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THE MILKABILITY AND SOMATIC CELL COUNTS OF MILK COWS IN VARIOUS SYSTEMS OF KEEPING AND MILKING**

P. Mijić[1*], I. Knežević[1], M. Matković[1], M. Baban[1], Z. Ivkić[2]

[1] Faculty of Agriculture in Osijek, Trg Sv. Trojstva 3, CRO-31000 Osijek, Croatia
[2] Croatian Livestock Center, Ilica 101, p.p. 160, CRO-10000 Zagreb, Croatia
*Corresponding author, e-mail: Pero.Mijic@pfos.hr
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Abstract: A high milk production, time limited milking and healthy udders are priority tasks at milking farms. The aim of our research was to study how different ways of keeping (free rang and tying) and milking (milking parlour, bucket machine and pipeline milking) influence on the mentioned cattle characteristics. Investigation was conducted at four milking farms and 382 Holstein cows in eastern Croatia. The variance analysis has shown significant difference (P<0,05) among researched farms for the milk yield per milking (MYM), the somatic cell count (LSCC) and the maximum milk flowing rate (MFR). Farms at which cows were kept and milked bound up in stables had more problems with udder health than farms at which milking was conducted at milking places. Also at these farms (at which cows were kept and milked bound up in stables) the maximum milk flowing rate was uneven, what was caused by uneven vacuum and obsoletes milking equipment. Keeping cows free at the stable and milking at a milking place have appeared to be more appropriate for cow's udder health, what finally influences a higher milking production. Such farms should be the future of modern milking production in Croatia.

Key words: milk yield, somatic cell count, milk flowing rate, milking method

Introduction

The way of keeping can have different influence on milk production and cow's udder health *(Brade,* 2002*)*. Today's recommendation of experts from the European Union is a free way of cow keeping for many reasons: stables with a free way of cow keeping are cheaper to build and also enable a

maximal mechanization use in the stable, milking parlour, feeding and cleaning out *(Hovi et al.,* 2003*; Kijlstra and Eijck,* 2006*)*. Many middle and eastern European countries have kept milking cows exclusively bound up. The same situation was also in Croatia until last 10 years *(Mijic et al.,* 2003*)*. The transition from one to another way of cow's keeping requires certain money investments into adaptation of objects, amongst which the milking place is important *(Hansen,* 1997*)*. However, it is necessary to know that even under the conditions of free keeping and milking at milking parlour, in certain situations a negative influence of different environmental factors on animals and their productivity can be revealed *(Tancin et al.,* 2004*)*.

Research showed that reactions to unfavourable environment are more explicit by more productive and improve animals and especially if they are held under unfavourable keeping conditions: closed objects, cows tied, bad airing, insufficient light *(Van den Wighe,* 1999*; Vaarst et al.,* 2005*)*. Therefore it is necessary to enable those animals specific environmental conditions and if those conditions are controlled then an illness occurrence is usually a consequence of human mistake or neglect *(Kupreus et al,* 2001*)*.

Material and methods

Four milking farms in eastern Croatia were chosen for research, which were in state property and today are privatised. Until privatisation all farms kept their cows bound up. After privatisation the object reconstruction was made, the way of keeping and milking changed at farms A and B, while at farms C and D were not any significant money investments (Table 1). Research was conducted on 382 Holstein cows.

Table 1. Characteristics of the investigated farms

Farm	Total no. cows at farms	No. of cows in investigations	Keeping	Milking method
A	350	61	Free rang keeping	Milking parlour 2x10
B	300	63	Free rang keeping	Milking parlour 2x11
C	280	129	Tying	Bucket machine milking
D	350	129	Tying	Pipeline milking

Each cow which was included into research was measured in the period between the 50th and 180th day of lactation both at morning or evening milking. All cows that were researched had to have a correctly morphological udder appearance and were not allowed to be treated from mastitis by the veterinarian. Measuring was conducted with the measuring unit Lacto-Corder (manufacturer WMB AG, CH-9436 Balgach) which controls milk production. The unit measured following parameters:

1. MYM: the milk yield per milking (kg),
2. MFR: the maximum milk flowing rate (kg/min),
3. SCC: the somatic cell count.

To make a normal distribution, the somatic cell count in milk was converted into logarithmic *(Ali and Shook,* 1980*)* by means of a formula (log2 (SCC/100.000) +3) and marked as LSCC. To compare the middle value of measured results a single variance analysis was used. A multiple comparison of middle values was performed by the Post Hoc Test and the LSD method at level $P<0,05$ in statistical program SPSS for Windows 11.0.

Results of investigations and discussion

The highest middle value for milking quantity per one milking was established at farm D (Table 2). These farms keep the cows bound up, and the milking is conducted into milk line. At farm C cows had the maximum flow rate and the highest value for LSCC. At those two farms there is a visible oscillation of the maximum flow rate what is most likely a result of uneven vacuum which at distant part of the stable is not the same as the one in the front.

Table 2. Milk yield per milking (MYM), maximum flowing rate (MFR) and logarithmic somatic cell count (LSCC) in milk for cows at researched farms

Farm	No. of cows	MYM, kg		MFR, kg/min		LSCC	
		Mean	SD	Mean	SD	Mean	SD
A	61	9,80	3,22	3,21	0,97	3,23	1,91
B	63	10,10	3,18	3,14	0,99	3,16	2,21
C	129	10,60	3,46	4,63	1,41	3,99	2,31
D	129	11,29	3,44	2,94	0,70	3,52	1,67

Extreme values of the maximum flow rate, both the fast and the low, at milking machines can harm the cow's udder health. Some previous research

showed that *(Roth et al.,* 1998*; Mijic et al.,* 2003*)*. Farms A and B performed milking at the milking place where higher protection possibility and udder hygiene is. The maximum flowing rate and a lower value of LSCC confirm that. The variance analysis showed a significant difference (P<0,05) between all compared parameters (Table 3). Such differences were expected because of different keeping and milking conditions at farms. Stables should be adjusted both to cattle and man. In that case a satisfactory milk production can be expected, but also the working efficiency at a farm will be higher *(Maller et al.,* 2005*)*.

Table 3. The variance analysis for researched characteristics of cows P<0,05*

Trait		Sum of Squares	DF	Mean Square	F
MYM	Between Groups	115,42	3	38,475	3,388*
	Within Groups	4292,29	378	11,355	
	Total	4407,71	381		
MFR	Between Groups	215,06	3	71,687	62,210*
	Within Groups	435,58	378	1,152	
	Total	650,64	381		
LSCC	Between Groups	40,34	3	13,447	3,251*
	Within Groups	1563,79	378	4,137	
	Total	1604,13	381		

The milk yield per milking was different (P<0,05) between farms A and D, and farms B and D (Table 4). Farms A and B had on average a smaller milk yield per milking compared to farm D (Table 2), so the significant difference was expected.

Table 4: Multiple comparison of middle values for milk quantity per milking

(I) Farm	(J) Farm	Mean Difference (I – J)	Std. Error	Sig.
A	B	-0,29	0,605	0,630
	C	-0,80	0,524	0,127
	D	-1,48	0,524	0,005*
B	C	-0,51	0,518	0,326
	D	-1,19	0,518	0,022*
C	D	-0,68	0,420	0,105

For table 4, 5 and 6: Sig.= P<0,05*

The reason for such significant difference was the fact that farms A and

B had a large number of cows in the first and second lactation. Those two farms were not only under object adaptation but the herd was also renewed with young cows. Those cows have not reached their maximum production yet compared to cows at farms C and D which were mostly in the third, fourth and fifth lactation. It is also important to mention that the milk production in stables with a free way of keeping can oscillate under cow's regrouping *(Hasegawa et al.,* 1997*)*.

Table 5: Multiple comparison of middle values for maximum flowing rate

(I) Farm	(J) Farm	Mean Difference (I – J)	Std. Error	Sig.
A	B	0,07	0,193	0,716
	C	-1,41	0,167	0,000*
	D	0,28	0,167	0,100
B	C	-1,49	0,165	0,000*
	D	0,20	0,165	0,215
C	D	1,69	0,134	0,000*

The maximum flow rate oscillated most at farm C (Table 5) which showed significant differences (P<0,05) in relation to other three farms. At this farm cows are kept bound up, and milking is performed in the stable, into bucket. Very old milking equipment at this farm can not respond to a modern milk production. It must also be considered that an old equipment at farms can jeopardize the safety of both working people and animals *(Zajdel,* 1999*)*.

Table 6: Multiple comparison of middle values for logarithmic somatic cell count

(I) Farm	(J) Farm	Mean Difference (I – J)	Std. Error	Sig.
A	B	0,072	0,365	0,844
	C	-0,754	0,316	0,017*
	D	-0,281	0,316	0,375
B	C	-0,826	0,313	0,009*
	D	-0,353	0,313	0,260
C	D	0,474	0,253	0,062

The health udder which was estimated according to the somatic cell count in milk was mostly disturbed at farm C and significantly differed between farms A and C, and farms B and C (Table 6). In his research *(Sawa,* 2004*)* claims that following factors were found to have a beneficial effect on

the hygienic quality of the milk: the free-stall system, milking in milking parlours or pipeline machines, milking machines regulated by pulsation, storing dairy utensils in, special rooms, the frequency of dairy utensil preservation according to their servicing instructions as well as cooperation with veterinary surgeons. Such experience could be applied to cattle farms in Croatia, what would demand significant investments into this cattle-raising sector.

Conclusion

Modern milk production demands certain changes in keeping and treating cows compared to previous ways represented in Croatia. The research results show that cows at farms with a free way of keeping and milking at milking places had a less somatic cell count than cows which were milked in stables. The flowing rate was also more uniform for milking at the milking place. Such indicators refer to a future production which would certainly be better by cows with a healthier udder.

MUZNE OSOBINE I BROJ SOMATSKIH ĆELIJA MLEČNIH KRAVA U RAZLIČITIM SISTEMIMA DRŽANJA I MUŽE

P. Mijić, I. Knežević, M. Matković, M. Baban, Z. Ivkić

Rezime

Visoka proizvodnja mleka, vremenski ograničena muža i zdravo vime krava prioritetni su zadaci na mlečnim farmama. Cilj našeg istraživanja je bio pručiti kako na ove navede osobine goveda utiču različiti sisemi držanja i muže. Merenja su provedena na četiri mlečne farme i ukupno 382 holstein krava u istočnoj Hrvatskoj. Analiza varijanse je pokazala signifikantnu razliku ($P<0,05$) između istraživanih farmi za količinu namuženog mleka u jednoj muži (MYM), broj somatskih ćelija (LBSS) i maksimalni protok mleka (MFR). Farme u kojima su krave držane i muzle u štali na vezu (mlekovod ili u kante) imale su više problema sa zdravljem vimena, od farmi u kojima je muža obavljana u izmuzištu. Također, na ovim prvo spomenutim farmama maksimalni protok mleka krava je bio neujednačen, na što je u

velikoj meri uticao neujednačeni vakuum i zastarela muzna oprema. Držanje krava slobodno u štali i muža u izmuzištu, pokazao se pogodnijim za zdravlje vimena krava, što će na kraju imati uticaja i na veću proizvodnju mleka. Ovakave farme bi trebale biti budućnost savremene proizvodnje mleka u Hrvatskoj.

Ključne reči: proizvodnja mleka, somatske ćelije, muzne osobine, muža

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