Slovak J. Anim. Sci., 46, 2013 (1): 31-34

ISSN 1337-9984

SOMATIC CELL COUNTS IN MILK OF DAIRY COWS UNDER PRACTICAL CONDITIONS

V. TANČIN[1,2]*

[1]Animal Production Research Centre Nitra, Slovak Republic
[2]Slovak University of Agriculture in Nitra, Slovak Republic

ABSTRACT

Knowledge related to udder health in dairy practice is considerably limited. The aim of the experiment was to study the changes of somatic cell counts (SCC) in milk in relation to the month of year, stage of lactation and parity under the practical conditions. Also the frequency of incidence of high SCC during the year was observed. The effectiveness of dry therapy and calving process on SCC was evaluated as well. The experiment lasted from January 2011 till January 2012 involving 146 dairy cows. From each milked cow two milk samples per month were collected to measure SCC during experimental observation. In total 2306 samples were collected during the experimental period. The SCC significantly increased with advanced numbers of lactation. The months of the year (season) significantly influenced the SCC in dairy cows. There was a significant increase of SCC during the period from May till July as compared with winter months of the year. The lowest value of SCC was measured at second month and the highest at tenth month of lactation. Also the first month of lactation was characterized by higher SCC as compared with second one. In conclusion, the high percentage of cows had SCC over $4.10^5 ml^{-1}$ and considerable effect of season indicate insufficient preventive mastitis control programme in dairy farm and therefore the high risk for milk quality on farm.

Key words: cow; somatic cells; mastitis; season; lactation

INTRODUCTION

Milk and milk products intake by consumers is crucial for economic profit of producers. Therefore the positive development of milk intake by consumers should be stimulated by the high quality of raw milk in dairy practice. There are many factors influencing milk and milk products consumption (Kubicová and Dobák, 2012).

Somatic cells are considered to be the cells of udder tissue (epithelial cells) and also cells coming from the blood like neutrophil, macrophages, lymphocytes. The white cells of udder are the most important part of udder immunity against pathogens penetrating through teat canal to the udder cistern (Kelly and McSweeney, 2002; Green *et al*., 2004). Therefore the increased somatic cell count (SCC) represents the response of udder tissue to the presence of pathogens causing the inflammation of udder called mastitis (Pyörärlä, 2003). Mastitis represented by increased SCC significantly reduces milk synthesis and therefore milk production (Tančin *et al.*, 2007) and milk composition especially content of lactose, chlorides (Barkema *et al.*, 1999) and technological quality of milk (Santos *et al*., 2003). Curd yield was found to be significantly lower in the infected glands than in the uninfected ones (Leitner *et al*., 2004).

The SCC could be considered as a main trait of udder health and milk quality (O´Brien *et al*., 2001). In general it is accepted that SCC is a gold standard at diagnostics of any form of mastitis in udder (Pyörärlä, 2003). On the other hand the SCC in milk are influenced by other internal and external parameters like stage of lactation, parity, teat position, milk flow kinetics (Tančin *et al*., 2007a,b) and frequency of milking (Hogeveen

***Correspondence:** E-mail: tancin@cvzv.sk
Vladimír Tančin, Animal Production Research Centre Nitra,
Hlohovecká 2, 951 41 Lužianky, Slovak Republic
Tel.: +421 903 546 401

Received: November 29, 2012
Accepted: February 8, 2013

et al., 2001), but these factors do not increase SCC dramatically as the mastitis do.

The SCC in dairy practice is mostly related to the price of milk received from dairy and therefore if SCC is below the limit (4.10^5 cells.ml^{-1}) the farmers are not dealing with SCC seriously. Therefore data from dairy practice could be useful for scientific evaluation to see more critical points that could be involved in mastitis prevention programmes. The aim of the experiment was to study the changes of SCC in milk in relation to the month of year, stage of lactation and parity under the practical conditions. Also the frequency of incidence of high SCC during the year was observed. The effectiveness of dry therapy and calving process on SCC was evaluated as well.

MATERIAL AND METHODS

The experiment was realized in a dairy farm in practice. The experiment included Red Holstein cows on the farm with average annual milk production of 7200 kg. The experiment lasted from January 2011 till January 2012 on 146 dairy cows in their first lactation (35 %), second lactation (21 %), third lactation (19 %) and fourth and more lactations (25 %).

The dairy cows were housed in free-stall housing system. Animals were milked two times a day in 2 x 4 autotandem milking parlour. The parlour was equipped with automatic devices for machine pre-stimulation and automatic cluster removal. The milking routine consisted from udder washing with water from hose, cleaning with towel and fore-stripping.

From each milked cow two samples of milk per month were collected to measure somatic cell counts during experimental observation. In total 2306 samples were collected during the experimental period and were analyzed on Fossomatic 5000.

Animals on the basis of SCC were divided into four groups: low (SCC < 2.10^5 cells.ml^{-1}), middle (SCC between 2.10^5 and 4.10^5 cells.ml^{-1}), high (SCC between 4.10^5 and 10^6 cells.ml^{-1}) and highest (SCC > 10^6 cells.ml^{-1}) to describe the frequency of possible udder health problems during experimental period. The effectiveness of dry therapy and calving process was studied through frequency of distribution of cows with different SCC in above mentioned groups. Cows were evaluated on the basis of three months average values of SCC before drying and after calving. Also the groups of animals according to the parity numbers were classified as primiparous cows and cows on their second and third lactation. Last group represented cows on their forth and more lactations. Stage of lactation was classified as first ten months of lactation and thirteen months were included to evaluate the effect of the year.

Obtained data were processed by Microsoft Excel program and statistically evaluated by SAS/ 8.2 (2002). The model was tested by using Fisher's F-test. Differences between the levels of the effects were tested by Scheffe multiple range test for studied traits. Data are presented as least square means ± standard error. For evaluation of somatic cells the following model was used:

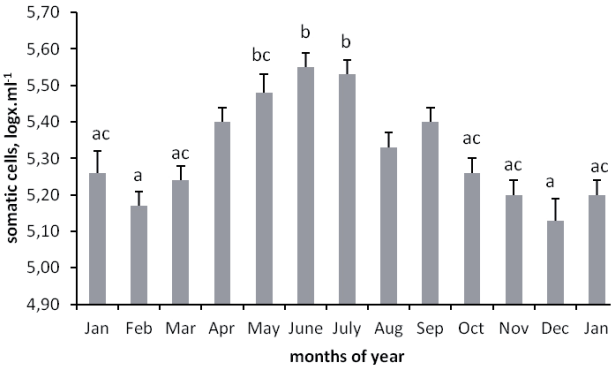
$$\mathbf{y = X\beta + Zu + e}$$

y – the measurements for somatic cell counts
β – the fixed effects of parity, stage of lactation, month of year
u – random effect of cow, $u \sim N(0, I\,\delta^2_c)$
e – random error, assuming $e \sim N(0, I\,\delta^2_e)$
X, Z – incidence matrices for fixed effects and random cow effects respectively

RESULTS AND DISCUSSION

The SCC significantly increased with advanced numbers of lactation. Especially group of cows on their fourth and higher lactations had 5.52±0.02 logx.ml^{-1} as compared with primiparous cows with 5.22±0.02 logx.ml^{-1}. Cows on second lactation had 5.24±0.02 and cows on third 5.30±0.03 logx.ml^{-1}. There were no significant differences among first three groups of parities indicating relatively low increase of health problems during first three lactations. In our earlier study (Tančin *et al*., 2007a) the multiparous cows had only numerically higher SCC as compared with primiparous cows and this difference is in agreement with other findings (Laevens *et al*., 1997). The clear increase of SCC from lactation to lactation was found in goat (Contreras *et al*., 1999).

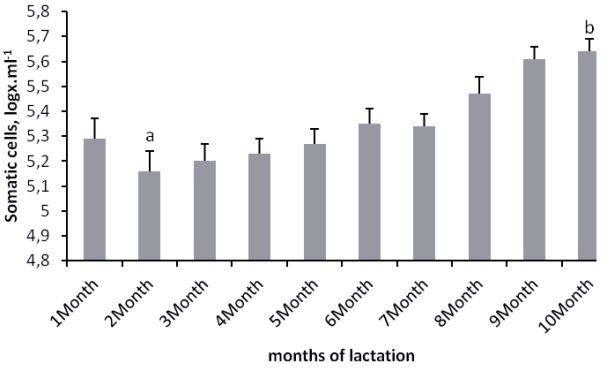
The months of the year (season) significantly influenced the SCC in dairy cows. There was a significant increase of SCC during the period of May, June and July as compared with winter months of the year (Fig. 1). Even during the June and July almost 18 % of cows had over million SCC in milk. Thus the summer time was critical for udder health in dairy farm. The higher SCC in our experiment suggested serious health problems of udders during summer period. It was reported that environmental pathogens caused higher incidence of mastitis during summer period (Smith *et al*., 1985) as a possible consequence of living conditions for bacteria (Mallet *et al.*, 2012). Rupp and Boichard (2000) also claimed that the risk of first clinical mastitis was the highest around the second calving in lactation starting in summer period. Under the conditions of healthy mammary glands the season was pointed out to have no significant influence on SCC (Malinowski, 2001). More important factor is udder hygiene as pointed by Tongeľ and Brouček (2010). Above mentioned authors calculated positive coefficients of correlation between udder hygiene scores and mastitis at the level 0.77.



[a–c]Least squares means without a common superscript letter were significantly different at $P \leq 0.05$

Fig. 1: The effect of season on SCC in the milk of dairy cows

Somatic cell count significantly changed throughout lactation. The lowest value was measured at second month and the highest at tenth month of lactation. As shown in Fig. 2 the first month of lactation was characterized by higher SCC as compared with second one. Under the practical conditions the periods after calving and the end of lactation are generally considered as critical for udder health. In our work we found the increase of SCC throughout lactation (Tančin *et al.*, 2007a). Significant effect of the stage of lactation in dairy cows was also documented by Laevens *et al*. (1997). From the management point of view the period early postpartum and before drying are critical for udder health and dairy practice should take more care on cows during above mentioned periods of lactation.



[a–b]Least squares means without a common superscript letter were significantly different at $P \leq 0.05$

Fig. 2: The effect of stage of lactation on SCC in the milk of dairy cows

In total during the experimental period 120 cows were calved in the herd. From them 55 % of cows were in low and 15 % in medium group. On the other side 80 cows were dried and 69 % of them were in low (38 %) and medium (31 %) groups. During both drying and calving period there were around 30 % of cows in a group of high. Though after calving the percentage of cows in low group increases (55 % versus 38 %), the high percentage of cows in high group indicate problems in the farm with the process of drying and calving. The dry therapy with antibiotics reduces the rate of udder infection in early dry period, but there was no effect during the prepartum period (Smith *et al*., 1985). Also above mentioned authors pointed out that dry cow therapy did not influence the incidence of environmental infection. Therefore the dry therapy with antibiotics is not the single solution to keep udder healthy as farmers initially thought. There are many other critical factors involved in higher risk of mastitis incidences during dry and transient period that should be taken into account in daily managing of dairy herd.

CONCLUSION

The season and stage of lactation significantly influenced SCC in milk of dairy cows under practical conditions. Both factors should be considered as a risk for mastitis and therefore should be taken into account in daily managing of dairy herd.

ACKNOWLEDGEMENT

This study was funded by the Operational Programme for Research and Development project "MLIEKO 26220220098" of the European Regional Development Fund.

REFERENCES

BARKEMA, H. W. – DELUYKER, H. A. – SCHUKKEN, Y. H. – LAM, T. J. G. M. 1999. Quarter-milk somatic cell count at calving and at the first six milkings after calving. *Preventive Vet. Med.*, vol. 38, 1999, p. 1-9.

CONTRERAS, A. – PAAPE, M. J. – MILLER, R. H. 1999. Prevalence o subclinical intramammary infection caused by *Staphylococcus epidermidis* in a commercial dairy goat herd. *Small Rum. Res.*, vol. 31, 1999, p. 203-208.

GREEN, M. J. – GREEN, L. E. – SCHUKKEN, Y. H. – BRADLEY, A. J. – PEELER, E. J. – BARKEMA, H. W. – de HAAS, Y. – COLLIS, V. J. – MEDLEY, G. F. 2004. Somatic cell count distributions during lactation predict clinical mastitis. *J. Dairy Sci.*,

vol. 87, 2004, p.1256-1264.

HOGEVEEN, H. – MILTENBURG, J. D. – Den HOLLANDER, S. – FRANKENA, K. 2001. Milking three times a day and its effect on udder health and production, *IDF Mastitis Newsletter*, vol. 24, 2001, p. 7.

KELLY, A. L. – McSWEENEY, P. L. H. 2002. Indigenous proteinases in milk. *Advanced Dairy Chemistry*, vol. 1, 2002, p. 494-519.

KUBICOVÁ, Ľ. – DOBÁK, D. 2012. [The development and the level of milk and milk product consumption in Slovak Republic and modulation of food demand in selected groups of families]. SPU Nitra, monograph, 2012, p. 88, ISBN 978-80-552-0821.

LAEVENS, H. – DELUYKER, H. – SCHUKKEN, Y. H. – DE MEULEMEESTER, L. – VANDERMEERSCH, R. – DE MUÊLENAERE, E. – DE KRUIF, A. 1997. Influence of parity and stage of lactation on the somatic cell count in bacteriologically negative dairy cows. *J. Dairy Sci.*, vol. 80, 1997, p. 3219-3226.

LARRY SMITH, K. – TODHUNTER, D. A. – SCHOENBERGER, P. S. 1985. Environmental mastitis: Cause, Prevalence, Prevention. *J. Dairy Sci.*, vol.68, 1985, p. 1531-1553.

LEITNER, G. – CHAFFER, M. – SHAMAY, A. – SHAPIRO, F. – MERIN, U. – EZRA, E. – SARAN, A. – SILANIKOVE, N. 2004. Changes in milk composition as affected by subclinical mastitis in sheep. *J. Dairy Sci.*, vol. 87, 2004, p. 46-52.

MALINOWSKI, E. 2001, Somatic cells in milk. *Medycyna Weterynaryjna*, vol. 57, p. 13-17.

MALLET, A. – GUÉGUEN, M. – KAUFFMANN, F. – CHESNEAU, CH. – SESBOUÉ A. – DESMASURES, N. 2012. Quantitative and qualitative microbial analysis of raw milk reveals substantial diversity influenced by herd management practice. *Int. Dairy J.*, vol. 27, 2012, p. 13-21.

O´BRIEN, B. – MEANEY, W. J. – McDONAGH, D. – KELLY, A. 2001. Influence of somatic cell count and storage interval on composition and processing characteristics of milk from cows in late lactation. *Australian J. Dairy Technol.*, vol. 56, 2001, p. 213-218.

PYÖRÄRLÄ, S. 2003. Indicators of inflammation in the diagnosis of mastitis. *Veterinary Res.*, vol. 34, 2003, p. 565-578.

RUPP, R. – BOICHARD, D. 2000. Relationship of early first lactation somatic cell count with risk of subsequent first clinical mastitis. *Livestock Prod. Sci.*, vol. 62, 2000, p. 169-180.

SANTOS, M. V. – MA, Y. – BARBANO, D. M. 2003. Effect of somatic cell count on proteolysis and lipolysis in pasteurized fluid milk during shelf-life storage. *J. Dairy Sci.*, vol. 86, 2003, 2003, p. 2491.

TANČIN, V. – IPEMA, A. H. – HOGEWERF, P. 2007. Interaction of somatic cell count and quarter milk flow patterns. *J. Dairy Sci.*, vol. 90, 2007a, p. 2223-2228.

TANČIN, V. – IPEMA, I. H. – HOGEWERF, P. H. – MAČUHOVÁ, J.: Sources of variation in milk flow characteristics at udder and quarter levels. *J. Dairy Sci.*, vol. 89, 2006, p. 978-988.

TANČIN, V. – UHRINČAŤ, M. – MAČUHOVÁ, L. – BRUCKMAIER, R. M.: Effect of pre-stimulation on milk flow pattern and distribution of milk constituents at a quarter level. *Czech J. Anim. Sci.*, vol. 52, 2007b, p. 117-121.

TONGEĽ. P. – BROUČEK, J. 2010 Influence of hygienic condition on prevalence of mastitis and lameness in dairy cows. *Slovak J. Anim. Sci.*, vol. 43, 2010. p. 95-99.