The effect of milking device disturbance on SCC in milk of dairy cows

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Summary

Control of the technical condition of pipeline milking systems DZ 100, DZ 100R, DZ2-020 and DZ2-030 was the object of the study. The apparatus Milko Test 2000 was used and 85 equipments were tested. We evaluated: vacuum of milk transfer and milking vacuum line, losses, caused by leakage in milk and vacuum lines, average free air capacity of pumps, pulsation rate, capacity of pipelines and performance of vacuum pump. The state of health in mammary gland was evaluated according to the somatic cell count in bulk samples of milk.

We found increased values of vacuum in 51.8 % equipmenst, leakages in 34.1 % equipments, and 52.8 % pulsators did not show the necessary pulsation rate. We found significant differences in SCC increase with leakage of milking vacuum line and poor capacity of vacuum line. Accumulated occurrence of faults influenced the SCC in milk negatively.

It is without doubt that the quality and function of the milking equipment create a part of the operation reliability for the breeder and participate in production of high quality milk. Well adjusted milking equipment performs milking of good quality and it contributes to acceptable frequency of occurrence of subclinical and clinical mastitis. With the polyfactorial character of mastitis can a possible effect of milking equipment on udders result in higher frequency of mastitis occurrence as a result of more numerous bacterial infections. In our country prevail tying stalls with milking into pipes performed on the standing during the period of decrease in dairy cows population in spite of reconstructions of stables and investments in the milking technique at present.

Klátik (1987) mentioned that if the process of milk gaining is not in line with the needs of dairy cows its components operate inhibitively and it affects negatively the release of milk from the milk gland and the transfer of infectious mastitis is more often. Škarda *et al*. (1990) give that bad functioning of the milking equipment participates with 7 % in the rise of

mastitis. Worstorff (1976) mentioned in his work that the fluctuation of underpressure in the milk circuit of the milking equipment causes the rise of back flows which can enable the inner transfer of mastitis. Bradnová and Ryšánek (1989) observed the negative dependence (r=-0.25 to 0.31) between the reserves of performance in the vacuum pump of the milk and underpressure circuit in the pipeline milking equipment and SCC in bulk samples of milk. Zitrický *et al*. (1990) set the level of function parameters in the pipeline milking equipments by the apparatus Milkotest 2000 and studied worsening of milking abilities in them in dependence on period of operation.

Key words*: Cows, milking, pipeline, milking equipment, somatic cell count, pulsation rate*

Introduction

The level of underpressure recommended for the use in practice changes considerably in consequence of relations between the milking efficiency (performance of milking parlours, etc.) and health condition in dairy cows (Hamann *et al*., 1994 and Mihina *et al*., 1998).

Material and methods

Results of thechnic controls of milking equipments in randomly selected agricultural enterprises in SR are embraced in the evaluation. We evaluated totally 85 pipeline equipments (DZ 100, DZ 100R, DZ 2-020, DZ 2-030) in 2 - 4 line tying stalls with milking on the standing. The construction and function of the mentioned types of milking equipments are on the same level, therefore they were evaluated as one type characterizing the pipeline system of milking. The apparatus Milko-Test 2000 was used for the measurements.

We studied:

- the values of underpressure in the milking equipment for the milk circuit and underpressure distributor (kPa) during milking;
- accuracy of measurement by vacuometer (deviations in kPa);
- losses of underpressure caused by leakage in the milk circuit and underpressure distributor (l / min);
- average air consumption per 1 set (l / min);
- number of impulses per minute;
- capacity of underpressure distributor (l / min);
- output of the vacuum pump of milk and air circuits (l / min).

Health condition of the mammary gland in the studied herds was characterized by the somatic cell count (SCC) in bulk samples of milk. SCC was assessed by the apparatus Fossomatic 90.

The results were evaluated by the basic statistical methods and significance of differences between averages was tested by t-test. The values of functional parameters of the milking equipment were classified according

to the recommended values with respect to their distribution and relative frequences of disorders were calculated. The so called "more serious disorders" which cause deterioration of the mastitis situation were selected on the basis of t-values from the tests of differences in SCC. The milking equipment was classified according to the number of these disorders.

Results and discussion

Underpressure in milk circuit and in underpressure distributor

Results in table 1 show that the increased values of underpressure in the milk circuit occur quite often (51.8 %). Lower values were noticed only in 3.1 % milking equipments. The average value of the set 54.6 kPa in the equipment we studied was higher than the recommended value. SCC was tested at the underpressure 54 kPa and higher. Increased SCC was noticed with higher underpressure, it was statistically nonsignificant.

Underpressure in the underpressure distributor also exceeded on average the recommended values slightly. High values of underpressure were noticed in 83.5 % cases, only 2.9 % and 13.6 % cases approached the recommended values. Statistically nonsignificant rise of CSS was observed at milking with higher underpressure, too.

Table 1. Underpressure in milk circuit and in underpressure distributor.

Vacuum of milk transfer				
Recommended value 50.0 kPa	Whole set	< 51 kPa (a)	51-54 kPa (b)	> 54 kPa (c)
n	88	3	41	44
	85	3	41	44
$x \pm s_x$	54.6 ± 2.5	49.6 ±3.1	52.8 ± 2.1	57.6 ± 2.6
%	100	3.1	45.1	51.8
SCC thousand / ml				
n	88	3	41	44
$x \pm s_x$	323 ± 80	320 ± 63	319 ± 74	329 ± 82

Significance of differences in SCC- non significant

Vacuum line				
Recommended value 50.5 kPa	Whole set	< 50.5 kPa (a)	50.5-51.1 kPa (b)	>51.1 kPa (c)
n	85	2	12	71
	85	2	12	71
$x \pm s_x$	53.8 ± 2.7	49.8 ± 2.0	50.9 ± 1.8	52.8 ± 1.9
%	100	2.9	13.6	83.5
SCC thousand / ml				
n	85	2	12	71
$x \pm s_x$	319 ± 78	313 ± 69	314 ± 77	320 ± 78

Significance of differences in SCC- non significant

Losses of underpressure caused by leakage in milk circuit and in underpressure distributor

Table 2 shows that average losses of underpressure caused by leakage in the milk circuit were lower than those which are the maximum tolerated. Higher losses were noticed in 36.8 % cases. Important is the significant increase of SCC with greater air leakage in the underpressure distributor (SCC 308 ths / ml or 309 ths / ml with standard level of leakage, it rose to 361 ths / ml, losses rose to more than 40 l / min.; the difference was 21 %).

Table 2. Losses caused by leakage in milk circuit and in underpressure distributor

Milk transfer				
Recommended value max. 67 l / min.	Whole set	< 20 l / min. (a)	21-40 l / min. (b)	>40 l / min.(c)
n	85	29	25	31
$x \pm s_x$	48.5 ± 39.8	18.3 ± 9.8	32.6 ± 29.8	43.2 ±16.9
%	100	34.2	29.0	36.8
SCC thousand / ml				
n	85	29	25	31
$x \pm s_x$	322 ± 75	300 ± 69	301 ± 71	341 ± 82

Significance of diferences in SCC a:c+, b:c+

Vacuum line				
Recommended value 50 l / min.	whole set	≤ 20 l / min. (a)	21-40 l / min. (b)	>40 l / min.(c)
n	85	42	14	29
$x \pm s_x$	49.3 ± 59.5	19.7 ± 31.6	33.8 ± 42.8	43.9 ± 39.6
%	100	49.5	16.4	34.1
SCC thousand / ml n		42	14	29
$x \pm s_x$		308 ± 59	309 ± 64	361 ± 93

Significance of diferences in SCC a:c++, b:c++
+ P<0,05 ++ P<0,01

Average consumption of air per machine

The values in table 3 show that the average consumption of air in the studied equipment was 20.6 l / min., i.e. in the middle of recommended span. Undesirable lower consumption was in 19.9 % studied equipments, higher in 18.5 %. The differences in SCC were nonsignificant.

Table 3. Average consumption of air per one set.

Recommended value 15-25 l / min.	Whole set	<15 l / min. (a)	15-25 l / min. (b)	>25 l / min.(c)
n	85	17	52	16
x ± s_x	20.6 ± 7.5	13.9 ± 6.9	20.1 ± 7.9	27.3 ± 8.3
%	100	19.9	61.6	18.5
SCC thousand / ml				
n		17	52	16
x ± s_x		310 ± 57	323 ± 76	319 ± 80

[3]Significance of differences in SCC - nonsignificant

Number of pulses in milking machines

From 340 tested pulsators pulsed 35.7 % on lower and 17.1 % on higher than recommended frequency (Table 4). It means that 52.8 % pulsators did not show the necessary frequency. Higher frequency in pulsators increased SCC to 331 ths / ml (nonsignificant). The analysis of this state shows further reserves in maintenance of milking technique in practice.

Table 4. Average number of pulses.

Average pulsation rate Recommended value 50±4	Whole set	< 46 (a)	46-54 (b)	> 54 (c)
n	340	121	160	59
x ± s_x	48.3 ± 6.5	44.8 ± 7.9	50.3 ± 5.9	58.3 ± 6.8
%	100	35.7	47.2	17.1
SCC thousand / ml				
n	85	30	40	15
x ± s_x	321 ± 71	324 ± 63	314 ± 73	331 ± 80

Significance of differences in SCC - nonsignificant
-P>0,05

Capacity of underpressure distributor

The average capacity of underpressure distributor exceeded markedly the tolerated minimum (Table 5); 13.4 % cases did not meet this request. It is an important effect as SCC increases markedly with insufficient capacity (359 vs. 314 ths / ml, P<0.01).

Table 5. Capacity of underpressure distributor.

Recommended value min.200 l / min.	Whole set [2]	< 200 l / min. (a)	>200 l / min. (b)
n	85	11	74
$x \pm s_x$	329 ± 129	189,0 ± 89	428 ± 131
%	100	13,4	86,6
SCC thousand / ml			
n	85	11	74
$x \pm s_x$	320 ±72	359 ± 73	314 ± 72

Significance of differences in SCC a:b++

Performance of vacuum pump in milk circuit and in underpressure distributor

Table 6 shows that 13.1 % milking equipments worked with insufficient performance of the vacuum pump. It did not affect the occurrence of CSS significantly.

Table 6. Performance of vacuum pump in milk circuit.

Recommended value min.700 l / min.	Whole set	< 700 l / min. (a)	>700 l / min. (b)
n	85	11	74
$x \pm s_x$	854 ± 159	698 ± 132	998 ± 169
%	100	13,1	86,9
SCC thousand / ml			
n	85	11	74
$x \pm s_x$	321 ± 75	324 ± 50	320 ± 79

Significance of differences in SCC - nonsignificant

Effect of parallel occurrence of more serious defects on mastitis frequency in herd

The so called “more serious faults” of milking equipments were selected during the study of effects of defects on SCC. The choice shows that the underpressure changes and mechanical stressing of tissue in udder and teat are the most common faults:

1. underpressure in milk circuit >54 kPa;
2. losses by leakage in milk circuit and underpressure distributor >40 l / min.;
3. average number of pulses <46 and >54;
4. capacity of underpressure in air distributor <200 l / min.

We analysed the effect of parallel occurrence of these faults on SCC (Table 7). Without these four more serious faults worked only 16.6 % milking equipments. Two parallel faults were observed in 34.6 %, and in 2.8 %

Table 7 Mastitis occurrence in dairy cows (SCC) according to the occurrence of faults on milking equipment (ME).

Number of defects	Number of ME		SCC thousand / ml	
	ks	%	$x \pm s_x$	t
0	14	16.6	311 ± 62	
1	25	28.9	309 ± 70	
2	29	34.6	333 ± 80	
3	15	17.1	346 ± 87	
4	2	2.8	344 ± 77	+++
Total	85	100.0	325 ± 75	

+++ P<0,01

milking equipments were all 4 present. SCC shows continuous, marked to statistically significant rise with rising number of faults. Cumulation of faults manifests itself as a marked risk factor.

The results show quite high number of faults on milking equipment and their often accumulated occurrence and effect on SCC in milk. It is necessary for the agricultural practice not to depreciate the effect of milking equipment on mastitis occurrence and to perform the maintenance and repair of the milking equipment to prevent disorders in dairy cows.