

## Traditional production and main characteristics of Galichki kashkaval

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Received - Prispjelo: 10.10.2013.  
Accepted - Prihvaćeno: 14.04.2014.

### Abstract

In this study, principles of traditional production and main characteristics of the traditional sheep cheese Galichki kashkaval from Bistra Mountain are presented. The contents of main components during ripening and storage of cheese were monitored. Analyses were performed on 1<sup>st</sup>, 30<sup>th</sup>, 60<sup>th</sup> and 100<sup>th</sup> day of ripening and 180<sup>th</sup> and 360<sup>th</sup> day of storage. On the first day cheese samples contained 20.75 % fat, 11.88 % total proteins, 1.20 % salt and 3.54 % ash. After 100 days of ripening cheese samples contained 27.87 % fat, 23.05 % total proteins, 2.02 % salt and 4.85 % ash. The technology process of kashkaval production was described in details. This cheese was produced and prepared in specific geographical area and fulfills the requirements listed in the National Law on quality of agricultural products. The data from this research might be a good starting point in the process of achieving the protected geographical indication.

*Key words:* kashkaval cheese, sheep milk, traditional production

### Introduction

Traditional cheeses belong to cultural heritage and are the result of accumulated empirical knowledge passed from generation to generation (Alichanidis et al., 2008). The dairy production is a reflection of the country and its inhabitants, the culture and their development. According to Dozet et al. (2004), autochthonous dairy production should not be considered as going back to old times, but as a base for development of novel products and for quality improvements of the existing ones.

Every traditional cheese is connected to the territory of its origin and to the prevailing pedoclimatic conditions. The pedoclimatic conditions in most parts of East-Mediterranean countries are characterized by relatively small and irregular rainfall, hot and dry summers, and largely hilly terrain (Alichanidis et al., 2008).

In the period of globalization and industrialization of the food production, traditional cheeses are significant part in the nutrition of consumers who take care about the nature and origin of the purchased products (Sarić et al., 2007). However, traditional cheeses are losing battle from the industry and they might extinct. Furthermore this could contribute to the lost of cultural identity (Mijačević et al., 2005). Macedonia is not resistant to this trend. As the economic and environmental conditions change within a region, the art of producing farmhouse or artisanal cheeses might be lost, especially since manufacturing procedures are not well described in the literature (Licitra et al., 1998). The number of traditional cheese producers is continuously decreasing.

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### *Kashkaval cheese*

The so called *Pasta Filata* cheeses like Kashkaval, Provolone, Mozzarella, Ragusano have a long tradition in the most east Mediterranean and neighboring countries. This type of cheese is different from other cheese types because critical parameters were found by analyzing the technological steps used in its production. In particular, the use of raw milk and the curd "stretching" process contribute to conferring typical characteristics of structure and aroma (Giardina et al., 2003). The term pasta-filata, which is derived from an Italian phrase that literally means "spun paste" or "stretched curd", refers to a unique plasticization and stretching process that is shared by all pasta-filata cheeses and which gives this diverse group their common identity. Kashkaval is one of the most popular hard cheeses in many Mediterranean countries. Its production is dating back to the eleventh and twelfth century. However, historical references suggest that kashkaval has an even older tradition (Kindstedt et al., 2004).

Different authors have studied the technological changes and chemical composition of pasta filata cheeses. Kindstedt et al. (2004) gave an overview of manufacturing technology and characteristics of kashkaval cheese. Pejić (1956) studied in detail the procedure of making the Balkan sharplaninski kashkaval. Pasta filata cheeses were also investigated by Dozet et al. (1996, 2004) for the region of Montenegro, Bosnia-Herzegovina and Niš; by Kožev (2006) for Bulgaria and by Çetinkaya and Soyutemiz (2006) for the Turkish traditional cheese - *kashar*. However, information about the Macedonian kashkaval is relatively scarce. Kapac-Parkačeva (1956) described the manufacturing process and gave comparative results for homemade Macedonian sheep's and cow's kashkaval.

The aim of this study was to investigate the principles of traditional production and to define the main physico-chemical characteristics of kashkaval from Galichnik (Galichki kashkaval). Galichnik is a mountain village in the western part of Macedonia situated on 1500 m above sea level on the mountain Bistra, whose pasture is recognized for its endemic vegetation. Galichki kashkaval is produced traditionally from raw sheep's milk without the addition of starter cultures. Also, the heat treatment of the curd during texturizing has a preservative effect on the product.

### **Materials and methods**

#### *On-site analysis and interviews*

To identify the production process onsite visits of production facility and interviews with the cheese maker were done. The production facility is located in the village Galichnik on the mountain Bistra where the kashkaval is traditionally produced during the summer pasture - from June to the middle of August.

#### *Sampling*

Sampling of raw milk and cheese were taken according the reference standard (EN ISO, 2008a). Thereat samples of bulk milk intended for cheese production were in four iterations collected from three farms on Bistra Mountain, transferred under refrigerated conditions (4-6 °C) and analyzed immediately. Cheese samples from four batches were taken on the 1<sup>st</sup>, 30<sup>th</sup>, 60<sup>th</sup> and 100<sup>th</sup> day of ripening and 180<sup>th</sup> and 360<sup>th</sup> day of storage. After 100 days of ripening cheese was transferred to the Laboratory, protected with copolymer emulsion- *Plasticoat* and stored under refrigerated conditions (4-6 °C).

#### *Physico-chemical analysis*

Milk samples were analysed for the content of dry matter, fat, protein, lactose and solids non fat by infrared analyser Milkoscan. Active acidity was measured with pH meter (Mettler Toledo, Spain) and titratable acidity according to the Soxhlet Henkel method (Carić et al., 2000).

The cheese composition was analysed by standard methods: dry matter (EN ISO, 2004), fat (EN ISO, 2008b), protein (FIL-IDF, 1993), salt (Mohr's method, Pejić and Đorđević, 1963), ash (Carić et al., 2000), titratable acidity (Carić et al., 2000) and pH (Mettler Toledo, Spain). The contents of moisture on a fat free basis (MFFB) and fat in the dry matter (FDM) were calculated (Codex, 1978).

### **Results and discussion**

#### *History and conditions of traditional production of kashkaval cheese*

Traditional production of Galichki kashkaval is a result of artisan production through generations.

According to historical data, between 100.000-120.000 sheep were breed in the Galichnik village at the end of 18<sup>th</sup> century. In that period, Galichki kashkaval was produced and merchandised on numerous bigger markets outside Macedonia (Buzaroski, 1976). It is reported in the Yugoslavian newspaper "Politika" from 1931, that 80 tons of kashkaval cheese was exported to New York.

The artisan production of kashkaval is mostly spread in regions with warm and dry climate, hilly relief and developed sheep breeding (Pejić, 1956). The mountain Bistra belongs to the group of mountains which constitute the most interesting mountain-pasture area of the Balkan Peninsula, with the most beautiful hilly pastures. Lowland meadows and hilly pastures are used in spring and early summer, after which sheep are moved to high pastures where grazing continues. This semi-nomadic livestock breeding system is dynamic, alterative and dependent on the climatic characteristics of the vegetation areas (Stefanova et al., 2012).

Specific sensory characteristics of this milk are based on climate characteristics, uncontaminated limestone land with high quality forage and different medical and aromatic plants, spring waters of excellent quality which are the key factors for the specificity of cheese on Bistra mountain. The floristic composition on Bistra mountain pastures is presented in Table 1.

According the data for Bistra pastures presented in Table 1 dominating plants are from family *Poaceae* - grasses with 48.84 %, then leguminous plants with 11.63 %, aromatic plants 18.60 % and other species 20.93 %.

#### *Cheesemaking process*

The production process of kashkaval cheese is subdivided into several steps as shown in a Table 2. Bulk raw sheep milk is first filtered, heated at 33-37 °C, renneted with powdered rennet and left to coagulate within 45 minutes. Curd is cut and stirred around 30 min with special wooden tool called "kr-

Table 1. Floristic composition of pastures on Bistra mountain (Micevski, 1994)

<i>Fabaceae</i> %	<i>Poaceae</i> %	Species diversa %	Aromatic plants %
<i>Trifolium arvense</i>	<i>Nardus stricta</i>	<i>Antyllis vulneraria</i>	<i>Thymus boissieri</i>
<i>Onobrychis Montana</i>	<i>Stipa mediteranea</i>	<i>Carex caryophyllea</i>	<i>Thymus albanus</i>
<i>Lotus corniculatus</i>	<i>Festuca valesiaca</i>	<i>C. haleriana</i>	<i>Th. ciliatopubescens</i>
<i>L. alpinum</i>	<i>F. paniculata</i>	<i>C. laevis</i>	<i>Satureja alpinum</i>
<i>Medicago lupulina</i>	<i>F. rubra</i>	<i>Edraianthus graminifolius</i>	<i>S. Montana</i>
	<i>F. duriuscula</i>	<i>Luzula spicata</i>	<i>Teucrium montanum</i>
	<i>F. glauca</i>	<i>Plantago atrata</i>	<i>T. hirsute</i>
	<i>F. falax</i>	<i>P. media</i>	<i>Asyneuma limonifolium</i>
	<i>F. rupicola</i>	<i>Dianthus minutiflorus</i>	
	<i>F. halleri</i>		
	<i>F. varia</i>		
	<i>F. cileniaca</i>		
	<i>F. hercegovinica</i>		
	<i>Poa violacea</i>		
	<i>P. mollinieri</i>		
	<i>Sesleria caerulea</i>		
	<i>S. wettsteinii</i>		
	<i>Bromus erectus</i>		
	<i>B. riparius</i>		
	<i>Melica ciliata</i>		
	<i>Phleum alpinum</i>		
11.63	48.84	20.93	18.60

Table 2. Production process of Galichki kashkaval

Step	Description
1	Raw sheep's milk
2	Setting the milk temperature (33-37 °C)
3	Addition of rennet
4	Renneting time (45 min)
5	Cutting and stirring the coagulum
6	Whey draining
7	Chopping the curd by hands
8	Pressing the curd (3-6 h)
9	Curd ripening (cheddaring) - 18 h
10	Cutting the curd (baskija) in pieces
11	Stretching in hot brine - plasticization (73-75 °C, 5 % NaCl)
12	Kneading, dry salting and molding
13	Ripening (3 months, 15-18 °C, RH 75-80 %)
14	Washing the cheese
15	Packaging

stach" and left standing for about 10 minutes (Figure 1). Subsequently the curd is placed in cheesecloth in order to drain whey. Afterwards the fresh curd in cheesecloth is placed on the table and chopped by hands till small grains are formed (Figure 2). This process is very quick (5 min) in order to prevent the curd from cooling down. Then the curd is wrapped in the cheesecloth and pressed by using weights, 1 kg rising to 15 kg per kg of curd over 3-6 hours. After pressing, the curd is cut in blocks (5-8 kg), covered with cheesecloth and polyethylene cloth. So the process of curd ripening called cheddaring starts and lasts for approximately 18 hours. Cheddared curd (mkd. baskija) has small holes, elastic consistency, light

yellow colour and pleasant odour with optimum pH value, usually between 5.2-5.4 i.e. titratable acidity of 62-66 °SH. Depending on the cheese maker decision the production continues, if a small piece of cheese soaked in hot water stretched well. Then the curd (baskija) is sliced into very thick sticky pieces (20 × 5-10 × 0.5-1 cm) placed in wooden basket and texturized by immersing the basket into the hot brine (5% NaCl, 73-75 °C) for about 5 min. The sliced curd is gently stirred with long wooden stick in order to achieve plastic and workable consistency. In the second stage, the plasticized curd is kneaded and stretched by hands in the basket. Subsequently the cheese dough is placed on a table and is kneaded carefully for 10-15 minutes until a uniform elastic mass is obtained and air bubbles are eliminated. According to Kindstedt et al. (2004) texturing has an additional advantage, i.e. a pasteurizing effect which suppresses undesirable microbial growth, encourages desirable fermentation and ripening and results in high-quality cheese. For kneading of the dough (5-10 minutes) dry salt is applied. During the molding the dough is carefully closed like mushroom and the small piece of cheese called "navel" (mkd. papok) is pulled out in order to completely fill the mould (Figure 3). The cheese is pricked with long needles to remove the remaining air and several times turned over for the period of 24 hours. The salting process with dry salt is conducted during 20-30 days. Before each salting, the cheese is cleaned with wet cloth. The cheese ripens for 3 months at 15-18 °C and 75-80 % relative humidity (RH). During ripening the cheese surface is cleaned with dry cloth. The cheeses are put one over another to maximum four wheels and the wheels are rotated periodically (Figure 4).

Table 3. Quality of milk used for the manufacturing of kashkaval cheese

Investigated parameters	Calculated parameters		
	Mean (n=4)	Max	Min
Total solids (%)	19.42	22.09	17.78
Fat (%)	8.45	9.89	7.08
Protein (%)	6.34	7.57	5.78
Lactose (%)	4.12	4.46	3.67
Solids non fat (%)	11.49	12.49	10.83
pH	6.50	6.70	6.41
Titratable acidity (°SH)	10.33	11.00	10.00





Figure 1. Cutting and stirring of curd



Figure 2. Chopping of curd



Figure 3. Molding and pulling out the "navel"



Figure 4. Kashkaval ripening

Galichki kashkaval acquires the shape of a flattened cylinder with weight of 3-3.5, 5-6 or 8-9 kg. The cheese is usually packaged in vacuum polymer foil.

#### *Physico-chemical parameters of sheep's milk used for the production of kashkaval*

The gross composition and physico-chemical parameters of raw sheep milk obtained from local breeds (pramenka and cross breeds) used for Galichki kashkaval production is presented in Table 3.

According to the results, sheep milk and the traditional cheese meet legal requirements defined in the national Rulebook of the quality of raw milk and dairy products (Regulation, 2011). The composition of sheep milk was similar to the results for milk in region, but fat and protein content were higher in comparison to the

results reported by Talevski et al. (2009) who examined bulk milk from different regions. Compared to the results of fat and protein content of different sheep breeds in Croatia, results of the present study were in line with the sheep breed *craska* (Garibović et al., 2006). Also the results are in accordance with the chemical composition of sheep milk in Bosnian-Herzegovian region given by Dozet et al. (1996).

#### *Physico-chemical parameters of Galichki kashkaval cheese during ripening*

The average values of quality parameters during ripening of kashkaval cheese are presented in Table 4. The content of fat, total protein, salt and ash increased during the ripening period. Total protein content ranged between  $11.88 \pm 2.71$  % at the

Table 4. Physico-chemical characteristics of Galichki kashkaval

Time days	Investigated parameters (n=4)								
	Moisture (%)	Fat (%)	MFFB*	FDM**	Total protein	Ash (%)	NaCl (%)	pH	Acidity (°SH)
1	46.48±2.42	20.75±0.95	58.63±2.08	38.77±0.57	11.88±2.71	3.54±0.30	1.20±0.19	5.47±0.07	65.13±4.73
30	43.8±1.51	21.75±0.95	56.28±1.52	38.88±1.37	12.06±0.61	4.01±0.32	1.29±0.12	5.42±0.06	66.75±4.43
60	39.20±1.40	24.37±1.88	51.87±2.15	40.12±3.41	21.03±1.59	4.24±0.31	1.48±0.21	5.35±0.02	74.88±10.29
100	36.63±0.55	27.87±0.85	50.80±1.04	44.00±1.58	23.05±1.71	4.85±0.26	2.02±0.25	5.34±0.01	77.61±10.16
180	32.92±1.49	29.00±0.91	46.36±1.80	43.24±1.51	25.30±0.51	5.43±0.14	2.44±0.33	5.28±0.05	93.16±13.89
360	27.53±0.35	31.40±1.45	40.14±0.28	43.33±1.79	28.41±1.67	5.81±0.15	2.90±0.19	5.26±0.06	107.28±4.73

\*MFFB- moisture on a fat free basis, \*\* FDM-fat in dry matter

first day up to  $28.41 \pm 1.67$  % at 360<sup>th</sup> day. The salt content after 100 days of cheese ripening was  $2.02 \pm 0.25$  %.

The ripening of cheese resulted in a decrease of pH value and an increasing of titratable acidity. According to the results for moisture on a fat free basis (MFFB), Galichki kashkaval belongs to a group of hard ripened cheeses at 100<sup>th</sup> day (Codex, 1978). Since the cheese was protected with copolymer emulsion and was cool stored storage after 100 days, the moisture rapidly decreased during storage. Consequently, according to the obtained results, the cheese belonged to a group of extra hard cheeses on 180<sup>th</sup> and 360<sup>th</sup> day of ripening. The same results were obtained by Kirin (2002) who investigated cheese yield of Trapist in relation to three different processes of ripening. The highest abatement was found in the case of cheese ripening on traditional way i.e. without applying the protective coating. Slightly lower abatement value showed cheeses with protective coating, while a negligible abatement was noticed in cheese samples packaged into a pouch.

After 100 days of ripening the content of milk fat in dry matter was  $44.00 \pm 1.58$  %. According to the Codex standard these cheeses belong to medium fat cheeses (Codex, 1978).

The protein and fat content of cheese after 100 days of ripening were  $23.05 \pm 1.71$  % and  $27.87 \pm 0.85$  %, respectively. The obtained results for fat content were in accordance with the results for kashkaval given by Kindstedt et al. (2004) and for Caciocavallo Pugliese given by Gobbetti et al. (2002). The results of the protein and salt content

and pH value were in agreement with the results shown by Angelis and Gobbetti (2011).

In comparison to research conducted on the Pirot kashkaval (Mijačević et al., 2005; Ružić-Muslić et al., 2011), some variations could be observed. Galichki kashkaval showed higher pH values and moisture content, which was most probably due to difference in the raw material, since Pirot kashkaval is made from mixed milk (raw cow and sheep milk). Also there were some variations in the production process.

Some variations in the cheese making process given by Çetinkaya and Soyutemiz (2006) for the kashar cheese were found. After 100 days of ripening the moisture content of kashar cheese (33.73-32.44 %) was lower than in Galichki kashkaval, taking in consideration that heating of the curd up to 41 °C for 30 min. was not present. Comparing the results on FDM, Galichki kashkaval had higher values than the kashar cheese which ranged from 37.77-40.08 % on 120<sup>th</sup> day of ripening.

## Conclusions

Traditional kashkaval in Macedonia is made from sheep milk in a special way characterised by ripening at ambient conditions which results in a product of an exceptional taste. The production is real art of cheese making transferred to the new generations starting from 18-19<sup>th</sup> century up to present. This cheese is produced and prepared in specific geographical area of which natural and human factors determine

it's quality and characteristics. Since traditional kashkaval meets requirements defined by the national *Regulation* (2010) and considering the data of the present research, a good starting point in the process of protecting traditional kashkaval by a PDO or PGI indication was observed.

### *Tradicionalna proizvodnja i glavna obilježja Galičkog kačkavalja*

#### Sažetak

U ovom istraživanju prikazana su načela tradicionalne proizvodnje i osnovna obilježja vrlo popularnog ovčjeg sira - Galičkog kačkavalja s planine Bistre. Utvrđivana je dinamika glavnih komponenti tijekom zrenja i skladištenja sira. Analize su provedene 1., 30., 60. i 100. dana zrenja, te 180. i 360. dana skladištenja ispitivanog sira. Sir je prvog dana sadržavao 20,75 % masti, 11,88 % ukupnih proteina, 1,20 % soli i 3,54 % pepela, dok je nakon 100 dana zreli sir sadržavao: 27,87 % masti, 23,05 % ukupnih proteina, 2,02 % soli i 4,85 % pepela. Tehnološki proces izrade kačkavalja (mkd. kaškaval) opisan je detaljno. Ovaj se sir proizvodi i priprema u određenom zemljopisnom području, a ispunjava zahtjeve nacionalnog zakonodavstva o kvaliteti poljoprivrednih proizvoda. Podaci iz ovog istraživanja mogu biti dobar temelj za početak procesa zaštite ovog tradicionalnog proizvoda i postizanje PDO ili PGI oznake.

*Ključne riječi:* kačkavalj (mkd. kaškaval),  
ovčje mlijeko, tradicionalna proizvodnja

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