

TRADITIONAL PRODUCTION AND CHARACTERISTICS OF SJENICA CHEESE AND PIROT KACHKAVAL

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Abstract

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In this paper, principles of traditional production and main characteristics of Sjenica cheese and Pirot kachkaval are presented.

Sjenica cheese belongs to the group of soft, white cheeses in brine and it is produced as autochthonous product made of sheep milk, on the territory of Sjenica-Pester plateau.

Pirot kachkaval is firm cheese of steamed curdle produced from mix of sheep and cow milk (1: 2 ratio) on the territory of Stara Planina Mountain.

These are geographical areas where production takes place in village households/farms and on mountains in summer cottages (katun, bacija), which is characteristic of craft dairy processing. Specific traits of traditional manufacturing of Sjenica cheese and Pirot kachkaval derive from climatic conditions, characteristic grass associations of the specific mountain region and milk from autochthonous populations (Sjenica and Pirot sheep). In order to maintain the traditional manufacturing technology of these native products and to have organized production, it is necessary to protect the geographical origin of these products.

Key words: Traditional production, Sjenica cheese, Pirot kachkaval

Introduction

Production of milk and processing into autochthonous dairy products in hilly-mountainous region of Serbia is very significant within livestock production from several aspects: economical, social, historical and cultural. Recently, more and more consumers of cheeses are requiring exclusive products manufactured in small quantities and in application of *traditional technology*.

Cheeses produced in this way are usually richer in taste, aroma, flavour, consistency compared to industrially produced cheeses, where technologies are strictly defined, production conditions under control and therefore the influence of the raw material, autochthonous micro-flora and creativity of the producer reduced to minimum (Stimac et al., 2003). Considering the price, most of these cheeses will never be able to “compete” with industrially produced cheeses, because they will always be

more expensive as a result of specific sensory characteristics (Mijacevic et al., 2005). Authenticity of traditionally manufactured cheese is attributed to the effects of the climate, soil type, natural vegetation, floristic composition of pastures, animal breed, animal nutrition and housing, as well as the tradition and experience passed from generation to generation (Samardzija et al., 2006; Monnet et al., 2000; Bugaud et al., 2001; Boyazoglu and Morand-Fehr, 2001).

Preservation of the traditional cheese production is important also from the aspect of prevention of depopulation in rural regions. Loss of special cheese types can also be considered as loss of cultural identity of the region (Petrovic, 1997).

The most important localities in the hilly-mountainous region of Serbia in regard to traditional production of dairy products are: Sjenica-Pester plateau and the territory of Stara Planina Mountain, identifiable by Sjenica cheese and Pirot kachkaval.

Objective of this paper was to study traditional production technologies and main characteristics of Sjenica cheese and Pirot kachkaval.

Material and Methods

Study included survey of the traditional production of Sjenica cheese and Pirot kachkaval, which included interviewing 12 households/farms in the wider area of Sjenica-Pester plateau and Stara Planina Mountain by method of random sample. Survey included questions referring to main elements of technological procedures and operations in traditional production of Sjenica cheese and Pirot kachkaval. The following locations were selected on Pester plateau: Stavalj, Karajukica bunari, Krstac, Breza, Leskova, whereas on Stara planina Mountain, study was carried out in following villages: Dojkinici, Brlog, Jelovica, Visocka Rzana and Rsovci.

Finally, the samples of Sjenica cheese and Pirot kachkaval were used for following analyses:

- Determination of the dry matter content

by standard method of drying at $102 \pm 1^{\circ}$ (Caric et al., 2000)

- Determination of cheese water content by computation

- Determination of the water content in fat free matter, also by computation: $MFFB(\%) = \%H_2O / (100 - \%MM) \times 100$

- Determination of total nitrogen content by method according to Kjeldahl (Caric et al., 2000)

- Determination of protein content by computation ($\% \text{ proteins} = \%N \times 6.38$)

- Determination of the milk fat content by method according to Van-Gulik (Caric et al., 2000)

- Determination of the content of milk fat in dry matter of cheese (FinDM) by computation

- Determination of the content of NaCl in cheese by method according to Mohr (Pejic and Dordevic, 1963)

- Determination of pH value using pH meter with combined electrode

- Determination of the titratable acidity of milk by method according to Soxlet-Henkel (Caric et al., 2000).

Results and Discussion

Conditions and characteristics of traditional production of Sjenica cheese

On defined geographical territory of Sjenica-Pester plateau which is specific in regard to climate, phytocenological composition of pastures, sheep population and tradition, Sjenica cheese is manufactured.

Sjenica-Pester plateau covers the south-west part of Raska region. This whole region represents unique spacious mountain area, which is traversed by a network of valleys, ravines, fields, bays, sinkholes, smaller surfaces and elevations, located between 1000 and 1350 m above sea level. This plateau has continental climate of mountain highlands.

Geological foundation of the soil comprises

Table 1
Floristic composition of pastures on locality Vrujci on Sjenica-Pester plateau (Vuckovic et al., 2004)

Fabaceae	Poaceae	Other species,%
<i>Genista sagittalis</i>	<i>Cynosurus cristatus</i>	<i>Achilea millefolium</i>
<i>Lathyrus latifolius</i>	<i>Anthoxanthum odoratum</i>	<i>Alectrolophus minor</i>
<i>Lotus corniculatus</i>	<i>Arrhenatherum elatius</i>	<i>Cirsium acaule</i>
<i>Trifolium pratense</i>	<i>Briza media</i>	<i>Dianthus deltoides</i>
<i>Vicia cracca</i>	<i>Danthonia calycina</i>	<i>Filipendula hexapetala</i>
<i>Trifolium alpestre</i>	<i>Bromus raceomosus</i>	<i>Galium verum</i>
<i>Trifolium panonicum</i>	<i>Agrostis vulgaris</i>	<i>Leucanthemum vulgare</i>
<i>Trifolium montanum</i>	<i>Dactylis glomerata</i>	<i>Moencia mantica</i>
	<i>Festuca rubra</i>	<i>Potentilla recta</i>
	<i>Festuca ovina</i>	<i>Ranunculus sp.</i>
	<i>Phleum pratense</i>	<i>Rumex acetosa</i>
		<i>Stellaria graminea</i>
		<i>Thymus serpyllum</i>
		<i>Leontodon autumnalis</i>
		<i>Silene vulgaris</i>
		<i>Stachus officinalis</i>
		<i>Plantago lanceolata</i>
		<i>Campanula patula</i>
Total,%	Total,%	Total, %
9.6	48.4	42.0

gravel, sand and clay, which means that, observed through structure of vegetation surfaces, meadows and pastures are dominating, providing ideal conditions for development of livestock production, and milk production as the most important part of it. The population of Sjenica sheep is dominant; milk yield ranges from 40-45 kg in lactation, with approx. 6-8% of milk fat (Petrovic, 2003; Bogdanovic et al., 2004).

Sheep rearing during summer and winter is different. In the summer period, sheep graze on meadows and pastures. The structure of plant associations present in this area has significant effect on specific quality of Sjenica cheese. In Table 1 the floristic composition of pastures on locality Vrujci, on Sjenica-Pester plateau, altitude of 1158

m, is presented.

On this location, the share of plants belonging to the family *Poaceae* – grasses was 48.40%, of leguminous plants 9.60% and other species 42%. In case of grasses, the highest share was determined for grasses of good and medium quality, from the aspect of animal nutrition.

Outside the vegetation period (November-May), nutrition is based on hay from sown meadows and concentrate feeds (400-600 g daily) prepared by the breeders who grind cereals/grain (barley, oats, wheat) produced on their own field crop surfaces.

Production of Sjenica cheese takes place in village households/farms and on mountains in summer cottages (katun, bacija), which is typical

Table 2
Chemical composition of Sjenica cheese

Traits	Min	Max	Mean (n=12)	SD
DM, %	42.54	50.64	46.64	3.32
Moisture, %	49.36	57.46	53.36	2.14
MFFB, %	67.62	76.61	73.32	1.74
Total nitrogen, %	2.05	2.67	2.33	0.06
Proteins, %	13.11	17.05	14.85	0.54
Ripeness coefficient, %	12.05	40.93	21.42	4.15
Fat, %	24.50	29.50	27.22	1.26
FinDM, %	53.32	62.58	58.42	2.90
NaCl, %	1.77	5.20	2.86	1.73
pH	3.71	4.67	4.28	0.54
Acidity (OSH)	57.54	97.73	82.71	1.16

DM - dry matter; MFFB - water in fat free cheese matter ; FinDM - fat in dry matter

in craft dairy processing. Autochthonous Sjenica cheese is made from sheep milk. Milk is filtered/strained, it is curdled either fresh without reheating, or evening milk is left through the night, cream is taken from the surface and heated. Temperature of curdling is from 25 to 34°C, average 30°C. Amount of rennet needed is 4-7 ml per litre of milk. Duration of curdling is 1 to 2 h. Afterwards, self-pressing and pressing takes place in cheese strainers (so called **grudnjace**), where curdles are formed. Curdle is placed in strainers, and left on special table and self-pressing lasts 1.5 - 5 h. Pressing load is 0.5 - 2 kg/kg cheese mass and pressing lasts 2 to 4 h. The other way includes self-pressing, where curdle is placed into strainer, and hung above the table, self-pressing lasts from 0.5 - 1 h, in order to improve the outflow of whey. Subsequently curdle is placed on the table/desk, formed, load is placed and pressed for the period of 1.5 - 3 hours. Curdle is cut into slices of size 15 x 15 x 5 cm and 10 x 10 x 3 cm. Salting is done using dry sea salt when cheese is piled into containers. Cheese is pressed by load after every piled batch or when the container is filled. Ripening takes place in salty brine. Considering that sheep remain in

summer cottages – bacija from May to November, process of ripening of Sjenica cheese lasts 5 to 7 months. Low pH and long ripening process hinder/prevent growth of microorganisms, which contributed to health safety of cheese. Cheese is stored in brine for longer period of time, regularly maintained and cleaned at the beginning every 3 to 4 days, and later in the period from 7 to 10 days (Jovanovic et al., 2004).

Chemical composition of Sjenica cheese

In Table 2 the chemical composition of Sjenica cheese is presented.

Data presented in Table 2 shows that Sjenica cheese has high water content (53.36%). This is consequence of manufacturing method, primarily: coagulation, curdle treatment and filtering/straining and salting methods (Macej et al., 2004). Content of water determined in autochthonous Sjenica cheese was similar to values in literature: in Travnik cheese 52.12% (Dozet et al., 2004), 48.13% and 49.20% (Dozet et al., 2004), Plevle cheese 46.38% (Dozet et al., 2004), Zlatar cheese 47-48% (Puda et al., 1994), Sjenica cheese 49.31-57.43% (Macej et al., 2004), as well as Polimle-

Table 3
Share of plant species on pastures of Stara planina (Tomic et al., 2003)

Location (a.s.l.)	Fabaceae,%	Poaceae, %	Other species, %
Rsovci,700 a.s.l.	<i>Trifolium pratense</i> <i>Trifolium repens</i> <i>Lotus corniculatus</i> <i>Lathurus sativus</i> <i>Vicia sp.</i> 39.36	<i>Festuca rubra</i> <i>Festuca ovina</i> <i>Lolium italicum</i> <i>Poa violacea</i> 45.81	14.83
Vrelo, 750 a.s.l.	<i>In traces</i>	<i>Anthoxatum odoratum</i> <i>Fesuca arundinacea</i> <i>Festuca ovina</i> <i>Lolium italicum</i> <i>Agrostis capillaris</i> 78.80	21.20
Brlog,800 a.s.l.	<i>Trifolium pratense</i> <i>Trifolium repens</i> <i>Lathurus sp.</i> <i>Vicia sp.</i> 42.40	<i>Nardus stricte</i> <i>Festuca arundinacea</i> 44.00	13.60
Dojkinci,900 a.s.l.	<i>Trifolium repens</i> <i>Trifolium pratense</i> <i>Trifolium campestre</i> 15.60	<i>Festuca ovina</i> <i>Nardus strictae</i> <i>Agrostis capillaris</i> 47.80	36.66
Dojkinci, 1200 a.s.l.	<i>Trifolium alpestre</i> <i>Trifolium montanum</i> <i>Genista ovata</i> <i>Vicia sp.</i> 8.85	<i>Nardus stricte</i> <i>Briza media</i> <i>Poa violacea</i> 82.31	8.84

Vasojevic cheese 47.47% (Konatar, 2000). Water in fat free cheese matter (MFFB) ranged from 67.62-76.61%, in average it was 73.32%, making it one of the groups of soft cheeses. This parameter is regulator of ripening process and proteolyses changes in cheese. Cheeses with high content of water in fat free cheese matter (MFFB) have faster degradation of proteins (Lawrence et al., 1993; Macej et al., 2004). High average value of

ripeness coefficient of 21.42% confirms intensive proteolyses ripening processes. Content of milk fat in dry matter (FDM) was 58.42%, making it full fat cheese (Codex Alimentarius Commission, 2000). Similar FDM values were determined in Zlatar cheese 55.0% (Puda et al., 1994), Plevle cheese 55.04% (Dozet et al., 1987), Travnik cheese 52.54% (Dozet et al., 1983). Average pH value of 4.28, which is in accordance with results obtained

Table 4
Physical-chemical characteristics of Pirot kachkaval

Trait	Min	Max	Mean (n=12)	SD
DM, %	58.47	67.63	63.35	2.57
Moisture, %	32.37	41.53	36.95	2.72
MFFB, %	47.41	56.12	51.49	2.53
Fat, %	26.00	32.50	29.66	0.84
FinDM, %	44.47	48.34	46.69	0.49
pH	5.30	5.47	5.42	0.05
Acidity (OSH)	32.00	48.00	42.14	2.28

DM - dry matter; MFFB - water in fat free cheese matter ; FinDM - fat in dry matter

by Lawrence et al. (1993), is typical of cheeses with sour curdle, low calcium content and have brittle consistency. Analyzed cheese samples had adequate sensory characteristics: slice of regular shape, no deformities and damages, typical white colour. Slice is typical, medium firmness, and with moderate number of cavities. Smell/odour is typically of sheep milk, and taste/aroma very pleasant, milky-sour, with slightly more explicit level of salinity in some samples. Since Sjenica cheese has this distinguishing fullness of aroma, taste and smell, it is in great demand outside the production region.

Conditions and characteristics of traditional production of Pirot kachkaval

The Stara Planina Mountain comprises west branches of the Balkan Mountain system, spreading from the Black Sea to Vrska cuka, in total length of 530 km. In our country it spreads from Zajecar to Dimitrovgrad, which is the Far East part of Serbia. The climatologic picture of Stara Planina Mountain is very complex and, depending on the altitude, it represents transition between the moderate continental climate and mountain climate. Diversity of geographical and ecological factors of Stara Planina Mountain has influenced the specificity of its plant and animal world (Petrovic,

1997). In Table 3 the shares of plant species present on pastures found on different localities of Stara Planina Mountain are presented. Leguminous plants in the floristic structure/composition of the pastures represent very important group of plants in regard to livestock nutrition and increase of milk production. The following useful leguminous plants were most present on studied areas: *Trifolium pratense*, *Trifolium repens*, *Trifolium campetris*, *Trifolium montanum*, *Lotus corniculatus*, *Vicia cracca* and others, and their share ranged from 0-42.40%. Share of grasses ranged from 44.00-82.31%, and other species which were present in range from 8.84-36.66%.

In addition to the climate, soil, water, botanical composition of meadows and pastures, sheep and cow population producing milk used as raw material in production of cheeses, and animal rearing conditions, also has considerable influence on the specificity of the autochthonous product (cheese, kachkaval) (Stimac et al., 2003).

In regard to sheep breed structure, Pirot population is dominant in this region. Daily milk yield is ranges from 0.3 to 0.5kg per animal, i.e. 60-90 kg in lactation (Petrovic, 2003). In cattle production, Simmental breed and crosses of Simmental breed type are predominant. Production of milk in the lactation is approx. 3000 kg with 3.8-4.2% milk fat. Basis of sheep and cattle nutrition during summer period is pasture/grazing or feeding cut meadow grass, and in winter period – meadow hay end grains (Dimova et al., 2009).

Mastery of cheese making in this area dates back to the time of nomadic herdsmen, so called «Crnovunci» who lived on pastures of Stara Planina Mountain, from the end of 19th century until the third decade of the 20th century. Traditional production of Pirot kachkaval is a result of long-term development of production technology through generations. It is produced using mixture of sheep and cow milk (ratio 1:2).

Technological procedure for manufacturing of Pirot kachkaval is defined in following stages: cur-

dling, curdle processing, curdle ripening, steaming of curdle and ripening of hard cheese.

Milk is treated at the temperature of 30-31°C. Coagulation of milk is done using powder rennet, and duration of coagulation is 60-70 min. Processing of curdle consists of cutting and mixing of curdle in order to achieve forming of grain and it is done using special wooden tool, so called **krstac**. Attrition of curdle last 10 min, subsequently the process of grain formation is stopped for 10 min in order for grains to settle and squeeze as much whey possible. By separating the whey and adding warm water at the temperature of 70°C from the pot/caldron where curdle was steamed, the drying of grain begins. Drying of grain takes place at the temperature of 37°C and it lasts 15 min. This procedure is used in traditional production in order to be able to utilize the fat and proteins which are brought to the water after steaming of curdle.

Ripening of curdle takes place in environment condition, at the temperature of 19-21°C, and it last approximately 13 h. Ability of curdle, i.e. ripened curdle for steaming is checked by steaming and stretching of cheese dough. Steaming of cut curdles - pH 4.9 is done in water at the temperature of 80°C. The dough is processed until uniform mass is obtained. Steamed mass is formed into ball and placed in moulds. Ripening of kachkaval takes place at the temperature of 15-18°C. Ripened hard cheese is packaged into vacuum bags and labelled as Pirot kachkaval.

The quality of hard cheese determined by its physical-chemical parameters is presented in Table 4.

By comparing our data with the results obtained by Mijacevic et al. (2005), slight variations in studied parameters are obvious. Namely, dry matter content was 64.08%, content of fat 30.30%, content of fat in dry matter 47.32% and pH 5.44.

After completing the ripening process, Pirot kachkaval acquires the shape of a flattened cylinder, weight of 5 kg. The crust is of light yellow colour, the dough is monolithic, partially puffy and elastic. It is of pleasant taste/aroma, tangy

and slightly tart.

Pirot kachkaval obtained in the traditional way is in compliance with the requirements of the standard (JUS E.C2.010).

European Community, in the Regulation (EEC) No.2081/92, has defined the concepts of »Protected Denomination of Origins« (PDOS) and »Protected geographical Indications« (PGIs), which refer to products whose quality derives from the uniqueness of the geographical area from which they originate, including human and other natural factors, and whose production and processing takes place within defined, unique geographical areas (Mijacevic et al., 2005).

Pirot hard cheese fulfils these requirements since dairy livestock is naturally grazed on the existing pastures, raw milk is used in the production, the characteristics of produced cheeses are under the influence of micro-flora of the milk serving as starter culture, and cheese is produced according to traditional technology (Mijacevic et al., 2005).

Conclusion

From the aspect of production of autochthonous dairy products, the most important locations in the hilly-mountainous region of Serbia are Sjenica-Pester plateau and Stara Planina Mountain.

Autochthonous Sjenica cheese is produced from fresh sheep milk;

Based on the chemical composition it can be concluded that this cheese has high water content (53.46%) and high content of fat in dry matter (58.66%), which is why it is classified as full-fat cheeses. High acidity of the cheese (84.07°SH) and pH 4.38 are typical for white cheeses in brine which is the group of cheeses to which Sjenica cheese belongs.

Pirot kachkaval is produced from raw combined sheep and cow milk in 1: 2 ratios. Kachkaval is manufactured manually according to traditional technology and it has specific maturation/ripening in natural conditions using autochthonous strain of lactic acid bacteria.

Dry matter, in addition to all other parameters of the quality of hard cheese is in compliance with the standard JUS E.C2.010 from 1996 and in accordance with “Regulation on the Quality and Other Requirements for Milk and Dairy Products”.

Cheeses had good sensory characteristics (taste, aroma/flavour, colour and consistency) appropriate to the type of milk of which are made.

In regard to protected geographical origin/indication, in addition to the requirement that the cheese is produced on certain area and using characteristic/ typical technological process, breed of dairy livestock as well as specific conditions of nutrition are also important in forming of the quality of the product.

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