

## QUALITY OF MILK AND WHEY OBTAINED DURING THE PRODUCTION OF SJENICA CHEESE AND A TYPE OF SJENICA CHEESE

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### Abstract

Sjenica cheese is one of the most famous types of cheese made in the Republic of Serbia, from the group of white cheese in brine. It is produced by indigenous technology on individual households on the Sjenica- Pester plateau. Sjenica cheese is made from fresh, whole sheep milk and a type of Sjenica cheese is made from whole cow milk. Procedure of making cheese is done immediately after milking without any thermal treatment. The quality and overall value of cheese depend on the chemical composition and quality of milk, and the chemical composition of whey depends on the degree of the utilization of milk components, and chemical composition of whey is an indicator of the correctness of keeping the technological process of making cheese. Because of these reasons it is necessary to determine chemical composition. The dry matter content in sheep milk had an average value of 20.45 % and 12.31 % in cow milk, milk fat 9.25 % in sheep milk and 3.68 % in cow milk, protein 5.96 % in sheep milk and 3.06% in cow milk. The chemical composition of whey was good which indicates good technological process of making cheese and a good utilization of milk components, and small losses through whey. Sheep whey had the following average chemical composition: dry matter 7.02 %, milk fat 0.60 %, protein 1.42%, total nitrogen 0.23%. The average chemical composition of cow whey had the following values : dry matter 5.62 %, milk fat 0.22%, protein 0.80 %, total nitrogen 0.11 %.

**Key words:** *Sjenica cheese, milk, whey.*

### Introduction

Chemical composition and quality of milk depend on the type of animal and animal breed. Differences exist in the same race, depending on the each individual animal. Sheep milk is about 50% richer with dry matter than cow milk. Because of the higher content of dry matter, especially because of the wealth of fats and proteins, sheep milk is very suitable for the production of cheese because it provides nearly twice utilization rate than cow milk. In to these factors, on chemical composition and quality of milk, affects the period of lactation addition, a physiological state of the mammary gland and nutrition. (Djordjevic, 1987). The quality and value of the cheese depends primarily on the quality of milk. The quality of milk, which is processed into cheese, depends on its chemical composition, physical, technological and microbiological properties. Technological properties of milk depend on the chemical composition, of the health status of the mammary gland and primary processing of milk. ( Dozet et al., 1979).

The quality of milk depends of the content of dry matter which has the most significant importance, then dry matter without fat, percentage of fat and proteins. Of all the components of milk, in the process of production, the greatest significance belongs to the casein. The technological process of cheese production is based on the specific properties of casein, in which the most important are the ability of coagulation and gel formation of milk, the ability of forming gel to syneresis, and propensity to proteolysis under the influence of proteolytic enzymes which are present in the cheese. (Pudja, 2009).

In the course of coagulation, milk fat fits in formed gel and thus is retained in the cheese. The primary function of milk fat is reflected in its contribution to the sensory properties of the cheese. Therefore cheese with high fat content is characterized by a full flavor and aroma. In the production of cheese, the small part of lactose retained in the cheese while most of it goes with the whey. Thanks to the presence of lactose in milk, fermentation is carried out. Mineral composition of cheese is closely related to the course of fermentation of lactose. By a control of fermentation course, we regulate mineral composition of cheese. (Pudja, 2009).

### Materials and methods

During 2008-2009, the researches which are included in this paper were carried out over a wide area of Sjenica-Pester plateau, where on the typical production sites were selected experimental households that produce cheese by indigenous technology in a traditional way. The experiments were conducted in 12 households. In 6 households cheese was produced from whole sheep milk, and it is original Sjenica cheese, and in 6 households cheese was made from whole cow milk, known as the type of Sjenica cheese. Because the quality and overall value of cheese depend on the quality of milk, the chemical composition and quality of milk were determined before cheese production. After making cheese, samples of whey were taken from cow and sheep milk, in which the analysis showed chemical composition and quality. Analyses of milk and whey were made in the chemical laboratory of the Special Veterinary Institute of Kraljevo, and have included :

- percentage of dry matter by method of drying at 102 0C
- percent of fat by acidobutirometrical method
- percentage of total nitrogen by Kjeldahl method and
- percentage of total proteins

Analyses of milk and whey were performed by standard methods (Pejic and Djordjevic., 1963).

### Results and Discussion

In the production of cheese quality and technological properties of milk, the most influence have the content of dry matter, fat, proteins and fat ratio - casein. Table 1. gives the chemical composition of sheep milk from the experiment.

Table 1. Average of chemical composition of sheep milk

Indicators per %	Calculated indicators				
	min	max	$\bar{X}_{n=6}$	Sd	Cv
Milk fat	8.40	10.60	9.25	0.86	9.29
Solids	19.69	21.51	20.45	0.78	3.81
Proteins	5.88	6.04	5.96	0.07	1.17
Nitrogen	0.91	0.94	0.92	0.01	1.08
Casein	5.11	5.25	5.18	0.06	1.19

Based on the results of the chemical composition of sheep milk (Table 1.), it can be concluded that it was of very good quality, typical for the breed. This especially applies to the high content of dry matter, fat and proteins. Because of the higher content of dry matter and especially because of the richness of fats and proteins, sheep milk is very suitable for the production of cheese, because it provides almost twice utilization rate than cow milk. Sheep milk is original and irreplaceable raw material in the production of cheese. The richness of the chemical composition of sheep milk, production provides original, high-quality cheese of high biological value. (Miočinovic, 1994) points out that the high content of individual components of sheep milk, contributes to better quality and higher utilization rate in the

production of cheese from the milk. (Adzic et.al, 1984) have identified the following chemical composition of sheep milk, which is used in production of Njegusi cheese : milk fat 6.80 % , dry matter 17.52 % , dry matter without fat 10.72 % . During the survey of sheep milk for production of Pljevlja cheese, (Dozet et.al, 1996) determined its chemical composition: dry matter 19.20 % , milk fat 7.60 % , total protein 5.75 % and casein 3.90 % .During the production of Sjenica cheese in industrial conditions, (Savic, 2014), used sheep milk of following chemical composition: dry matter 18.14%, milk fat 6.80%, protein 5.97%, casein 5.20%. Describing indigenous technology of Polimsko-Vasojevic cheese, (Konatar, 2006) determined chemical composition of sheep milk: dry matter 18.14%, milk fat 6.90%, protein 6.05%. Results from the experiment, are consistent with the data quoted by these authors. Table 2.gives the average chemical composition of cow milk, in the production of the type of Sjenica cheese.

Table 2.Average of chemical composition of cow milk

Indicators per %	Calculated indicators				
	min	max	$\bar{X}_{n=6}$	Sd	Cv
Milk fat	3.20	4.00	3.68	0.28	7.87
Solids	11.70	12.66	12.31	0.33	2.69
Proteins	2.88	3.26	3.06	0.07	2.31
Nitrogen	0.44	0.50	0.47	0.02	4.25
Casein	2.50	2.83	2.66	0.05	2.12

Based on the results of the chemical composition of cow milk (Table 2.) we can see that cow milk was of good quality and of characteristic chemical composition typical for the breed. It is important to emphasize that the content of the fat and proteins, and especially of casein was good, which affected on the quality of finished product. The ratio of casein and fat was narrow, so milk fat was well blended by casein, resulting by minimal losses of milk fat through the whey. The ratio of protein and fat is an important indicator for defining the required fat content in dry matter of cheese. For the cheese which is produced in a traditional way, ratio between casein and milk fat is important, as the casein represents the only protein which is involved in the construction of the proteins net of the cheese, and serum proteins mostly depart with the whey. Examining chemical composition of cow milk intended for manufacture of Polimsko-Vasojevic cheese, (Dozet et.al,1996) determined following chemical composition: dry matter 13.92%, milk fat 4.40%, total protein 4.18% and casein 3.57%. Macej- (1989), gives the following chemical composition of cow milk intended for making white soft cheese: milk fat 3.72%, dry matter 12.23%, total protein 3.02%, dry matter without fat 8.53%. It can be seen that the results of experiments are in the agreement with it and there is no any significant deviation.

Table 3. Average of chemical composition of sheep whey

Indicators per %	Calculated indicators				
	Min	Max	Average	Sd	Cv
Milk fat	0.49	0.80	0.60	0.12	18.82
Solids	6.80	7.19	7.02	0.12	1.56
Proteins	1.32	1.51	1.42	0.06	4.15
Nitrogen	0.20	0.25	0.23	0.007	4.08

Table 4. Average of chemical composition of cow whey

Indicators per %	Calculated indicators				
	Min	Max	Average	Sd	Cv
Milk fat	0.16	0.20	0.21	0.05	14.36
Solids	5.46	6.00	5.62	0.17	3.38
Proteins	0.76	0.83	0.80	0.03	3.23
Nitrogen	0.10	0.12	0.11	0.05	3.75

On the basis of data on the chemical composition of whey, it can be seen that the percentage of milk fat in cow and sheep whey was low, suggesting that the technological process of making cheese was properly guided.

The whey from cow milk in average contained 0.21% of milk fat, and sheep whey contained 0.60% of milk fat. Analysis shows that these differences were statistically significant. Properly guided technological process of making cheese, allowed a good utilization of milk fat and total milk nitrogen compounds, which is directly reflected in a better utilization of milk dry matter. The dry matter content in cow whey was 5.62%, and in sheep whey it was 7.02%. Analysis shows statistically high significant difference.

### Conclusion

Based on the above it can be concluded that:

-The milk quality in production of Sjenica cheese and the type of Sjenica cheese was very good. On milk quality, among other things, also contributes the feeding of dairy cattle on pastures of high grass quality, located on an altitude of over 1,000m.

-because of the richness of chemical composition, sheep milk is original and irreplaceable raw material in the production of Sjenica cheese

-traditional technology of making Sjenica cheese is characterized by variability and often uneven quality of cheese which can be considered as a lack, and can be served as a recommendation for modern and standard technology for production of Sjenica cheese

-with standard technology and high quality, Sjenica cheese is an important product not only for the local market but also for the wider market, and it is important for the recognition of the area

-Sjenica cheese is famous and recognizable product, and with the protection of the name and geographical origin, it will become a initiator and support for economic development of Sjenica-Pester plateau.

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