COMPARISON OF LACTOSE, CALCIUM, CHLORIDE CONTENT AND SOMATIC CELL COUNT IN BULK MILK SAMPLES FROM HOLSTEIN AND CZECH FLECKVIEH BREED

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ABSTRACT

During the period of 1.5.2013 to 26.6.2013 (57 days) bulk milk samples was obtained in herds of Holstein (H) cows from University farm in Žabčice. Same number of bulk milk samples was obtained in herd of Czech Fleckvieh (C) cows from farm GENAgro Říčany, a.s. Samples were taken daily (n=114). Average values of milk parameters of Holstein cows were follows: lactose content 4.66 $g.100g^{-1}$, calcium content 1.02 $g.l^{-1}$, chloride content 0.90 $g.l^{-1}$, somatic cell count 206 $10^3.ml^{-1}$. There was average diurnal temperature 16.58 °C in stable. The average values of milk parameters of Czech Fleckvieh cows were follows: lactose content 4.78 $g.100g^{-1}$, calcium content 1.03 $g.l^{-1}$, chloride content 0.90 $g.l^{-1}$, somatic cell count 286 $10^3.ml^{-1}$. There was average diurnal temperature 18.56 °C in stable. For both breeds was also found chloride-lactose ratio (for Holstein cows 1.93, for Czech Fleckvieh cows 1.88). Based on the analysis of milk samples were measured average values of this two breeds compared among themselves. Statistically very highly significant difference between breeds was found ($P<0.001$) in lactose content and somatic cell count. In average diurnal temperature and chloride-lactose ratio was detected statistically significant difference ($P<0.05$). Difference of calcium and chlorides content between this two breeds were not statistically significant ($P>0.05$).

Key words: bulk milk samples, lactose, calcium, chlorides, somatic cell count, Holstein breed, Czech Fleckvieh breed

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INTRODUCTION

Milk yield of dairy cows is influenced by their genetic potential, nutrition and health (Bouška J. *et al.* 2006). Changes in milk composition (for example in lactose content, mineral content, enzymes or somatic cell count) can be attributed to disease onset, so there may be differences in milk composition useful for early detection of health problems and starting the treatment (Hamann J., Krömker V. 1997). Other influences affecting the composition of milk is breed, season, stage of lactation or heat stress (Gajdůšek S. 2003). Increasing somatic cell count (SCC) in milk leads to changes in its composition, for example, in representation of protein fractions, minerals and lactose content. These changes have a negative impact on the further processing of milk. Affecting SCC is based especially in optimal breeding conditions (Zadražil K. 2002). For SCC in raw milk is given as standard in 1 ml ≤ 400 000 SC (Doležal O. *et al*. 2000). Among the most sensitive indicators of udder disease belongs lactose content. If there is disease its content decreases (Lukášová J. *et al.* 1999). Therefore, there is a negative correlation between SCC and lactose content in milk (Gajdůšek S. 1996). Average milk contains 4.6 $g.100g^{-1}$ of lactose. To compensate osmotic pressure in the mammary gland, because of low lactose content, there is an increased transfer of sodium chloride from blood to milk. The average chloride content in milk is in range 0.8-1.4 $g.l^{-1}$ (Harding F. 1996; Gajdůšek S. 2003). Koestler (1920) used the ratio of chloride ions and lactose to indicate normal or mastitis milk (McSweeney P.L.H., Fox P.F. 2009). In normal bulk milk samples is chloride-lactose ratio 1.7–2.2. Values greater than this upper limit points to secretory disorders in the mammary gland (Šustová K. 2005). McSweeney P.L.H., Fox P.F. (2009) presents upper limit to 3. Among the minerals what values decline in mastitis is included Ca (Gajdůšek S. 2003). From a technological point of view the content of calcium in milk is one of the critical factors affecting milk clotting enzymes in cheese production (Lukášová J., Smrčková A. 2003).

It is evident that the quantity of milk and its composition is also influenced by breed (Janů L. *et al.* 2007). In the Czech Republic, dominate two breeds of cattle – Holstein dairy breed (H) and Czech Fleckvieh breed (C) dual purpose breed (Bouška J. *et al.* 2006).

The aim of this study was evaluate lactose, calcium, chloride content and somatic cell count in bulk milk samples from Holstein and Czech Fleckvied breed.

MATERIAL AND METHODS

During the period of 1.5.2013 to 26.6.2013 were analysed bulk milk samples from morning milking (sampled daily) obtained in herd of Czech Fleckvieh cows (C; n=57) from farm GenAGRO Říčany, a.s. In the same way in this period were sampled bulk milk samples obtained in herd of Holstein cows (H; n=57) from University farm in Žabčice. Total number of samples was 114, representing the morning milk yield. Cows were fed total mixed ration *ad libitum* and were in various stage of lactation.

Analysis of samples was performed in the laboratory of Department of Animal Breeding at Mendel University in Brno. **Average diurnal temperature** represents the arithmetic mean of the temperatures in the control days, measured every 15 minutes using 3 sensors with HOBO data logger (Onset Computer). **Lactose content** was measured on instrument Julie C5 Automatic (Scope Electric) working on the principle of thermo analysis. C**hloride content** in milk was determined after the addition of nitric acid by titration argentometric. Chlorides were precipitated by excess silver nitrate solution and for reverse titration was used a solution of ammonium thiocyanate. For the determination of **calcium content** was used complexometric titration with EDTA,2Na. **Somatic cell count** was measured on NucleoCounter SCC-100 (Chemometec). It is an integrated fluorescence microscope designed to detect signals from the fluorescent dye, propidium iodide

bound to DNA. **Chloride-lactose ratio** (x) number was determined according to the formula $X = \frac{a.100}{b.10}$

a…chloride ions content ($g.l^{-1}$)

b…lactose content in milk ($g.100g^{-1}$)

RESULT AND DISCUSSION

Tab. 1 provides relationship between both monitored breeds within measured properties of milk. On both farms (n=114), the average diurnal temperature was 17.57 °C. Average diurnal temperature in GenAGRO Říčany, a.s. (Czech Fleckvieh breed - C; n=57), was 18.56 °C, in University farm in Žabčice (Holstein breed - H; n=57) was measured average diurnal temperature during monitored period 16.58 °C. Difference between temperatures was 1.98 °C. In research Polák O. *et al.* (2011) were found slightly higher diurnal temperatures in the Žabčice stable. Mudřík Z. *et al.* (2006) state, that the effects of heat stress in dairy cows are reflected at temperatures above 24 ° C. Between temperatures at both farm was found statistically significant difference ($P<0.05$). Average lactose content in milk samples from C and H breed was found 4.72 $g.100g^{-1}$, in samples from H breed was measured average lactose content 4.66 $g.100g^{-1}$, in case of C breed was found 4.78 $g.100g^{-1}$ lactose content. Difference between values was 0.12 $g.100g^{-1}$. Between H and C breed was found statistically very highly significant difference in lactose content ($P<0.001$). With higher lactose level in case of C breed than in case of H breed agree Kučera J., Král P. (2006). Different result state Polák O. *et al.* (2011) and Javorová J. *et al.* (2013a) beccause in their studies was not found statistically significant difference ($P>0.05$) and there was slightly higher lactose content in case of H breed. Average somatic cell count in milk samples from C and H breed was detected 247 $10^3.ml^{-1}$. For H breed was the average content of somatic cell 206 $10^3.ml^{-1}$, for C breed was detected 286 $10^3.ml^{-1}$. Diference between values was 80 $10^3.ml^{-1}$. Between both breeds was found statistically very highly significant diference in somatic cell count ($P<0.001$). Javorová J. *et al.* (2013b) state (in winter season), there is difference between somatic cell count within C and H breeds 49 $10^3.ml^{-1}$ and lower somatic cell count in case of H breed. Hanuš O. *et al.* (1992) states more favorable values (statistically significantly lower) somatic cell count in C breed samples. Average value of chloride-lactose ratio (in milk samples from both breeds) was calculated 1.91. For H breed it was 1.93, for C breed 1.88. Differences between values was 0.05. Between monitored breeds was found statistically significant diference in this parameter ($P<0.05$). Hanuš O. *et al.* (1992) state average value (milk samples from C and H breed) 2.27. They discovered statistical significancy between chloride-lactose ratio and breeds. This value was found lower in case of milk samples from C breed. Gajdůšek S. (1996) adds that the ratio of chloride and lactose is already changing when somatic cell count rise above 250 $10^3.ml^{-1}$.

Between both monitored breeds was not found statistically significant difference ($P>0.05$) in calcium content in milk. Average content of Ca (both breeds) was found 1.03 $g.l^{-1}$. For H breed was average content of this parameter 1.02 $g.l^{-1}$, for C breed 1.03 $g.l^{-1}$. Diference between values was 0.01 $g.l^{-1}$. Czerniewicz M. *et al.* (2006) states that in their research was for H breed found average calcium content 1.21 $g.l^{-1}$ (period from October to April), Dambacher M.A. (1995) adds that the active excretion of calcium into the milk from organism is observed in cows with higher milk yield. Kučera J., Král P. (2006), however, states that the C breed has a higher content of Ca than H breed. Between the two breeds was not found statistically significant difference ($P>0.05$) in chloride content in milk. For both breeds was their average content found identically 0.90 $g.l^{-1}$. Hanuš O. *et al.* (1992) discovered statistical significancy between chloride content and breeds, lower content of Cl was found in milk samples from C breed.

Tab.1 Relationship of both monitored breeds within measured properties of milk

PARAMETER	UNIT	$\overline{x}$	BREED		Significancy
			H	C	
Number of samples	n	-	57	57	-
Average diurnal temperature	°C	17.57	16.58	18.56	*
Lactoses content	$g.100g^{-1}$	4.72	4.66	4.78	***
Somatic cell count	$10^3.ml^{-1}$	247	206	286	***
Calcium content	$g.l^{-1}$	1.03	1.02	1.03	N.S.
Chlorides content	$g.l^{-1}$	0.90	0.90	0.90	N.S.
Chloride-lactose ratio	-	1.91	1.93	1.88	*

N.S.= non-significant (P>0.05), *= P<0.05, ***= P<0.001

CONCLUSIONS

The aim of this study was evaluate lactose, calcium, chloride content and somatic cell count in bulk milk samples from Holstein and Czech Fleckvied breed. It was found that between this two breeds was very highly statistically significant difference in lactose content and somatic cell count. Statistically significant diference between monitored breeds was found in chloride-lactose ratio and average diurnal temperature observed in the monitored farms. Statistically not significant difference was reseached in calcium content and chloride content. The existence of significant differences between Czech Fleckvieh and Holstein breed within the monitored parameters support opinion that should be taken into account in the evaluation of milk quality.

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