

IMPACT OF CROSSING OF SVRLJIG PRAMENKA WITH EAST FRIESIAN SHEEP ON CHANGE IN MILK PROTEIN CONTENT**

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**Original scientific paper

Abstract: This research paper presents the results obtained based on a study on the impact of crossing the Svrljig pramenika and East Friesian sheep breed on the milk protein content and yield in the F1 generation of crossbreeds in the course of lactation.

In all the three sheep breeds, while the difference between the first and last lactation months was of exceptionally high significance.

The average protein content in the milk yielded by the East Friesian sheep and crossbreeds is very similar and amounts to 5.32% and 5.37%, while in the Svrljig Pramenka it was 5.53%. Based on the statistical significance appraisal of the differences in mean values of protein content in each stated breeds for the whole lactation period a highly significant difference between the Svrljig Pramenka and East Friesian sheep ($p < 0.01$) can be observed, as well as a significant difference between the Svrljig Pramenka and crossbreeds ($p < 0.05$), and an insignificant difference between the East Friesian breed and crossbreeds ($p > 0.05$).

The crossing of the stated breeds had an impact on the increase in the total yield of milk protein in the halfbreeds (5948.72g), which is an increase of 1755.36g compared with that in the Svrljig Pramenka, and a decrease of only 237.36g in relation to that in the East Friesian sheep breed.

Key words: ewe milk, lactation, protein content, protein yield

Introduction

The production of ewe milk compared with that of cow's milk in the world and our country accounts for only 3-5%. The Mediterranean countries

particularly excel in the production of ewe milk covering about 47% of the total word production. In Serbia the share of sheep breeding is considerably larger in hilly regions (60-80% of the total sheep numbers in the country). The dominant sheep breed is the Pramenka (over 80%), which is characterised by low milk production per head, high resistance easily adapting to the natural habitat.

Contrary to the Svrljig Pramenka, representing one of the strains of the Pramenka breed, the East Friesian sheep is a typical dairy sheep representative, adapting less easily to the conditions of new environment. This breed is used for crossbreeding in order to alter genetic features and improve production properties of sheep. The combination resulting from the crossbreeding of the Svrljig Pramenka and East Friesian sheep is encompassed by our research.

Ewe milk presents a raw material of high biological value, whose chemical composition, especially the quantity of dry matter without fat and proteins is of great technological and economical importance for the dairy industry. Besides, the quantity of proteins in ewe milk contributes to its high nutritive and biological value.

The paper objective was to determine whether and to what extent the crossing of the stated sheep breeds had an impact on the milk protein content and yield throughout lactation.

Materials and methods

There were the ewe milk proteins (329 samples) studied in the Svrljig Pramenka (SP), East Friesian (EF) breeds and F1 generation of crossbreeds (HB) obtained by crossing of these two breeds. The milk sampling was carried out at one sheep farm in the hilly and mountainous regions of Eastern Serbia. All the three breeds were kept under the same management, housing and feeding conditions.

Milk samples were taken once a month throughout the course of lactation period and were composite, consisting of the milk collected at morning and evening milking.

The milk yield was controlled immediately upon milking. The daily milk yields were calculated by adding the stated quantities of milk obtained at morning and evening milking.

The protein quantity was determined estimating the nitrogen content by the Kjeldahl method.

The protein yield was calculated based on the following formula: protein

quantity x milk quantity.

The obtained results were analysed statistically using the "Microstat" statistical software package programme by Ecosoft Inc. 1985 version.

Results and Discussion

The changes of ewe milk protein content in the course of the lactation period are shown in the Table 1.

Table 1. Statistical indicators of protein content changes in milk throughout lactation

Lactation Months	X	σ	cv %
Svrljig Pramenka Breed			n=109
I	5.1158±0.0666	0.3265	6.3828
II	5.0972±0.0943	0.3128	6.1371
III	5.3476±0.1442	0.5200	9.7241
IV	5.7509±0.1013	0.4752	8.2637
V	5.8000±0.1025	0.5614	9.6808
VI	6.0477±0.0693	0.2081	3.4414
East Friesian breed			n=99
I	4.9637±0.1913	0.5412	10.9038
II	4.5340±0.0802	0.2536	5.5953
III	4.8929±0.0584	0.2410	4.9261
IV	5.2165±0.0842	0.4041	7.7476
V	5.7438±0.1016	0.4311	7.5061
VI	5.8804±0.1177	0.5648	9.6048
Crossbreeds*			121
I	4.7475±0.0683	0.2733	5.7569
II	4.8837±0.1477	0.5908	12.0976
III	5.1480±0.0680	0.2151	4.1790
IV	5.4792±0.0686	0.4285	6.8630
V	5.5875±0.1104	0.4940	8.8422
VI	5.9625±0.0776	0.3471	5.8214

*Crossbreeds obtained by crossing of the Svrljig Pramenka and the East Friesian sheep

It can be seen from the Table that the protein quantity in the milk at the commencement of the lactation period amounted to 5.12% in the Svrljig

Table 2. Statistical significance appraisal of differences in mean values of protein content throughout lactation period

Lactation Months	- I		- II		- III		- IV		- V	
	difference	signif.	difference	signif.	difference	signif.	difference	signif.	difference	signif.
Svrljig Pramenka Breed n=109										
II -	0.0186	NS ¹⁾	-	-	-	-	-	-	-	-
III -	0.2319	NS	0.2504	NS	-	-	-	-	-	-
IV -	0.6351	***	0.6536	***	0.4032	* ²⁾	-	-	-	-
V -	0.6842	***	0.7027	***	0.4523	** ³⁾	0.0491	NS	-	-
VI -	0.9319	***	0.9505	***	0.7001	*** ⁴⁾	0.7969	*	0.2478	NS
East Friesian sheep n=99										
II -	0.4298	-	-	-	-	-	-	-	-	-
III -	0.0708	NS	0.3589	***	-	-	-	-	-	-
IV -	0.2528	NS	0.6825	***	0.3236	**	-	-	-	-
V -	0.7801	***	1.2099	***	0.8509	***	0.5274	***	-	-
VI -	0.9167	***	1.3464	***	0.9875	***	0.6639	***	0.1365	NS
Crossbreeds n=121										
II -	0.1363	NS	-	-	-	-	-	-	-	-
III -	0.4005	***	0.2643	NS	-	-	-	-	-	-
IV -	0.7317	***	0.5955	***	0.3312	*	-	-	-	-
V -	0.8400	***	0.7038	***	0.4395	**	0.1083	NS	-	-
VI -	1.2150	***	1.0788	***	0.8145	***	0.4833	***	0.3750	**

¹⁾p>0,05 (non-significant)

²⁾p<0,05 (significant)

³⁾p<0,01 (highly significant)

⁴⁾p< 0,001 (very highly significant)

Pramenka, 4.96% in the East Friesian breed and 4.75% in the crossbreeds, which indicates that the Svrlijig Pramenka's milk contained 3.22, i.e. 7.79% more protein than the milk of the East Friesian sheep and crossbreeds.

Throughout lactation an increase in milk proteins is observed in all the three sheep breeds, and a mild decrease during the second month of lactation in the Svrlijig Pramenka and East Friesian sheep. In the Svrlijig Pramenka, there was the most conspicuous increase in proteins present between the third and fourth month (7.48%), and a sharp increase noticed between the fourth and fifth month in the East Friesian breed (9.96%), while an increase in protein quantity was more conspicuous at the end of lactation that is between the fourth and sixth month of lactation in the crossbreeds(6.62%).

The protein quantity at the end of lactation was substantially higher compared to its commencement. This increase amounted to 18.16% in the Svrlijig Pramenka, 18.55% in the East Friesian breed, and as much as 25.47% in the crossbreeds.

The Table 2 presents the statistical significance appraisal of protein quantity throughout specific lactation months for each of the sheep breeds, respectively. The protein quantity in all the three breeds being compared, the difference between the first and last months was highly conspicuous, that is, of exceptionally high significance.

The mean protein values throughout the entire lactation are presented in the whole in the Table 3.

Table 3. Statistical indicators of average protein content for entire lactation period

Breed	n	X	$\bar{\sigma}$	cv %
Svrlijig Pramenka	109	5.5350±0.0530	0.5543	10.0151
East Friesian sheep	99	5.3217±0.0628	0.6253	11.7516
Crossbreeds	121	5.3741±0.0522	0.5743	10.6875

The data obtained indicate that the average protein quantity in the milk of the East Friesian breed is the lowest compared with the two remaining breeds (5.32%). In the milk of crossbreeds there was the average protein quantity of 5.37% found for the entire lactation, and that of 5.53% in the Svrlijig Pramenka, with the standard deviation and variation coefficient

somewhat lower than is the case with the East Friesian sheep.

By comparing the protein quantity in specific lactation months it can be observed that the milk yielded by the Svrlijig Pramenka and crossbreeds at the end of the third and beginning of the fourth month of lactation had approximately the same protein content obtained throughout the entire lactation. In the case of the East Friesian sheep, the average protein content for the entire lactation was identical to the protein quantity in the fourth month of lactation.

The statistical significance appraisal of protein quantity in milk among the breeds investigated in the course of the entire lactation is shown in the Table 4.

Table 4. Statistical significance appraisal of differences in mean values of protein content among breeds for entire lactation period

Breeds	- EF		- HB	
	difference	signif.	difference	signif.
SP -	0.2133	**	0.1609	*
EF -	-	-	0.0524	NS

EF – East Friesian

CB – crossbreeds

SP – Svrlijig Pramenka

It may be concluded from the results that there was a highly significant difference between the Svrlijig Pramenka and East Friesian breed ($p < 0.01$), a significant difference between the Svrlijig Pramenka and crossbreeds ($p < 0.05$) and an insignificant difference between the East Friesian breed and crossbreeds ($p > 0.05$).

The impact of crossbreeding on the protein yield in the course of the whole lactation is presented in Table 5.

The values obtained indicate that the average ewe protein content in the milk of the breeds studied is inversely proportional to the quantity of milk yielded throughout lactation, which also has an effect on the total milk protein yield. The average protein content in the milk of the East Friesian breed being lower (5.32%) compared to that of the Svrlijig Pramenka (5.53%), nevertheless there was an increase of 1992.72 g in the total milk protein yield obtained in the entire lactation. The crossing of the stated breeds had an impact on the increased total milk yield in the crossbreeds (5948.72g), which presents an increase of 1755.36g in relation to that in the

Svrlijig Pramenka, and a decrease of only 237.36 g compared with that in the East Friesian sheep breed.

Table 5. Milk protein yield throughout lactation

Breed	n	Average Protein Content (g/100g)	Average Daily Milk Quantity (g)	Daily Yield of Milk Protein (g)	Total Yield of Milk Protein (g)
		X	X	X	X
SP	109	5,5350	411,7889	22,79	4193,36
EF	121	5,3741	601,6528	32,33	5948,72
CB	99	5,3217	631,8181	33,62	6186,08

EF – East Friesian

CB – crossbreeds

SP – Svrlijig Pramenka

Research on the changes in ewe milk protein the throughout the lactation period was conducted by other authors as well, who established even much higher variations. *Sokolov and Kuts* (1983) state an increase in protein of 13.80% in the course of three-month period of lactation in the Precoce breed. In the Piva Lake sheep, *Adžić* (1981) determined an increase of 92.53% in the average quantity of protein in the course of lactation, and *Erokhin et al.* (1984) that of 91.42% in the Romanov and Finnish Landrace breeds.

Much lower protein values at the commencement of lactation, in comparison with our results, were obtained by *Buevich and Galatov* (1982) in the Southern Urals, Altai and Soviet Merino sheep (4.20; 4.40 and 3.80%). However, there was the protein quantity exceeding 6% found at the end of lactation.

Milk proteins in the stated breeds throughout the entire lactation was also studied by *Živanović* (1988).

The results obtained by our research on the average protein content in the investigated sheep breeds during lactation is slightly higher than those reported by *Živković*, 1988 (the East Friesian sheep 4.98, Svrlijig Pramenka 5.39% and crossbreeds 5.20%).

Dorđević and Carić (1971) found a higher protein content in the course of lactation in the Cigaja breed (6.02%) as well as *Dozet et al.* (1987) in ewe

milk of the Vlašić region (5.99%).

By the crossbreeding of the Svrljig Pramenka and East Friesian sheep, a higher protein content was attained in the crossbreeds compared with the East Friesian sheep. These results are in keeping with the data reported by other authors in the relevant literature concerning the sheep crossbreeding. *Kompan et al.* (1987) attained a higher quantity of proteins in the crossbreeds by crossbreeding the Bovška sheep with the East Friesian one.

In his research studies, *Fitscher* (1986) found that the content of most nitrogen components was higher in the milk yielded by the Merino sheep than that in the East Friesian one.

Miočinović (1994) emphasises that the quality and technological properties of milk are best estimated based on its chemical composition, particularly, based on the total dry matter content, fat and proteins. The fact that there is a considerably higher protein content found in ewe than in cow's milk, in its procession, has a significant impact on the increased cheese yield.

UTICAJ UKRŠTANJA SVRLJIŠKE PRAMENKE I ISTOČNO FRIZIJSKE OVCE NA PROMENE PROTEINA MLEKA

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Rezime

U ovom radu su prikazani rezultati uticaja ukrštanja između svrljiške pramenke i istočnofrizijske rase ovaca na sadržaj iprinos proteina mleka kod meleza F₁ generacije u toku laktacije.

Tokom laktacionog perioda se uočava povećanje proteina mleka kod sve tri rase ovaca, a razlika između prvih i zadnjih meseci laktacije bila je vrlo visoko signifikantna.

Prosečan sadržaj proteina u mleku istočnofrizijske rase i meleza je veoma sličan i iznosi 5,32 i 5,37%, a kod svrljiške pramenke je 5,53%. Ocenom statističke značajnosti razlika srednjih vrednosti sadržaja proteina po rasama za ceo laktacioni period zapaža se visoko signifikantna razlika ($p < 0,01$) između svrljiške pramenke i istočnofrizijske, signifikantna razlika između svrljiške pramenke i meleza ($p < 0,05$) i nesignifikantna razlika

između istočnofrizijske rase i meleza ($p > 0,05$).

Ukrštanje navedenih rasa je uticalo na povećanje ukupnog prinosa proteina mleka kod meleza (5948,72g) što je za 1755,36 g više nego kod svrljiške pramenke, a samo 237,36 g manje nego kod istočnofrizijske rase ovaca.

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