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TRADITIONAL PRODUCTION AND CHEMICAL COMPOSITION OF ''BIENO CHEESE" IN THE REPUBLIC OF MACEDONIA

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Abstract: *Bieno cheese is an autochtonous dairy product in our country with indigenous production technology which dates back from the Ottoman Empire. The research includes and presents results of the chemical composition and safety of raw milk for traditional production of Bieno cheese, technology and physico-chemical quality of Bieno cheese. Milk samples quality was determined within the permissible maximum according to data legislation. After 45 days of ripening the Bieno cheese registered average results for the following parameters: moisture (38.96%), dry matter (61.13%), milk fat (26.30%), milk fat in dry matter (43.02%), protein (26.21%), ash (9.37%), salt (5.09%) and average of yield (9.14%). In this experiment the microbiological quality of bieno cheese cheese maturing in 45 days is studied. The technology, physico-chemical and microbiological quality could be used in the protection of the origin and geographical label based on its unique technology.*

Keywords: *traditional production, raw milk, chemical composition, quality.*

1. Introduction

In the Republic of Macedonia today three kinds of cheese are mainly being produced: cheese, white brined cheese and hard (bieno cheese). These types of cheese are autochthonous products typical to a particular region and specific to the geographic region.

Bieno cheese is a typical indigenous dairy product in Macedonia from the central area of Mariovo region whose production dates back from the Ottoman Empire. Bieno cheese is manufactured in industrial conditions, but in some places it is still homemade, formerly produced from sheep milk, but today mostly from cow milk.

In rural and environmentally unpolluted regions, such as Mariovo, the production of traditional cheese is preserved today. The future of small farmers is to preserve the traditional technologies, production of authentic and traditional products, protection and marketing of domestic and foreign markets. Given its solid consistency and extremely salty taste it is often consumed by the poor and therefore called 'poor cheese'. Bieno cheese is hard, low fat cheese with spongy appearance, which matures in brine, with a great diversity in production and non-standard quality. From this perspective, the study finds a particular practical application and economic viability in the

new conditions, plans and policies for the development of agriculture and rural development of certain regions in the country.

2. Matherials and methods

2.1 Analysis and sampling

This paper presents the results of the milk quality, technology and physico-chemical quality of Bieno cheese. Sampling of milk and cheese, as well as production technology, were done in the Mariovo region in Republic of Macedonia.
The technology of Bieno cheese includes the following steps:

Raw milk
↓
Squeezing through cloth lurch
↓
Heating to 35-36^{0}C and coagulation with liquid rennet
↓
Processing of curd and heating of curd (by adding boiling water t = 75-80 ^{0} C)
↓
Kneading and collecting of curd in ball
↓
Self pressing with hanging in the cloth 16-18 h
↓
Ripening at 25-30^0 C, 5-7 days, sunbathing of balls
↓
Cutting strips (4-5cm)
↓
Dry salting (1-2 days)
↓
Salting in brine (20%)
↓
Ripening and storage (45 days) 18-20^0 C

2.2 Physico-chemical analysis

Milk samples were analysed for the content of dry matter, fat, protein, lactose and solids non fat by infrared analyser LactoScope. Active acidity was measured with pH meter (Testo 206) and titratable acidity according to the Soxhlet Henkel method (Carić et al., 2000). Total count of somatic cell was analysed with a Somascope, and total count of bacteria with Bactoscan.
For the **whey** there were conducted the following analysis:
- Active acidity of the milk with a digital pH meter (testo 206) **;**
- Titrable acidity (^{0}SH) - by the method of Soxhlet Henkel (Carić et al., 2000)**;**
- Chemical analisys of whey (milk fat, protein, lactose and dry matter) with an infrared analyzer LactoScope.

The cheese composition was analysed by standard methods: dry matter (AOAC,1995), fat Soxhlet Henkel method (Carić et al., 2000), protein (AOAC, 1995), salt and ash (Inihov method, 1971). The contents of moisture and fat in the dry matter (FDM) were calculated (Codex, 1978), and also the yield of bieno cheese (Balthadzieva,1993).

2.3 Microbiological analysis

The cheese was subject to the following microbiological analysis:

- ISO 6579, Microbiology of food and feed-Horizontal method for the enumeration of *Salmonella spp* (ISO6579: 2002 / Cor: 2004);
- ISO 16649, Microbiology of food and feed-Horizontal method for the enumeration of β - glucuronidase - positive *Escherichia colli* ISO 16649 1, 1: Material of counting colonies of 44 0C using membranes and 5 bromo-4-chloro- 3-indolyl β - D-glucoronide
(ISO 21528-1: 2001);
- ISO 21528-2, Microbiology of food and animal feed - Horizontal

method for the detection and enumeration of *Enterobacteriaceae*, Part 2: Method of counting colonies (ISO 21528 1: 2004);

- ISO 11290-1, Microbiology of food and animal feed - Horizontal method for the enumeration of *Listeria monocitogenes*, Part 1: Detection method (ISO 11290-1: 1996/ Amd.1: 2004);
- ISO 6888-1, Microbiology of food and feed-Horizontal method for the detection of *Staphylococcal koagulasa* positive (*Staphyloccocus aureus* and other species), Part 1: Technique using Baird-Parker agar medium (ISO 6888-1: Amd 1: 2003)

3. Results and discussion

The quality parameters of raw milk used for the production of bieno cheese are shown in Table 1.

Table 1

Physico-chemical parameters and hygienic quality of milk for bieno cheese

	Raw cow milk				
Parameters %	$\bar{x}$	**Min**	**Max**	**Sd**	**Cv**
Milk fat	3.46±0.04	3.38	3.55	0.06	1.81
Proteins	3.19±0.05	3.11	3.24	0.06	1.89
Lactose	4.49±0.02	4.46	4.53	0.03	0.57
Dry matter	12.60±0.10	12.42	12.77	0.13	1.03
pH	6.57±0.08	6.46	6.70	0.10	1.53
°SH	6.73±0.06	6.65	6.85	0.08	1.16
*TCSC/ml	364600	323000	389000	28500.88	7.82
*TCB/ml	237800	221000	273000	20510.97	8.63

*TCSC/ml (Total count of somatic cells)
*TCB/ml (Total count of bacteria)

The milk used for the production of indigenous bieno cheese has good chemical composition; hygiene is right with allowable number of somatic cells and the total number of bacteria in accordance with the special requirements for raw milk. Our results regarding the chemical composition of cow's milk were in accordance with the results from other authors [1, 2, 3]. In the indigenous technology of production of bieno cheese, must pay particular attention to all the factors that affect the microbiological quality of the milk and the hygienic correctness, namely: hygienic milking, milk cans, cooling devices (tankers) were the milk is held at a temperature of 5°C, transport and storage. It is necessary to respect the hygienic-sanitary norms related to cultivation, preservation and care of the milking herds, and with the right technology of milking, [4,5]. All these factors play a major role for the hygienic correctness and the microbiological quality of the milk.

According to the author Levkov et.al [6] in milk used for cheese production the total number of bacteria is 2.7×10^6 to $1,0 \times 10^8$ / ml. The total number of bacteria depends on the season and the standard of hygiene on the farm.

The total number of bacteria in the milk used for the manufacture of "bieno" cheese varies in the range of 2.0 to 3.5 x 10^7 / ml by the author [7] and that depends on milking hygiene, storage and transportation of milk. Whey is a product obtained in the manufacture of cheese. It is more or less clear, yellowish liquid with a distinctive sweet flavor.

The chemical composition and properties of whey depend primarily on the quality of milk and the technological process of producing cheese. The results of chemical composition and acidity of the whey can be seen in Table 2. Whey is an important by product in the manufacture of ''bieno'' cheese which can be used to obtain fresh albumin cheese.

Table 2

Chemical composition of whey

	Whey				
Parameters %	$\bar{x}$	**Min**	**max**	**Sd**	**Cv**
Milk fat	0.50±0.03	0.45	0.55	0.04	8.16
Proteins	1.05±0.05	0.94	1.10	0.06	6.04
Lactose	4.63±0.03	4.57	4.64	0.03	0.69
Dry matter	6.91±0.07	6.76	7.01	0.10	1.39
pH	6.67±0.07	6.52	6.72	0.09	0.01
^{o}SH	4.95±0.11	4.80	5.20	0.10	0.01

From the table 2 can be seen that the high content of milk fat (0.50±0.03) in whey likely due to the higher heat treatment or during mating in the curd, resulting in major losses occurring fat. Lost of fat in milk whey are essential effect on the production and quality of the cheese produced.

Protein is an important component in the chemical composition of whey and average mean values ranging from 1.05 ± 0.05%. Most % of the dry matter constitutes lactose whey, followed by protein and minerals and finally, with the lowest number was fat. The active acidity of the whey has an average mean (6.67±0.07) and the titrable acidity has an average mean (4.95±0.11). Similar results are found in whey obtained in the production of cheese and soft white cheese in research of [2,8].

From Table 3, the Bieno cheese contains 38.96±0.24 of moisture, 61.13±0.35 of dry matter, 26.30±1.04 fat, 43.02 ±1.56 fat in dry matter, proteins 26.21±0.72, ash 9.37±0.15 and salt 5.09±0.06 after 45 days of ripening. Those results coincide with results of scientific papers whose topic was hard cheese and that show that moisture content ranges from 38 to 40%, fat 21 - 26% and fat in dry matter 40 - 43% [9,10].

Yield is a complex variable because it depends upon a number of factors, the major effect on the quality of milk, the protein content and milk fat, [11]. The greater degree of the distribution of the components of milk into cheese, primarily protein and milk fat affect the majority of the cheese dressing percentage. This statement can be seen in our results obtained in our research and average cheese yield of bieno cheese was (9.14 %).

Table 3

Chemical composition of bieno cheese after 45 days of ripening

	Bieno cheese				
Parameters %	$\bar{x}$	**Min**	**Max**	**Sd**	**Cv**
Moisture	38.96±0.24	38.60	39.56	0.37	0.94
Dry matter	61.13±0.35	60.35	61.60	0.48	0.79
Milk fat	26.30±1.04	24.63	27.43	1.23	4.69
Fat in dry matter	43.02±1.56	40.11	44.78	1.96	4.55
Proteins	26.21±0.72	25.26	27.30	0.90	3.45
Ash	9.37±0.15	9.21	9.60	0.17	1.83
Salt	5.09±0.06	5.01	5.23	0.08	1.64

The research specified the microbiological quality of "bieno" cheese after 45 days of ripening in accordance with the special requirements of food safety regarding the microbiological criteria.

Table 4.

Microbiological analisys of bieno cheese after 45 days of rippening

	Entereobacteriaceae cfu/ml	***E. coli*** cfu/ml	***Coagulase positive staphylococcus*** cfu/ml	***Listeria monocytogenes*** cfu/ml	***Salmonella*** **spp.** cfu/ml
I	1200	252	30	/	/
II	2000	840	112	/	/
III	1200	720	6	/	/
IV	3000	960	70	/	/
V	2000	1280	50	/	/

From the results of Table 4 can be concluded that it was not determined the presence of *Listeria monocytogenes* and *Salmonella spp*. The presence of *Enterobacteriaceae* set possibly due to the production of bieno cheese from raw milk. For cheeses manufactured from raw milk, according to the Regulation on microbiological quality, allowed the presence of coagulase positive staphylococcus. In our study, these values are much lower in all variants in all iterations of the experiment; it can be connected with the fact that at the time of mating the cheese dough temperature of 75-80 ^{0}C comes to the destruction of coagulase positive staphylococci as confirmed in tests of [12] and [13]. *E. coli* whose limits are allowed (10 to 100 cfu / ml) was determined in all samples in limits given refer to each tested unit - sample. [6], following the dynamics of coliform bacteria during the whole technological process for hard cheese, 45 th day of ripening in brine, found the presence of coliform bacteria in height 10^4 -10^6/ml.In tests of [7], 45 th day of ripening of hard cheese in brine, the number of coliforms ranged from $1,0\times10^6$ to $2,8\times10^6$/ ml. The presence of *Enterococci* under [14] in their

ripening, due to their tolerance to temperature of 10 to 45 ^{0}C, pH value of 4.0 to 9.0 as a result of tolerance to certain concentrations of salt (6.5%).

4. Conclusion

Bieno cheese from the region Mariovo was indigenous product with specific and recognizable properties.

The research results show that cow's milk, as the raw material for cheese production, is of satisfactory quality. Bieno cheese has a good chemical composition: dry matter was (61.13 %), milk fat (26.30 %), the content of fat in dry matter (43.02 %), protein (26.21 %), ash (9.37 %), salt (5.09 %). According to dry matter content cheese belongs with hard cheeses, and according to their storing belongs to the sour brined cheese. Average yield of Bieno cheese was (9.14 %).

The data obtained may serve as the basis for creating standardized production procedures, leading to the uniform quality of these products. Therefore, traditional dairy should not be seen as a return to the past, but as an effort to preserve the indigenous technology, to gain their organized form, the ethnographic richness of a given region so distinctive, a time stamp to the development of a nation.

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