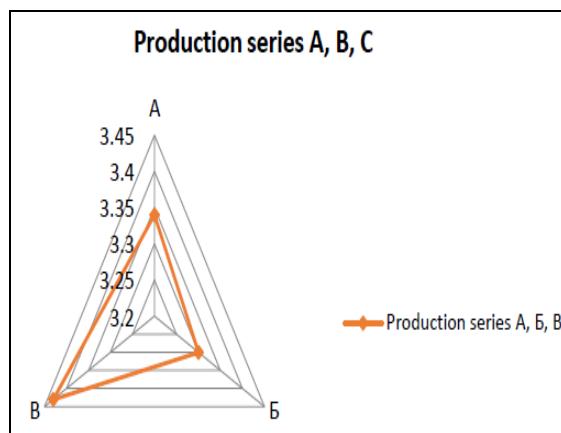


Figure 4: Illustration of the real Mean weighted value

The obtained results support the conclusion that the production series C demonstrated the best results with a Mean weighted value of 3.43, followed by the production series A with 3.34, and, the poorest results are observed in the production series B, with a real mean weighted value of 3.30. According to the obtained results, Bieno cheese from series C can be ranked as a product of superior quality compared to the other two series,

and cheese B as a product of inferior quality.

The best organoleptic quality of Bieno cheese can be related to the content of free amino acids. The amount of individual amino acids significantly affects the texture and organoleptic traits of cheeses and the specific aroma of various types of cheese (Mikulec et.al, 2010).

The sensory evaluation stands sound for authentic products and moves in two directions, one of which is to determine the basic characteristics, and the other is to study the reactions of consumers to a product and to get acquainted with the basic features of that product.

CONCLUSION

Bieno cheese from the Mariovo region in R.N. Macedonia is an indigenous product with specific and distinguishable traits, which were acknowledged through the results of this research. As of this research, the microbiological quality of all

three different production series of Bieno cheese is by the Rulebook regarding the applicable criteria, which indicates that the hygienic and sanitary norms were observed during the production of all series of cheese and being properly matured and stored. The aforesaid allows the assumption that the milk with the best microbiological quality was used concerning the special requirements for raw milk safety. The sensory analysis shows satisfactory ratings in terms of the examined traits, nevertheless, what is important to emphasize is that it is necessary to standardize the technological process of production of Bieno cheese, to control the physico-chemical, microbiological parameters and adding of clean starters that would achieve the proper course of the lactic acid fermentation process, as well as retaining or improving the distinctive sensory traits.

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