Relationships between morphological and functional udder traits and somatic cell count in milk of ewes

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Summary

On the basis of analysis of 20 parameters studied during the milking period in ewes of 8 genotypes we found positive phenotypic and residual correlations between teat position (r = 0.163; P<0.001 and/or 0.102; P<0.05) and teat size (r = 0.141; P<0.001 and/or 0.133; P<0.01) (1st to 3rd lactation, years 2002 – 2004) and by means of logarithm transformed SCC (LOGSCC or SCS). Ewes with more horizontal teat position and larger teats had higher LOGSCC. We found no significant residual correlations between the areas of both udder cisterns and LOGSCC. Residual correlations between parameters of milkability and LOGSCC varied from –0.173 to –0.175 (P<0.001). Ewes with quicker milk ejection (they produced more milk during 30 and 60 s) and higher amount of machine milk had lower LOGSCC. On the contrary, higher LOGSCC was in ewes with higher machine stripping. We found highly significant phenotypic and residual correlation between LOGSCC and proportion of machine stripping (r = 0.199 and/or 0.165; P<0.01).

Key words: *Ewe, linear description of udder, udder cisterns, milkability, somatic cells*

Introduction

Breeding programmes in milk sheep are more and more aimed at the so-called functional traits that influence their longevity. New selection criteria are being looked for to be used in milk sheep breeding for better milkability and good udder health condition (Sanna et al., 2002; Margetin et al., 2003). It is necessary to find the genetic and phenotypic relations among somatic cells (indicator of udder health), udder morphology and milk ejection (Rupp et al., 2003) for us to be able to define the global milk index in milk sheep that provides good health condition in udder and milkability in ewes. The objective of this work was to find the degree of

dependence between the somatic cell count on one hand and linear evaluation of udder, udder cistern size and milkability of ewes on the other by means of phenotypic and residual correlations.

Material and methods

During the years 2002 – 2004 we performed linear evaluation of udder in ewes (tab. 1) of 8 genotypes created on the basis of purebred Tsigai (T), Valachian (IV) sheep and sheep of Lacaune breed (LC) within a milking period. We used ultrasonographic method to detect udder cistern size, and we recorded selected traits that characterize milkability in ewes (tab. 1). We sampled milk form the same ewes and we assessed somatic cell count (SCC) by means of Bentley apparatus 500. Because of irregular SCC distribution we analyse in this work the decimal logarithm SCC (LOGSCC) as well as the somatic cell score trait – SCS (SCS = $\log_2$ (SCC/ 100000 + 3). To analyse primary data of all variables (n = 517 – 571) we used linear model with fixed effects and we took into consideration the effect genotype (8 levels), parity (3 levels), control year (3 levels), and milking period (2 levels). We calculated the residual correlations from estimates of residua detected on the basis of mentioned linear model of analysis of variance. We used the mathematical and statistical package of programmes SAS – ver. 8.2 (SAS/STAT, 1999-2001), GLM and CORR procedure, for calculations.

Results and discussion

Mean estimates of selected morphological and functional characteristics of udder and somatic cells in milk of ewes are given in tab. 1. Analysed traits of linear evaluation of udder were in 2 cases (position and size of teats) in statistically significant relation with LOGSCC and/or SCS irrespective of whether we started from phenotypic or residual correlations (tab. 2). Ewes with more horizontal teat position and larger teats had higher somatic cell count (r = 0.102 to 0.163; P<0.05 to P<0.001). Ewes with more horizontal teat position (linear evaluation 7,8,9) have greater problems with milk output, greater probability of subclinical mastitis inception. Therefore it is necessary to put greater attention to udders with more horizontal teat position at machine stripping. We found no statistically significant residual correlation coefficients (tab. 2) between the size of udder cisterns detected by ultrasonographic method and LOGSCC. In two cases we found significant phenotypic correlations between udder cistern size and LOGSCC (r = 0.149 and/or 0.174; P<0.001) that are presumably related to the effect of LC breed, having the largest cisterns as well as the highest SCC. Milk amount milked during 30 seconds, 60 seconds and machine stripping were in significant negative correlation with LOGSCC or SCS (P<0.001) in our observations. Ewes with worse milk ejection have higher somatic cell counts at machine milking without the help of milker and there is greater probability of subclinical mastitis occurrence. Remarkable is the detection of positive phenotypic and residual correlation between LOGSCC (r = 0.217 and/ or 0.175; P<0.001) and portion of machine stripping. Somatic cell counts

rose with rising portion of machine stripping. Subclinical mastitis connected with increased SCC is one of the factors influencing portion of machine stripping. Selection of sheep for lower portion of machine stripping could therefore manifest itself in better state of udder health.

Table 1. Least square means (LSM) of chosen morphological and functional characteristics of udder and somatic cell count in milk.

Trait	Number of obser.	LSM	Root MSE	Variation coefficient	Minimal value	Maximal value
Udder depth (points)*	564	4,84	1,194	24,70	1	9
Cistern height (points)	564	4,94	1,701	34,43	1	9
Teat position (points)	564	5,12	1,554	30,33	1	9
Teat size (points)	564	4,46	1,156	25,89	1	9
Udder cleft (points)	564	4,82	1,490	30,90	1	9
Udder attachment (points)	564	5,39	1,135	21,05	2	9
Udder shape (points)	564	5,22	1,351	25,90	2	9
Area of left udder cistern (method 1, mm^2)	552	1853,1	735,51	39,69	137	6598
Area of right udder cistern (method 1, mm^2)	552	1875,7	689,99	36,79	188	5552
Area of left udder cistern (method 2, mm^2)	554	2104,7	750,15	35,64	166	6731
Area of right udder cistern (method 2, mm^2)	554	2133,5	725,29	33,99	178	4832
Machine milk milked per 30 s (MM30s, ml)	517	217,5	82,68	38,01	0	560
Machine milk milked per 60 s (MM60s, ml)	517	284,3	114,54	40,29	0	780
Machine milk (MM, ml)	517	293,0	120,17	41,01	0	780
Machine stripping (MS, ml)	517	110,0	68,94	62,65	0	720
Total machine milk (TMM, ml)	517	403,0	129,65	32,17	30	1020
Portion MS/TMM (PMS, %)	517	28,4	15,04	52,94	0	100
Somatic cell count (SCC)x1000	571	421,6	1138,1	269,93	13	15328
Log$_{10}$ SCC	571	5,16	0,518	10,04	4,114	7,185
Somatic cell score (SCS)	571	3,54	1,721	48,64	0,057	10,260

*Median and modus for traits of linear evaluation = 5

Table 2. Phenotypic and residual correlations between LOGSCC (SCS) and linear evaluation traits, udder cistern size a milkability of ewes.

Trait	Udder depth	Cistern height	Teat position	Teat size	Udder cleft	Udder attachment
Phenotypic correlations	0,242+++	0,136++	**0,163+++**	**0,141+++**	0,003ns	-0,025ns
Residual correlations	0,069ns	0,050ns	**0,102+**	**0,133++**	0,038ns	-0,053ns

Trait	Area of left udder cistern	Area of right udder cistern	Area of left udder cistern	Area of right udder cistern
	Method 1 (ultrasonography from below)		Method 2 (ultrasonography from side)	
Phenotypic correlations	0,149+++	0,174+++	0,077ns	0,068ns
Residual correlations	0,005ns	0,009ns	-0,060ns	-0,066ns

Trait	MM30s	MM60s	Machine milk	Machine stripping	TMM	PMS
Phenotypic correlations	-0,071ns	-0,045ns	-0,046ns	0,204+++	0,048ns	**0,217+++**
Residual correlations	**-0,173+++**	**-0,175+++**	**-0,175+++**	0,100+	-0,110+	**0,175+++**

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