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IMPACT OF SEASONAL GRAZING ON UDDER HEALTH OF COWS

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Abstract

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The somatic cell count (SCC) in individual cow milk was used as an indicator of the udder health of cows in the mountain area in the Czech Republic. The monthly test-day records on SCC in milk of total 12,788 cows from 26 herds were scrutinized in order to elucidate the impact of the seasonal grazing on occurrence of milk secretion disorders. The interaction between the season (summer: May–October; winter: November–April) and the feeding system (seasonal grazing; permanently-indoor feeding) effects was used as a measure of the effect of pasture on SCC. The effect of season significantly interacted with the effect of farm ($P < 0.001$) and the between-farm variation in SCC was higher than the seasonal variation on particular farms. In both the feeding systems, the SCC was lower in the summer season than in the winter season ($P < 0.01$). The effect of season did not interact with the effect of feeding system ($P > 0.05$). The Holstein cows had on average higher SCC than the Czech Fleckvieh cows ($P < 0.001$) and this genetic effect did not interact with the season nor with the season and the farm effects ($P > 0.05$). The results indicated a higher importance of the management and the genetic factors for the occurrence of milk secretion disorders in comparison to the seasonal factors. No negative effect of the seasonal grazing on udder health was identified.

mastitis, pasture, Czech Fleckvieh, Holstein, somatic cell count

The mastitis causes serious economic losses to dairy producers (Seegers *et al*., 2003). Aside animal and nutrition factors determining the immune status of cows, also the environmental conditions – the occurrence of pathogens, the udder hygiene, the milking procedure, and other management practices affect the udder health substantially (Barkema *et al*., 1999; Köster *et al*., 2006a,b; Doherr *et al*., 2007; Bezdíček *et al*., 2008; Skýpala and Chládek, 2008; Chládek *et al*., 2009). Preventive management decissions based on an early identification of the udder infection may reduce the risk of mastitis. The somatic cell count (SCC) in milk serves as a reliable indicator of the udder infection and it playes an important role mainly in early detection of the subclinical variety of the mastitis (Schukken *et al*., 2003; Ryšánek *et al*., 2007; Čuboň *et al*., 2008; Bezdíček *et al*., 2009; Hanuš *et al*., 2010).

In the mountain areas of the Czech Republic, the breeding of two most common dairy breeds, the Holstein and the Czech Fleckvieh, relies on two feeding strategies: (1) the seasonal pasture in May–October period followed by the silage feeding indoor in the rest of a year, and (2) the all-year-through indoor silage feeding without any access to pasture. The dietary and the etological factors related to pasture are suspected to act as the stressors and to increase the risk of subclinical mastitis in grazing cows (Coulon and Pradel, 1997; Lamarche *et al*., 2000). The aim of this study was to examine the impact of the seasonal grazing on the occurrence of milk secretion disorders in herds. The SCC in individual milk was used as an indicator of milk secretion disorders and the significance of the interaction between the season and the feeding system effects was tested as a measure of the impact of the pasture on udder health.

MATERIAL AND METHODS

Twenty-six herds located at the altitude 490–896 meters above sea level in the south-western part of the Czech Republic were selected for the study (Tab. I). Seven herds (farm 1–7 in Tab. I) consisted of two breeds, the Holstein and the Czech Fleckvieh, the other herds were formed only by one of these breeds. The Holstein breed refered to the cows with 50–100% deal of H-breed or R-breed (breeding groups of H1–4), the Czech Fleckvieh cows had 51–100% deal of C-breed (breeding groups of C1–2). Fourteen herds were seasonally grazed from May to October – in the summer season (farm 1–3, 8–11 and 17–23). In addition to pasture *ad libitum*, the cows were offered a fresh herbage in stalls during two milkings a day. During the rest of a year (November–April, the winter season) the cows were fed a grass or maize silage and different supplements (hay, straw, rapeseed, brewery draff) depending on a farm. The other twelve herds were permanently housed in the stalls and fed a grass or maize silage and different supplements (hay, straw, rapeseed, brewery draff) throughout all the year. Grain supplements were offered to cows during all the year in both feeding systems.

The data on SCC in individual milk samples were recorded by the Czech-Moravian Breeders Corporation in frame of monthly test-day monitoring of breeding value of cows. The lowest SCC accepted for the analysis was 1 thousand ml^{-1} milk and the highest value was 9,999 thousands ml^{-1} milk (the upper value limit in the used database). Only the records of cows in the first to the sixth lactation were used. In total 161,395 test-day records collected between January 2004 and December 2008 by 12,788 cows were thus obtained. The General Linear Models analysis (StatSoft CR s r.o., 2008) was conducted in order to evaluate the seasonal, the management (farm, feeding system) and the genetic (breed) effects of SCC in individual milk samples. Three different models were computed to obtain the most comprehensive information on the implication of the management and the genetic factors in the seasonal variation of SCC. All twenty-six herds were included in model 1 and 2, in which the

I: *The characterization of the herds, P – pasture feeding system, I – indoor feeding system, H – Holstein breed, C – Czech Fleckvieh breed, Model 1, 2, 3 – three models of GLM analysis*

Farm	Altitude m.a.s.l.	Feeding system	Number of cows		Number of records		Milk per standard lactation		Model
			H	C	H	C	H	C	
1	793	P	49	219	929	3249	6971	6386	1,2,3
2	896	P	135	159	1843	1818	6929	6038	1,2,3
3	575	P	137	172	2185	2592	6628	5626	1,2,3
4	550	I	588	139	9106	3281	7593	6099	1,2,3
5	535	I	735	291	9797	3485	6658	5756	1,2,3
6	635	I	688	447	6036	4135	6154	5492	1,2,3
7	567	I	160	174	1136	1936	5451	5135	1,2,3
8	668	P	1155	0	14229	0	6717		1,2
9	694	P	450	0	4657	0	6640		1,2
10	680	P	77	0	740	0	6150		1,2
11	651	P	148	0	2658	0	5648		1,2
12	500	I	422	0	4823	0	10416		1,2
13	554	I	696	0	7973	0	8954		1,2
14	745	I	671	0	10809	0	7924		1,2
15	620	I	984	0	10406	0	7771		1,2
16	558	I	498	0	7006	0	7165		1,2
17	724	P	0	180	0	2626		5995	1,2
18	760	P	0	161	0	2167		5939	1,2
19	684	P	0	163	0	2506		5733	1,2
20	690	P	0	209	0	3143		5665	1,2
21	786	P	0	956	0	12340		5352	1,2
22	730	P	0	440	0	5799		5142	1,2
23	753	P	0	210	0	3328		5033	1,2
24	510	I	0	276	0	3201		5866	1,2
25	490	I	0	239	0	2399		5587	1,2
26	569	I	0	760	0	9057		5003	1,2

effect of breed was not considered. Only seven herds (farm 1–7) were included in model 3, which considered also the effect of breed. The effect of farm was used in model 1 and 3, whereas the effect of feeding system (seasonal pasture vs. permanently-indoor feeding) was used in model 2. The other factors included in analysis were the year of milk collection and the parity of cow (three categories: the first, the second, and the third to sixth lactations). The days in milk and the daily milk yield (kg / cow / day) were used as covariates. The SCC values were log-transformed before the model calculation in order to receive a normal distribution of this variable (Ali and Shook, 1980).

RESULTS

The results of GLM analysis are given in Table II. The effect of season was insignificant in model 1 and 3 ($P > 0.05$), where the effect of farm was included. The effect of farm was significant ($P < 0.001$) and it interacted with the effect of season ($P < 0.001$). Generally, the differences in mean SCC between the farms were higher than the seasonal differences on particular farms (Fig. 1). The effect of season was significant in model 2 ($P < 0.01$), where the feeding system effect instead of the farm effect was used. Higher SCC were found in the indoor than in the pasture feeding system ($P < 0.001$) and in the winter than in the summer season ($P < 0.01$). The effect of season did not interact with the effect of feeding system ($P > 0.05$). In model 3, the significant effect of breed on SCC was found ($P < 0.001$). The Holstein cows had on average higher SCC than the Czech Fleckvieh cows and this genetic effect did not interact with the season nor with the season and the farm effects ($P > 0.05$; Fig. 2). The other factors included in the analysis: the year, the parity, the days in milk and the daily milk yield had significant effects on SCC ($P < 0.001$). The SCC increased from the primiparous cows to the second lactation cows and from the second lactation to the third-to-sixth lactation cows.

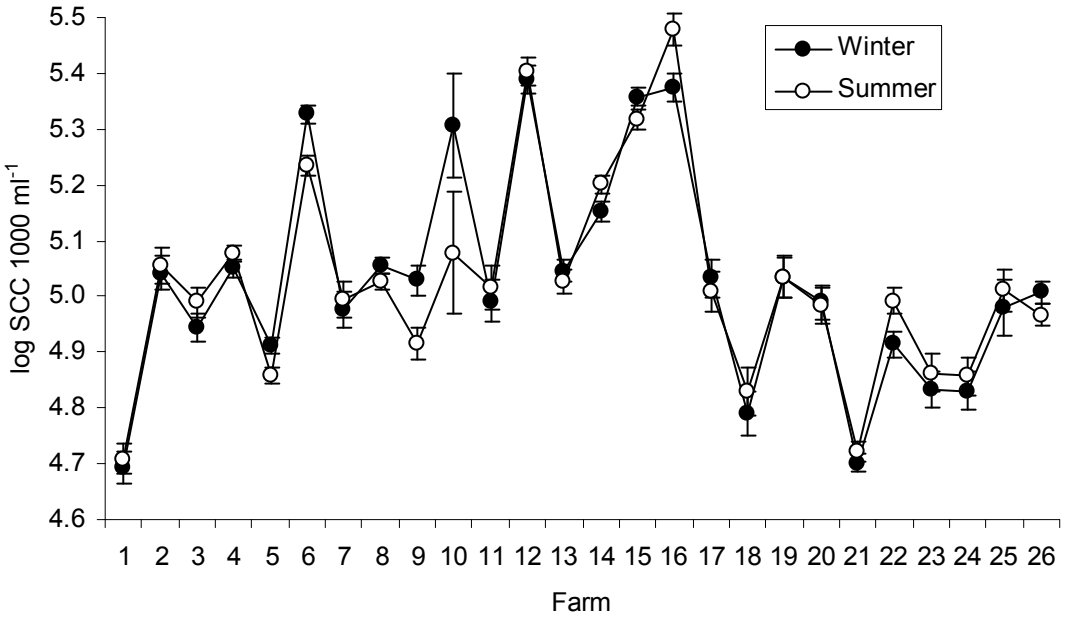
DISCUSSION

The analysis of individual SCC of two breeds in 26 herds enabled to scrutinize the impact of coincidentally acting seasonal, management and genetic factors on this important udder health indicator. The seasonal variation in SCC revealed lower in comparison to the differences between the farms or between the breeds. At genetic level, higher milk production is associated with a higher risk of mastitis (Van Dorp *et al.*, 1998; Ingvartsen *et al.*, 2003), although the interaction with the environment modifies this relationship (Windig *et al.*, 2005). In the separate analysis on seven herds executed in this study, the Holstein cows with an average milk production 6,626 kg had significantly higher SCC than the Czech Fleckvieh cows with only 5,790 kg milk production, which supports the above mentioned relation between the milk performance and the risk of mastitis. The breed differences in the susceptibility to udder infection disease were reported also by other authors (Busato *et al.*, 2000; Washburn *et al.*, 2002; Doherr *et al.*, 2007).

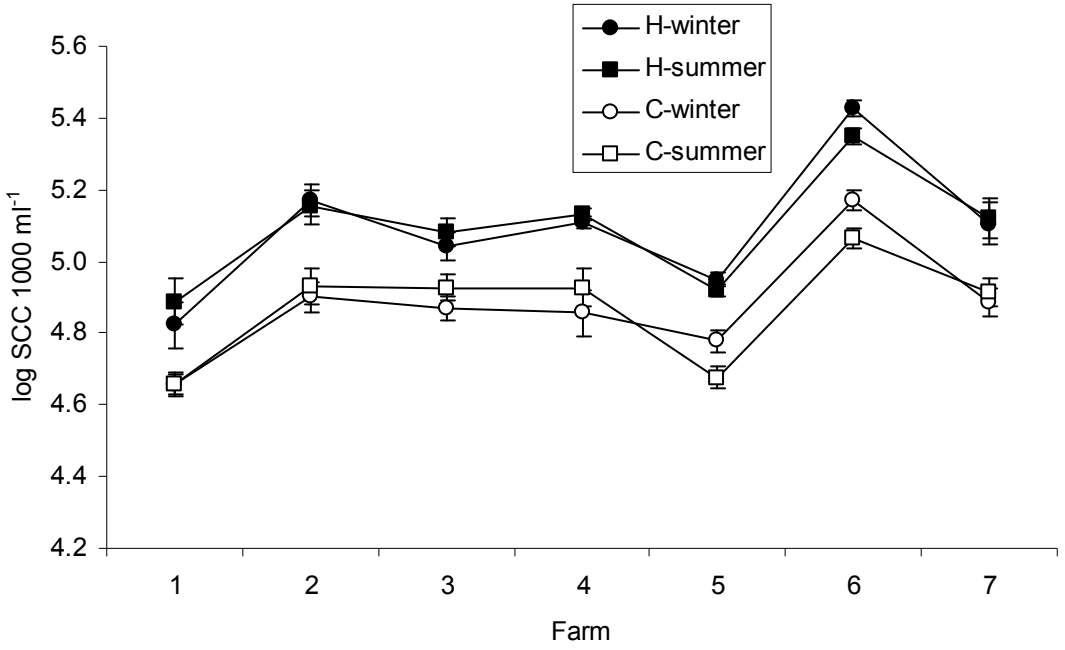
Higher milk SCC were found in the winter than in the summer season in both the feeding systems. The insignificant interaction between the season and the feeding system indicated that the feeding system itself was not a major factor determining this seasonal trend. Other factors than the pasture related, feeding or movement circumstances were thus implicated in the seasonal variation. The photoperiod can be one of the important factors. The prolonged lenght of the daylight increases the milk production in cows (Dahl *et al.*, 2000). Higher feed intake and a better milk performance generally indicate a better health and immune status of cows (Bareille *et al.*, 2003). In precedent studies dealing with the same herds as in this study, higher milk yields and significant changes of the milk fat composition were observed during the summer season in comparison to the winter season (Frelich *et al.*, 2009a,b). The change of a herd environment and the increased physical strain by grazing cows may, however, act as the stress factors suspected of a higher subclinical mastitis inci-

II: *The results of three models of GLM analysis and the achieved levels of significance. n.s. – P > 0.05; W – winter season; S – summer season; I – indoor feeding system; P – pasture feeding system; H – Holstein breed; C – Czech Fleckvieh breed*

Effect	Model 1	Model 2	Model 3
Season	n.s.	$P < 0.01$ (W > S)	n.s.
Farm	$P < 0.001$	–	$P < 0.001$
Feeding system	–	$P < 0.001$ (I > P)	–
Breed	–	–	$P < 0.001$ (H > C)
Parity	$P < 0.001$	$P < 0.001$	$P < 0.001$
Year	$P < 0.05$	$P < 0.001$	$P < 0.001$
Days in milk	$P < 0.001$	$P < 0.001$	$P < 0.001$
Milk yield (24 hours)	$P < 0.001$	$P < 0.001$	$P < 0.001$
Season*Farm	$P < 0.001$	–	$P < 0.001$
Season*Feed.system	–	n.s.	–
Season*Breed	–	–	n.s.
Season*Breed*Farm	–	–	n.s.



1: *The least square means of log SCC and 95% confidence intervals given by the GLM analysis (Model 1) in the winter and in the summer season in 26 herds*



2: *The least square means of log SCC and 95% confidence intervals given by the GLM analysis (Model 3) in the winter and in the summer season in the Holstein (H) and in the Czech Fleckvieh (C) cows on seven farms*

dence observed in herds in the alpine grazing conditions (Agabriel *et al*., 1997; Coulon and Pradel, 1997; Busato *et al*., 2000; Lamarche *et al*., 2000). The positive effect of the grazing on udder health or SCC in milk was reported by other authors, nevertheless (Goldberg *et al*., 1992; Pomiès *et al*., 2000; Regula *et al*., 2002; Washburn *et al*., 2002; Cempírková, 2007; Węglarz *et al*., 2008), which is in accordance also with the results of this study.

SUMMARY

The analysis of SCC data on individual milk samples of 12,788 cows from 26 herds was conducted in the mountain area in the Czech Republic. The interaction between the season (summer: May–October; winter: November–April) and the feeding system (seasonal grazing; permanently-indoor feeding) effects was used as a measure of the effect of pasture on SCC. The effect of season did not interact with the effect of feeding system ($P > 0.05$). The effect of season significantly interacted with the effect of farm ($P < 0.001$) and the between-farm variation in SCC was higher than the seasonal variation on particular farms. The Holstein cows had on average higher SCC than the Czech Fleckvieh cows ($P < 0.001$) and this genetic effect did not interact with the season nor with the season and the farm effects ($P > 0.05$). The results did not indicate any negative impact of the application of seasonal grazing on the udder health.

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