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Study of mastitis in Slovak dairy sheep

PAVOL MAKOVICKÝ[1]✉, MILAN MARGETÍN[2], PETER MAKOVICKÝ[3,4], MELINDA NAGY[1] and ANDREA PUSKÁS[1]

J. Selye University, Faculty of Education, Bratislavská cesta 3322, 94501 Komárno, Slovak Republic

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There is a large literature on mastitis, relative to dairy cattle, but much less information is available for dairy sheep. Most of the research has been carried out in Mediterranean countries, where the dairy sheep has a long tradition. The reports are inevitably different according to the different breeds, rearing system, environment and experimental designs. The annual incidence of clinical mastitis in small dairy ruminants is estimated to be less than 5%, whereas the prevalence of subclinical mastitis ranges between 5-30% or higher in some cases. In dairy sheep, good udder conformation is associated with a decreased risk of mastitis. Little is known on the incidence of intramammary infections in dairy ewes. Mastitis is inflammation of the udder that usually develops as a result of IMI. Intramammary infection is the invasion and multiplication of potentially pathogenic micro-organisms, usually bacteria, in the mammary gland. Mastitis is important from three perspectives, which are economic (mortality of ewes and lambs, reduced milk production, impaired growth rate of lambs and the costs associated with treating infected animals), hygiene (risk of bacterial infections) and legal aspects (regulations on raw milk standards).

The aim of the paper was to find out dependence between the number of somatic cells (NSC) and milk production, and between NSC and the milk composition of Tsigai (T) and Improved Valachian (IV) breeds ewes during lactation and milking periods.

Data were processed by restricted maximum likelihood (REML) methodology using a MIXED procedure from the SAS statistical package v.9.2, 2002–2008. NSC data were transformed using decimal logarithm (log10 NSC) before being used in regression analysis.

Table 1 shows the average NSC values, milk production and the milk composition of ewes milk calculated for the lactation and milking period in 2017 and 2018. These are cumulative data for ewes of breed T and IV. Data presented in Table 1 should be the basis for obtaining an overall picture on the dynamics of changes in the evaluated markers in the reporting period. Table 2 shows that between log10 NSC and ewes milk production, statistically significant negative phenotypic correlations were found in both T and IV breeds during both lactation and milking periods ($P<0.05$ to 0.001). Less dependence of milk production on NSC was found in both breeds during the milking period ($r = - 0.160$ and $- 0.230$, respectively).

It is evident from Tables 2 and 3 that an increased NSC of ewes is associated with a decrease in milk production. Phenotypic correlations between log10(NSC) and MP were negative but not statistically significant in 2017; in 2018, and for the cumulative data for years 2017 and 2018, the correlations were statistically highly significant ($P<0.001$), although these were only moderate ($r<0.5$) and weak ($r<0.3$) dependence, respectively. Tables 2 and 3 also show phenotypic correlation results between ewes milk and dry matter, fat, protein and the lactose content of milk. Log10(NSC) was highly significant statistically in relation to dry matter, protein, fat and lactose content ($P<0.001$), both in T and IV breeds and irrespective of the stage of lactation (lactation or milking period). However, it is clear from Table 3 that these dependencies may not always be statistically significant. On the other hand, the cumulative results for both monitored years indicate that during the lactation and milking period, the NSC is in direct dependence on dry matter content ($r = 0.536$ and 0.330, respectively), protein ($r = 0.431$ and 0.361, respectively) and fat ($r = 0.520$ and 0.293, respectively). The data in Tables 2 and 3 indicate that the binding between NSC and fat and protein content is likely to be stronger during lactation than in the milking period.

A significant relationship between NSC and lactose content is evident from Tables 2 and 3. In almost all cases of both T and IV breeds during both lactation and milking periods, a statistically highly significant indirect dependence ($P<0.001$) between NSC and lactose content in milk was observed. Correlation coefficients (r), except the milking period in 2017, were always higher than 0.3 and lower than 0.5.

Present address: [1]J. Selye University, Faculty of Education, Bratislavská cesta 3322, 94501 Komárno, Slovak Republic. [2]Slovak University of Agriculture in Nitra, Department of Animal Production, Faculty of Agrobiology and Food Resources, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic.[3]University of Ostrava, Faculty of Medicine, Department of Histology and Embryology, Syllabova 19, 70300 Ostrava-Vitkovice, Czech Republic. [4]Cancer Research Institute, Biomedical Research Centre of the Slovak Academy of Sciences, Dubravska cesta 9, 845 05 Bratiaslava, Slovak republic. ✉Corresponding author email: makovicky.pavol@gmail.com

Table 1. Average value of the number of somatic cells (× 10^3/ml), and the milk composition of ewes during the lactation and milking period

Markers	Year	Lactation period					Milking period (after weaning)					Sum
		Milk control measurements					Milk control measurements					
		1	2	3	4	5	1	2	3	4	5	
n	2017	48	48	45	43	-	40	40	39	36	30	369
NSC*		270	314	274	330	-	457	490	268	465	485	364
Log_{10} (NSC)		2.23	2.20	2.16	2.25	-	2.26	2.30	2.11	2.43	2.36	2.25
Daily milk production (ml)		1594	1896	1960	1449	-	606	542	520	334	277	1077
Dry matter (%)		18.7	17.6	17.8	18.0	-	17.6	17.7	18.2	18.6	18.5	18.1
Protein (%)		4.59	4.12	4.78	4.51	-	5.06	5.12	5.17	5.71	6.15	4.98
Fat (%)		8.52	7.75	7.07	7.66	-	6.81	6.79	7.43	7.46	6.91	7.41
Lactose (%)		4.66	4.80	5.07	4.96	-	4.87	4.87	4.69	4.52	4.51	4.78
Lactation day		9	23	36	51	-	78	106	135	162	190	-
n	2018	37	48	59	57	57	55	50	45	46	43	497
NSC*.		1897	400	585	755	1291	544	991	1837	1037	2139	1091
log_{10}(NSC)		2.92	2.51	2.58	2.71	2.94	2.35	2.45	2.79	2.76	2.91	2.68
Daily milk production (ml)		1690	1610	1672	1357	951	527	649	520	482	348	987
Dry matter (%)		21.8	20.1	19.4	19.7	20.0	19.3	19.3	19.4	20.0	19.6	19.8
Protein (%)		5.34	4.39	4.54	4.95	5.17	5.63	5.72	5.70	6.21	6.02	5.33
Fat (%).		10.75	9.80	8.91	8.86	9.21	8.05	7.79	7.94	8.44	8.36	8.78
Lactose (%)		4.79	4.97	5.05	4.96	4.78	4.67	4.93	4.89	4.42	4.28	4.79
Lactation day		6	17	30	44	64	73	101	128	157	185	-

* NSC, number of somatic cells.

Genetic studies of SCC in dairy sheep are more recent and less frequent than in dairy cattle. The genetic studies available are mainly limited to the Churra (Baro *et al*. 1994, El-Saied *et al*. 1998 and 1999) and Lacaune (i.e. Barillet *et al*. 1999, Rupp *et al*. 2001, Rupp and Boichard 2003) breeds and the estimates were usually based on the average SCS during the lactation. Results based on repeatability test day models for SCS, indicated heritability estimates ranging from 0.04 for the Churra breed (Baro *et al*. 1994) to 0.16 for the East Friesian breed (Hamann *et al*. 2004). Other studies reported higher heritability estimates for the average SCS during lactation, from 0.11 to 0.18 (Mavrogenis *et al*. 1999, Barillet *et al*. 2001, Rupp *et al.* 2001).

Our research results confirm the results obtained so far by foreign authors, which shows that the lactose content of sheep milk can be a good indicator of udder health, both during the lactation of lambs and during the milking period.

SUMMARY

A trial was conducted on lambing ewes of Tsigai and Improved Valachian breeds in the 1st to the 3rd lactation in 2017 and in the 1st to 4th lactation in 2018. The lambing ewes were housed and managed under the same conditions over the experimental period. Milk samples for determination of SCC (Fossomatic 90, Foss Electric Co., Denmark) and contents of solids (% S), proteins (% P), fat (% F) and lactose (% L) (Multispec infrared analyzer) were taken by ewe milking in S period after intravenous application of oxytocin (5 i.u./ewe) and as part of milk recording at morning hand milking in M period. Milk samples were taken in such a way to be representative ones of the ewe's whole milk yield. Daily milk production (MP) was also recorded in individual ewes on the day of milk sampling; in S period, it was calculated from a milk quantity produced within a 4 h interval and milked after

Table 2. Phenotypic correlations (r) between log10(NSC) and ewes milk production, and milk composition during lactation (1) and milking period (2) in Tsigai and Improved Valachian breeds

Dependent variable	Tsigai		Improved Valachian	
	1	2	1	2
Daily milk production (ml)	$- 0.309^{+++}$	-0.160^{+}	-0.258^{+++}	-0.230^{++}
Dry matter (%)	0.559^{+++}	0.271^{+++}	0.518^{+++}	0.389^{+++}
Proteins (%)	0.511^{+++}	0.342^{+++}	0.373^{+++}	0.379^{+++}
Fat (%).	0.524^{+++}	0.242^{+++}	0.515^{+++}	0.343^{+++}
Lactose (%)	-0.301^{+++}	-0.312^{+++}	-0.379^{+++}	-0.304^{+++}
n	210	224	232	200

$^{+}$P<0.05; $^{++}$ P<0.01; $^{+++}$ P<0.001.

Table 3. Phenotypic correlations (r) between log10(NSC) and ewes milk production and milk composition during lactation (1) and milking period (2)

Dependent variable	2017		2018		Sum	
	1	2	1	2	1	2
Daily milk production (ml)	-0.091	-0.126	-0.255^{+++}	-0.309^{+++}	-0.291^{+++}	-0.192^{+++}
Dry matter (%)	0.240^{++}	0.109	0.435^{+++}	0.278^{+++}	0.536^{+++}	0.330^{+++}
Proteins (%)	0.103	0.169	0.464	0.364	0.431	0.361
Fat (%).	0.301^{+++}	0.002	0.413^{+++}	0.276^{+++}	0.520^{+++}	0.293
Lactose (%)	-0.374^{+++}	-0.022	-0.479^{+++}	-0.458^{+++}	-0.347^{+++}	-0.314^{+++}
n	184	185	258	239	442	424

$^{+}$P <0.05; $^{++}$P<0.01; $^{+++}$P<0.001.

the second oxytocin application, in M period from the yield obtained at morning and evening milk measuring. Calculation of linear phenotype correlations (r) was used to evaluate the relation between SCC and MP, or the content of basic components. Transformed SCC data (log(10)SCC) were used for regression analysis. The results indicate potential differences in the evaluated relations when the years or lactation stages are compared (S or M period).

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