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Short Communication

Influence of some factors on milk flow and udder health status in two different cattle breeds

Eva Strapáková[1*], Peter Strapák[1], Iveta Szencziová[2]

[1] *Slovak University of Agriculture in Nitra, Nitra, Slovak Republic*

[2] *Ministry of Agriculture and Rural development of the Slovak Republic, Bratislava, Slovak Republic*

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In this study were analyzed average daily milk flow and udder health status (by somatic cell score) in dairy cows. A total of 100 Holstein (H) and 48 Slovak Simmental (SS) cows were investigated. The Holstein cows had average daily milk flow significantly higher by 1.24 kg/min and somatic cell score (SCS) by 0.5 higher than Simmental cows. The factors like breed, parity, rear teat canal length and front teat canal diameter had a significant effect on milk flow but no significant effect on SCS. Thus, these results indicate differences between breeds and parity in milk traits and health status.

Keywords: cattle, milk flow, somatic cell score, ultrasonography

1 Introduction

Average daily milk flow is an important functional trait in dairy cattle for its impact on labor cost (Boettcher et al., 1998). Genetic differences in milk yield exist between breeds because of their ethiology. Many different milking systems are used for dairy cows. Switching from a milking parlour to an automated milking (AM) system may affect the milking performance of the cows, the teat tissues and quality of the milk (Neijenhuis and Hillerton, 2002) but on the other hand induced many disorders of udder (Twardon et al., 2001). The teat of farm animals used for milk production is an important part of the udder, onto which a milking cluster is attached and which serve the role of both a valve regulating the outflow of milk and of a natural barrier for exogenous infections (Hamann and Mein, 1988). Many authors established a connection between mastitis in cows, the characteristics of the teat, the stage of lactation and the visualization of the teat canal (Celik et al., 2008). Ultrasonography of the udder is among other things for designation of the internal teat structures. It allows for detailed measurements of the length and diameter of the teat canal, cistern, and the thickness of the teat wall (Stádník et al., 2010). The aim of this study was to study differences in average dairy milk flow and SCS between two cattle breed and analyze of effects on these milking and udder health characteristics.

2 Material and methods

Dairy cows of Holstein (n = 100) and Slovak Spotted (n = 48) breed in the first, second or third and higher (multiparous) parity were included in the data set. The experiment was carried out on two different farms with another AM system. All the cows had clinically healthy udders. The cows were housed in a free stable with a straw bedding and milked two times a day. Average daily milk flow was defined as total daily milk yield divided by total daily milking duration. Somatic cell count (SCC) was measured during the entire observation as well. The sample of milk was taken from each cow for milk SCC. Evaluation of SCC was performed by NucleoCounter NC-100 machine. The SCC values were converted to a somatic cell score (SCS) by following equation: SCS = log2 (SCC/100) + 3. The scanning procedure was based on studies of Stádník et al. (2010). Ultrasound images of the longitudinal cross-section of teats from the Aloka Prosound 2 (Aloka Co., Ltd., Tokyo, Japan) scanner coupled with 7.5MHz linear probe (UST586-7.5MHZ) were made. Images were recorded in real time

* **Corresponding Author:** Eva Strapáková, Slovak Unversity of Agriculture in Nitra, Faculty of Agrobiology and Food Resources, Department of Genetics and Animal Breeding Biology, Tr. A. Hlinku 2, 949 76 Nitra, Slovak republic. E-mail: eva.strapakova@uniag.sk

on a computer and archived in the form of video files. The diameter and length of teat canals were measured on images recorded in a NIS 3.2 software (Laboratory Imaging, Ltd., Prague, Czech Republic). All measurements were taken in right front and right rear teats.

Statistic analysis were performed by software SAS 9.3, Enterprise Guide 5.1 (SAS, 2011). Influence of factors like parity, breed, length and diameter teat canal were calculated according to the linear model equation, as follows:

$$Y_{ijklmno} = breed_i + parity_j + LTCF_k + LTCR_l + DTCF_m + DTCR_n + e_{ijklmno}$$

where:

$Y_{ijklmno}$ = milk flow and SCS
$breed_i$ = H and SS
$parity_j$ = first, second, three and other lactations
$LTCF_k$ = front teat canal length (k= 148)
$LTCR_l$ = rear teat canal length (l = 148)
$DTCF_m$ = front teat canal diameter (m = 148)
$DTCR_n$ = rear teat canal diameter (n = 148)
$e_{ijklmno}$ = random residual effect

3 Results and discussion

Based on the statistical analysis, we calculated the basic statistical characteristics for average daily milk flow and somatic cell score by breed and parity. Statistical differences between two breeds were confirmed only for average daily milk flow, for SCS were no significant.

The H had greater ($P < 0.05$) average daily milk flow than SS. Equivalent tendency was demonstrated for SCS. Holstein cows had SCS about 0.5 higher than Slovak Spotted cows (Table 1). Walsh et al. (2007) confirmed also significant differences between breeds in average milk flow (AMF). The crossbreds achieved the greater AMF. Milk flow achieved the highest value (2.92 kg min^{-1}) on second lactation. Differences between parity 1: multiparous, and 2: multiparous were significant ($P < 0.05$). SCS was the lowest in second parity (3.39), multiparous cows achieved the highest SCS (3.83) (Table 1). McCarthy et al. (2007) reported an increase lactation-average SCS as parity increased.

Breed, parity, rear teat canal length and front teat canal diameter had a significant effect on milk flow (Table 2). This result was confirmed by Walsch et al. (2007). Antalik and Strapak (2011) detected a significant influence of parity and lactation stage on average milk flow rate. Used linear model, there was not found significant effect on SCS (Table 2). On the contrary, Olde Riekering et al. (2007) states that this effect may be conformable to an increased incidence rate of clinical mastitis with increasing parity. Jorstad et al. (1989) declare a strong positive association between teat canal diameter and somatic cell count in milk.

Table 1 Descriptive statistic for average daily milk flow and SCS

Daily milk flow (kg min^{-1}) ±s.d. n = 148			SCS ±s.d. n = 148		
2.31 ±1.30			3.7 ±1.79		
H n = 100	SS n = 48		H n = 100	SS n = 48	
2.71 ±1.35*	1.47 ±0.63*		3.86 ±1.83	3.36 ±1.67	
Parity 1 n = 48	Parity 2 n = 42	Multiparous n = 58	Parity 1 n = 48	Parity 2 n = 42	Multiparous n = 58
2.47 ±1.14*	2.92 ±1.65*	1.73 ±0.82*	3.81 ±1.84	3.39 ±1.76	3.83 ±1.77

* $P < 0.05$

Table 2 The effects affecting average daily milk flow and SCS

Effects	Daily milk flow			SCS		
	Mean Square	F value	P > F	Mean Square	F value	P > F
Breed	167.5534552	9.83	0.0021	7.40890825	2.34	0.1287
Parity	67.2876511	3.95	0.0215	3.41047694	1.08	0.3439
Front teat canal length	4.6209364	0.27	0.7629	7.02488919	2.22	0.1130
Rear teat canal length	108.6817540	6.38	0.0023	6.01880502	1.90	0.1537
Front teat canal diameter	52.6701161	3.09	0.0487	0.39566229	0.12	0.8828
Rear teat canal diameter	14.2279113	0.83	0.4362	0.54040700	0.17	0.8435

4 Conclusions

The results from this study confirm differences between H and SS breeds milked with another AM in average daily milk flow and somatic cell score. The factors like breed, parity, rear teat canal length and front teat canal diameter significantly affected average daily milk flow. The influence this factors on SCS was not found.

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