

RE-CLASSIFICATION OF COLLECTED RAW MILK BASED ON SOMATIC CELL COUNT (SCC) AND TOTAL BACTERIAL COUNT (TBC)

Marek Eugeniusz Jurczak, Krzysztof Zdziarski

*Department of Animal Breeding and Production,
Warsaw Agricultural University – SGGW, Warsaw, Poland*

Key words: raw milk classification, somatic cell count and total bacterial count in milk

Introduction

Poland is a Member State of the European Union with 10% participation of cow population and 8% milk production. Dairy quota is equal to almost 9 billion litres, what makes nearly 50% of the milk quotas, being totally granted to 10 states, which have recently become the members of the Community. The accession of Poland to the European Union has imposed the necessity of quick introducing the uniform quality standards for the collected raw milk by the Polish milk processing plants. At the end of 2006, the liquidation of the purchase of raw milk with total bacterial count (TBC), exceeding 100 000 bacteria and 400 000 somatic cells (SCC) in 1 cm³ of milk is anticipated ; it means the adaptation of Polish Standard PN-A-860002 to the EU Directives, i.e. to EU Directive 92/46 [6, 7, 8].

Material and methods

The studies were conducted in 2004, at the territory of a big Mazovian dairy plant (central part of Poland). The analysis included the results of laboratory tests of bulk milk, covering the period of 12 months of 2004. The collection of the data, embracing 56844 milk deliveries was divided into two seasons: summer season (V – X) and winter season (XI – IV), and two quality grades: Extra grade and grade I (according to Polish Standard). The data included hygienic parameters of the raw milk: SCC in 1 cm³, TBC in 1 cm³ of milk and chemical composition of the raw milk. The results of laboratory tests were statistically estimated (SPSS v.12), using the multi-factor analysis of variance, according to the following constant linear model:

Were:

$$Y_{ijk} = \mu + A_i + B_j + (AB)_{ij} + e_{ijk}$$

Y_{ijk} – level of the examined trait,

μ - overall mean,

A_i - effect of the i-th feeding season,

B_j - effect of the j-th grade of milk hygienic quality,

$(AB)_{ij}$ – effect of interaction between the feeding seasons and quality grade,

e_{ijk} - random error

Results

The results of the studies have been presented in tab.1 and fig.1. The studies showed a significant effect ($p \leq 0.01$) of the season of raw milk production on the level of TBC and SCC in milk. The higher level of the examined parameters of hygienic quality was found in the samples, collected during the summer period. Lactose content in the examined milk differed between the seasons and quality grades. According to the expectations, the level of lactose in the milk was lowered with the increase of the somatic cell count.

Total bacterial count (TBC) was the main reason for re-classification of the raw milk during the whole year (100%) to the worse quality grade (42%) while SCC determined the re-classification in 35%. Critical values of the both discussed parameters of hygienic milk quality were exceeded in almost 25% of milk deliveries of grade I. From among all raw milk deliveries, collected during summer season, the re-classification of 63% of the deliveries had place whereas in winter period, almost of 37%. In the summer season, the higher dominance of TBC than that of SCC, affecting the classification of milk was observed, as compared to the winter season. We should also mention a worrying phenomenon of frequent (almost 60% of milk deliveries of grade I) exceeding the level of somatic cell above value of 400 000.

Discussion

The results of the studies are coincident with other reports, characterizing hygienic quality of Polish raw milk [5, 6, 7]. The increased level of total bacterial count in the raw milk was accompanied by the rise of somatic cell count. The TBC was a dominating reason for re-classification of the raw milk. A small lowering of lactose level, as found in the bulk milk, was always co-existing with the increased SCC level what speaks for the presence of milk coming from the cows, suffering from sub-clinical *mastitis*. Lactose is an extremely sensitive biochemical indicator of functional state of the udder. The decrease of its level in milk, with the simultaneous rise of SCC level is an evidence of the decrease of production of all milk constituents by mammary tissue, thus, of fat and casein. The studies on the interaction between the factors brought an interesting observation: it was demonstrated that TBC level in Extra grade milk was practically unchanged between the seasons for critical value of 100 000 what supports the correctness of the technique of milk production and its cooling down, employed by the producers. During the summer period, the rise of SCC level in the both quality grades was stated as compared to the winter period what indicates the increased participation of the cows, suffering from sub-clinical forms of *mastitis* in milk production.

The discussed observations were also supported by the studies of Bramley and Dodd [1], Fitzpatrick [3], and Jayarao, Pillai, Sawant, Wolfgang and Hegde [4]. For Polish dairying, only two years have been left (till the end of 2006) for adaptation of the raw milk quality to the EU requirements [8]. Failure to meet the mentioned above condition may cause the limitation of the national milk quota for Poland [5, 6, 7].

Conclusions

The conducted studies indicate the necessity to intensify the work, connected with the improvement of milk hygienic quality in Poland, in respect of TBC and SCC.

Big differences in the number of milk deliveries of grade I between the seasons indicate the insufficient care of maintaining the hygiene during milk production and its cooling down during the warmer seasons of the year

The increase of milk yield from one cow, as necessary due to the reduction of cow population, may increase the difficulties in keeping the level of SCC, required for Extra grade of milk.

References

1. Bramley A.J., Dodd H.F. - *Reviews of the progress of dairy science: mastitis control-progress and prospects. J. Dairy Sci. 1984, 51: 481-512.*
2. De Haas Y, Veerkamp R.F., Barkema H.W., Gröhn Y.T., Schukken Y.H. – *Associations Between Pathogen-Specific Cases of Clinical Mastitis and Somatic Cell Count Patterns. J.Dairy Sci. 2004, 87: 95-105.*
3. Fitzpatrick J.L. - *Milk somatic cells – what do they do? Proceedings of British Mastitis Conference, Garstang, 2001, p 56-62.*
4. Jayarao BM, Pillai SR, Sawant AA, Wolfgang DR, Hegde NV, - *Guidelines for monitoring bulk tank milk somatic cell and bacterial counts. J. Dairy Sci. 2004, 87:3561-73*
5. Jurczak M. E., Zdziarski K., - *Analysis of the size of milk purchase and of the structure of quality grades in the period before the accession of Poland to the European Union. Ann. Wars. Agric. Univ. Anim. Sci. 2003, vol.41: 45 – 53.*
6. Jurczak M.E. - *Analysis of classification accordance of processing milk in Poland with the European Union standards. Ann.Wars. Agric. Univ. Anim. Sci. 2002, vol.39: 3 – 13.*
7. Kupczyk A., 2003. *Aktualna sytuacja polskiego mleczarstwa – szybka poprawa jakosci skupowanego mleka, niska kwota mleczna, nadal rozdrobniona baza surowcowa [Current situation of Polish dairying – a quick improvement of the purchased milk, low milk quota, still disintegrated raw milk resources]. Przegl. Mlecz.11: 412 – 414 [In Polish].*
8. *Rozporządzenie Ministra Rolnictwa i Rozwoju Wsi (polski odpowiednik Dyrektywy Rady Unii Europejskiej 92/46/EEC dotyczącej warunków zdrowotnych produkcji i wprowadzania do obrotu mleka surowego, poddanego obróbce cieplnej oraz przetworów mlecznych) z dnia 5 lipca 2002 roku, Dziennik Ustaw nr 117, poz. 1011 [Regulation of the Minister of Agriculture and Rural Development (Polish equivalent of the Council Directive 92/46/EEC of 16, June 1992 laying down the health rules for production and placing on the market of raw milk, heat-treated milk and milk-based products), of 5 July 2002, Official Journal of Laws no 117, item 1011 [in Polish].*

Tab. 1 The least square means (LSM) and standard errors (SE) of total bacterial count (TBC) and somatic cell count (SCC) and lactose level in bulk milk deliveries, depending on season of delivery and milk quality grade

FACTOR	N	TBC x 1000		SCC x 1000		LACTOSE	
		LSM	SE	LSM	SE	LSM	SE
Totalny	56844	109.76	0.18	257.50	0.56	4.666	0.001
FEEDING SEASON							
Summer	29050	115.29	0.23	272.27	0.71	4.655	0.002
Winter	27794	104.24	0.28	242.73	0.87	4.678	0.002
Significance level		p≤ 0,01		p≤ 0.01		p≤ 0.01	
MILK QUALITY GRADE							
Extra grade	44559	69.30	0.16	143.95	0.51	4.738	0.001
Grade I	12285	150.23	0.32	371.04	1.00	4.595	0.002
Significance level		p≤0,01		p≤0.01		p≤0.01	
INTERACTION							
Summer season x Extra grade	21268	68.99	0.24	161.88	0.73	4.722	0.002
Summer season x Grade I	7782	161.58	0.39	382.66	1.22	4.587	0.003
Winter season x Extra grade	23291	69.60	0.23	126.03	0.70	4.753	0.002
Winter season x Grade I	4503	138.87	0.51	359.42	1.60	4.603	0.004
Significance level		p≤0.01		p≤0.01		p≤ 0.01	

Fig.1 Reasons for re-classification of milk deliveries during a year (totally) and during the particular seasons

