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EVALUATION OF DAILY MILK PRODUCTION IN TSIGAI EWES BY SOMATIC CELL COUNT

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ABSTRACT

The objective of our research was to study daily milk production which was affected by somatic cell count (SCC). The study was performed on a selected flock of purebred Tsigai ewes (326 animals). Regular milk yield recording was performed during the evening milking in around the middle of April, May and June. Milk samples were analyzed for basic milk composition (fat, protein and lactose) and somatic cells count. SCC were evaluated using decadic logarithm (logSCC).According to animals, the dairy ewes were divided into the four groups on the basis of individual SCC (G_1 = SCC <100 × 10^3 cells.mL^{-1}, G_2 = SCC between 100 – 300 × 10^3 cells.mL^{-1}, G_3 = SCC between 300 – 600 × 10^3 cells.mL^{-1}, G_4 = SCC >600 × 10^3 cells.mL^{-1} to study the frequency of distribution of animals in selected group of ewes throughout experimental period. The average daily milk production in selected flock of Tsigai was 421.02 mL. We reached the highest daily milk production in April 476.40 mL and the highest content of fat and protein in June, while milk production was the lowest. From this flock of purebred Tsigai 76% of eweswere below SCC 300 × 10^3 cells.mL^{-1}. This SCC indicated a good health status of experimental ewes, at which 61% sheep were at the first lactation. We found a tendency to lower milk production by a higher SCC. With the increasing SCC decreased lactose content from 4.78% (G1) to 4.32% (G4). Reduced lactose content refers to the occurrence of mastitis and there is a need for performing bacteriological examination in milk.

Keywords: sheep; milk yield; milk composition; SCC

INTRODUCTION

The small ruminants rearing have a rich history in Slovakia. Nevertheless, this sector has always been a marginal part of agricultural. Except the production function the sheep and goat rearing has a very big importance in non-productive meaning (environmental and rural development, **Margetín et al., 2013a**). Ewe's milk is mainly used for making cheese in Slovakia. **Bianchi et al. (2004)** presented in their work that SCC was associated with various udder health statutes, and lactational phases were evaluated to verify their role in milk quality with regards to its cheese-making properties. In particular, udder inflammation (indirectly diagnosed using SCC) and late lactation were associated with high plasmin activities in milk that, in turn, were responsible for marked proteolytic phenomena. Casein index (ratio of casein to crude protein) was reduced in ewes with infected udders compared to milk from healthy ones. The most evident consequence of protein degradation in milk from infected udders was a significant decrease in the frequency of samples reactive to rennet. Secondly, milk from infected glands was associated negatively with curd characteristics. Although the SCC is not considered as factor influencing the price of milk, it is also an important factor determining theyield and quality of the final product **(Oravcová et al., 2007; Margetín et al., 2013b)**. Selection for milk yield, milk components and health of an ewe's udder may have an impact on the further improvement of Slovakian breeds of local origin traditionally, i.e. Tsigai and Improved Valachian **(Margetín et al., 1995, Margetín, et al., 1996)**. In dairy cattle, detection of subclinical mastitis by milk somatic cell counts (SCC) is standard practice. In the past the suitable methodes for the detection of subclinical mastitis (NK test, California Mastitis Test – CMT, Whiteside Test – WST) were rarely used in milking of sheep, although their use is generally recommended **(Bergonieret al., 2003**; **Špániket al., 1996)**. In dairy ewe's instantaneous physiological and pathological thresholds of SCC ranging from (0.25 to 1.0) × 10^6 cells.ml^{-1}, have been available since the early1990s **(Ariznabarreta et al., 2002)**. In sheep and goats, mastitis episodes are the main reason for culling because of sanitary problems, which occur mainly during the first 2 – 3 months of lactation **(Bergonier et al., 2003; Leitner et al., 2008)**.

Berthelot et al. (2006) recommends that a decision rule proposes to consider an udder as healthy if every SCC are lower than 0.500 × 10^6 cells.mL^{-1} and infected if at least two individual SCC are higher than 1 or 1.2 million cells.mL^{-1}. **Arias et al. (2012)** found inmanchega sheep that milk yield was always higher for ewe with SCC ≤300 × 10^3 cells.ml^{-1} than for those with SCC > 300 × 10^3 cells.mL^{-1}. Subclinical mastitis should be always suspected as one of the primary causes in cases of decreased milk production in dairy flocks **(Fragkou et al., 2014).** In fact, coagulase-negative *staphylococci*, which are the most common aetiological agents of subclinical mastitis **(Contreras et al., 2007)**, are also frequent inhabitants of the skin of the udder. Most sheep mastitis occurs before the end of lactation (at the beginning of dry period) and also during the rearing lambs **(Albenzio et al., 2003**; **Bergonier et al., 2003**; **Contreras et al., 2007)**.

Although none of the definitions of udder halves infection status would reflect perfectly the Dynamics of infections observed (one-monthly sample throughout lactation), the third one (healthy, brief and durable infections) could represent an acceptable compromise describing the diversity observed under field conditions. Thus, many halves were culture-positive only during the suckling-milking period (mainly during the first week post-partum) and never later; a strict application of the first definition could lead to consider these halves infected. Likewise, the interpretation of the bacteriological results of samples collected at the end of lactation (close to drying-off) is difficult **(Fthenakis, 1994)**.

The objective of ourresearch was to study the effect of parity, season and udder health on daily milk yield, milk composition and somatic cell count of Tsigai ewes in the year 2014.

MATERIAL AND METHODOLOGY

The study was performed in the pedigree breeding of purebred Tsigai ewes (326 animals) in the year 2014. We have evaluated ewes at first and second lactation. The ewes were on pasture with addition 0.5 kg grain by milking. The lambing of the ewes mostly performed in February. The ewes were machine milked twice a day after weaning of their lambs at the beginning of April. Regular milk yield recording was performed during the evening milking in around the middle of April, May and June. Individual milk samples were obtained from whole milk collection as an average sample. Milk samples from each udder were transported to the certificated Central laboratory of the Breeding Services of the Slovak Republic (Plemenárske služby š.p. Bratislava) for milk analysis. Milk samples were analyzed for basic milk composition (fat, protein and lactose) and somatic cells count (SCC). Basic milk composition was done by MilkoScan FT120 (Foss, Hillerød, Denmark) and somatic cells count were determined using a Fossomatic 90 instrument (Foss Electric, Hillerod, Denmark) after heat treatment at 40 °C for 15 min. SCC were evaluated using decadic logarithm (logSCC).

According to animals, the dairy ewes were divided into four groups on the basis of individual SCC (G_1 = SCC <100 × 10^3 cells.mL^{-1}, G_2 = SCC between 100 – 300 × 10^3 cells.mL^{-1}, G_3 = SCC between 300 – 600 × 10^3 cells.mL^{-1}, G_4 = SCC >600 × 10^3 cells.mL^{-1}. According the number of lactation animals were divided into two groups: first and second lactation. The sampling period was divided into three periods related to April, May, Jun, which also partialy corespond to lactation stage.

The effect of above mentioned factors on milk yield, composition (fat, protein, lactose content) and on SCC was analysed by SAS/STAT 9.2 (PROC Mixed, 2009).

RESULTS AND DISCUSSION

The average daily milk production (DMP) per milking was 421.02 ml in selected flock of Tsigai. We found the average fat content of 7.72% and 6.41% protein per lactation. The DMP and milk component contents are meeting the criteria for the breed standard specifies forTsigai breed **(ZCHOK, 2014)**. Dairy ewe's at 1stlactation achieved 395.87 ml of daily milk production and the second one 446.17 ml. Although, the ewe's in the 2nd lactation had higher milk yield (p <0.05), they reached a similar fat and protein content (Tab. 1). Nevertheless ewes on both lactations reached negligible differences in fat and protein content in addition to lactose. The significantly lower lactose content between the first and second lactation may indicate problems with mastitis in ewes while SCC is the same.

Asimilar fat content, but higher protein content was observed as compared to results of **Oravcová et al. (2007)**. These ewes reached higher milk yield and similar components in milk in the year 2014 by comparison with 2013 **(Vršková et al., 2015)**. From the available publications **Špánik et al. (1996)**, **Margetín et al., 1995, Margetín, et al., 1996, Margetín et al. (1998)** and **Oravcová et al. (2005),** which researched the composition of Tsigai milk rearing in Slovakia, a positive trend of increasing milk production was observed.

The fat content differences have been observed, but the protein content has positively grown by 0.30%. Similarly, we found a positive trend in the SCC, which came to its decline. Consider a change in the technique of preparation for milking ewes **(Vršková et al., 2015)**.

Sheep Breeder machine milked already during rearing lambs after their suckling and did not begin machine milking until weanig of lambs. **Antonič et al. (2013)** have found that immediately after weaning there was relatively high percentage of ewes with high SCC indicating health problem of the udder during suckling period. Increase in SCC during next two milkings could be caused by stress from weaning and starting of machine milking.

When monitoring the impact of the season, we found the highest milk yield was in April (Tab. 2). The highest content of fat and protein was observed in the month of June, when the average milk production was lower (p <0.0001) compared to the April. Milk yield had decreasing trend by season (p <0.0001). Components in milk had increasing trend (p <0.0001). In June we observed the lowest content of lactose. These changes of the milk yield and milk composition are mainly related and could be also expained by the stage of lactation.

We found that the protein content of milk is more than 6%, in each season. Compared with a team of **Antonič et al. (2013)**, we found a higher daily milk yield and content of components excluding lactose (0.5% less) for a similar logSCC (Tab. 2).

It was found that the protein content of milk was over 7% within each season. Last year had lower content of protein by lower milk yield **(Vršková et al., 2015)**. Compared to **Antonič et al. (2013)** in April we reached increased daily milk yield and containing components, excluding lactose 0.5% less and lower SCC.

Table 1 The investigated parameters depending on the order of lactation.

	Lactation			
	First (n=198)		Second (n=128)	
	mean	S. E.	mean	S. E.
Daily Milk Production (ml)	395.87[a]	16.71	446.17[b]	20.19
Fat (%)	7.65	0.11	7.78	0.14
Protein (%)	6.41	0.05	6.40	0.06
Lactose (%)	4.65[a]	0.03	4.56[b]	0.03
logSCC	5.30	0.04	5.30	0.05

Legend: Daily Milk Production – DMP per milking

Table 2 The investigated parameters depending on the season.

	Season (months)						
	April		May		June		
	mean	S. E.	mean	S. E.	mean	S. E.	Significant
DMP (ml)	476.40	17.31	440.92	16.99	345.74	17.57	1:3, 2:3
Fat (%)	6.99	0.14	7.24	0.13	8.86	0.14	1:3, 2:3
Protein (%)	6.23	0.05	6.17	0.05	6.81	0.05	1:3, 2:3
Lactose (%)	4.55	0.03	4.46	0.03	4.81	0.03	1:2, 1:3, 2:3
logSCC	5.27	0.05	5.31	0.05	5.31	0.05	–

Legend: significant p <0.0001

SCC is used to assess the health status of the cows, sheep or goats udder.The strong relationship observed between the annual geometric mean of bulk SCC and the estimated prevalence of intramammary infections can be considered as an indirect validation of our decision rule and thresholds **(Lagriffoul et al., 1999)**. SCC was stable for each season at 250 × 10^3 cells.mL^{-1}(Tab. 1). Depending on the season, there were no differences by logSCC (Tab. 2). LogSCC was balanced throughout lactation, indicating good health udder of experimental ewes. In this breeding was milked ewes during rearing lambs and thus to eliminate the stress of weaning lambs and transition to only machine milking. SCC was lower values by comparison with last year **(Vršková et al., 2015).**

In Table 3, the animals were divided into groups by SCC. We found a trend toward lower milk production with higher SCC. With increasing SCC the lactose content of 4.78% (G_1) was reduced to 4.32% (G_4). This phenomenon was also statistically significant. Reduced lactose content is related to the incidence of mastitis in which microorganisms utilize lactose as an energy source. This is best observed in the groups G_3 and G_4, which have the same daily milk production, but the difference in lactose content of 0.28%.

For individual animals, the best approach has been provided by **Berthelot et al. (2006)**. The mentioned author suggested that values <0.5 × 10^6 cells mL^{-1} indicate a healthy mammary gland and values >1.0 × 10^6 cells.mL^{-1}indicate a mammary gland with clinical or subclinical mastitis. Furthermore, there is no need to perform a simultaneous bacteriological examination of milk samples to confirm the problem. Values between 0.5 × 10^6 and 1.0 × 10^6 cells.mL^{-1}, according to those authors, indicate 'suspected disease',

Table 3 The milk yield and milk composition by SCC.

	SCC group								
	G_1(1), n=86		**G_2**(2), n=163		**G_3**(3), n=35		**G_4**(4), n=42		
	mean	S. E.	mean	S. E.	mean	S. E.	mean	S. E.	Significant
DMP (ml)	463.37	19.11	431.41	14.93	394.56	27.27	394.74	25.67	
Fat (%)	7.20	0.15	7.56	0.11	7.99	0.22	8.04	0.21	1:3, 4
Protein (%)	6.17	0.06	6.35	0.04	6.48	0.08	6.61	0.08	1:2, 3, 4; 2:4
Lactose (%)	4.78	0.03	4.73	0.02	4.60	0.05	4.32	0.05	1:3, 4; 2:4, 3:4

Legend: G_1 = Group1 of (SCC <100 × 10^3 cells.mL^{-1}), G_2 = (SCC between 100 – 300 × 10^3 cells.mL^{-1}), G_3= (SCC between 300 – 600×10^3 cells.mL^{-1} and G_4 = (SCC >600 × 10^3 cells.mL^{-1}), significant p <0.05.

hence there is a need for performing bacteriological examination in milk. From a practical point of view, individual milk SCC are used, for subclinical mastitis control; "doubtful" ewes are grouped either with "healthy" (whenfarmers decide to cull "infected" females) or "infected" ewes (in order to implement a selective drying-off therapy). The lambs' mouths and milkers' hands are the sources of milk contamination **(Albenzio et al., 2003)**. These autors have found that within 4 weeks lasting experiment there was higher SCC at machine milking of ewes when compared to suckled ones, as a consequence of higher bacterial positive samples at machine milking.

CONCLUSION

From this flock of purebred Tsigai 76% of ewes were below SCC 300 × 10^3 cells.mL^{-1}. This SCC indicated good health status of experimental ewes, at which 61% sheep were at the first lactation. We found a tendency to lower milk production by a higher SCC. With the increasing SCC decreased the lactose content from 4.78% (G_1) to 4.32% (G_4). Reduced lactose content refers to the occurrence of mastitis and there is a need for performing bacteriological examination in milk. However more detail study is needed to see relationship between high SCC and presence of microorganisms to better understanding thereasons the physiological and pathological SCC in the udder. Individual milk SCC represents a useful tool for the detection of subclinical mastitis in dairy ewes. It is recommended to evaluate a series of SCC, take into account the stage of lactation and use two thresholds allowing to distinguish three classes of ewes: healthy, doubtful (or briefly infected) and infected (or persistently infected).

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