Effect of two milking systems on the milking performance of dairy cows over a complete lactation

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Summary

Dairy cows were milked with either of two milking systems over a complete lactation. Milking system 1 (WB) had of a heavy cluster weight and wide-bore tapered liners. Milking system 2 (NB) used a light cluster weight and narrow-bore liners. There was no significant difference between milking systems for milking time, milk-flow rate, gross milk composition or new infection rate. Milk yield was ($P<0.08$) higher at the morning milking for WB than for the NB milking system. There was a significant ($P<0.001$) interaction for all parameters with lactation stage and a system x stage interaction ($P<0.01$) for somatic cell count (SCC), with NB tending to have higher SCC during lactation than the WB milking system. Both systems gave satisfactory milking performance.

Key words: *Dairy cows, milking systems, teat tissue*

Introduction

In Ireland cows are milked with milking machines using heavy clusters, and wide-bore tapered liners or with an alternative milking system, which incorporates a light cluster weight and narrow-bore tapered liners. Vacuum at the teat-end, was shown to be 7kPa higher for wide-bore liners with simultaneous pulsation patterns as compared to narrow-bore liners using an alternate pulsation pattern (O' Callaghan, 1998). This increased vacuum may affect milking time (Gleeson *et al.*, 2003) and changes in teat thickness (Hamann *et al.*, 1993), which is associated with higher infection rates (Zecconi *et al.*, 1992). The objective of this study was to compare the affect of two milking systems on milking characteristics, SCC and teat tissue over a complete lactation.

Material and methods

Fifty-six Holstein-Friesian dairy cows were assigned to either of two milking systems at calving. Milking system 1 (WB) consisted of a heavy cluster weight (3.2kg) with a claw volume of 150ml, wide-bore tapered liners (31.6-21.0mm) and a simultaneous pulsation pattern. System 2

(NB) used a light cluster weight (1.65kg) with a claw volume of 275ml, narrow-bore tapered liners (25.0–21.0mm) and an alternate pulsation pattern. All cows were milked in a 14-unit, 80-degree side-by-side milking parlour, using id-13.5mm long milk tubes, with a milk lift of 1.5m above the cow standing. Cows were milked at intervals of 16h and 8h. Milk yield (kg), milking time (sec) and peak milk flow-rate (l/min) was recorded daily. The pulsation rate was 60 cycles/min and pulsator ratio was 65.1 and 68.4 % for NB and WB milking systems, respectively. The system vacuum level was 48kPa and system vacuum reserve was 870-l/min. Milk samples were measured weekly for fat, protein and lactose percentage and biweekly for SCC. Changes in teat tissue after machine milking were measured during mid and late lactation using ultrasonography. The measurements recorded were teat canal length, teat diameter thickness, cistern diameter, teat wall thickness and teat length. Measurements of teat tissue (mm) are presented as the mean changes in values per teat directly after milking as compared to pre-milking values.

Results and discussion

There was no significant difference in lactation milk yield between milking systems. However, morning milk yield tended to be higher ($P<0.08$) for the WB system as compared to the NB system. There were no differences between milking systems for milking time, milk butterfat, protein, lactose percentages and SCC. There was a significant ($P<0.001$) interaction for all measurements with lactation stage. This interaction could be expected as milk yield per cow is reduced as the lactation progresses. There was a system x stage interaction for SCC ($P<0.01$) and peak milk-flow-rate ($P<0.08$). NB tending to have higher SCC during the lactation than the WB milking system and a higher peak flow-rate during the latter part of lactation. Increased changes in the cistern diameter ($P<0.001$) and teat wall thickness ($P<0.01$) were shown with WB as compared to the NB milking system at the mid lactation stage. While changes in teat diameter tended to be higher with the WB system as compared to the NB system, these changes did not result in higher infection rates. There was no difference in the incidence of clinical mastitis or sub-clinical mastitis between systems. The number of cows with clinical mastitis was 9 (15 cases) and 13 (16 cases) for WB and NB milking systems, respectively.

Table 1. Mean daily milk yield, milking time, peak milk flow-rate, and somatic cell count for WB and NB milking systems for the complete lactation.

	WB	NB	SED	Lactation Stage (*P*)	System (*P*)	Lactation Stage x System (*P*)
Milk yield AM (kg/c/)	13.40	12.73	0.42	0.001	0.08	NS
Daily milk yield (kg/c)	20.19	19.47	0.70	0.001	NS	NS
Daily milking time*	0.054	0.055	0.003	0.001	NS	NS
Daily peak flow-rate (l/min)	3.22	3.31	0.18	0.001	NS	0.08
SCC (Log_{10})	4.76	4.89	0.11	0.001	NS	0.01

*Milking time= (yield/time*100) SED: standard error of differences

Table 2. Effect of milking system on mean teat-tissue changes (mm.)

	Mid lactation				Late lactation			
	WB	NB	s.e.d	Sig	WB	NB	s.e.d	Sig
Canal length	2.11	1.89	.52	NS	1.86	1.54	0.63	NS
Teat diameter	1.16	0.84	.34	NS	1.08	0.43	0.39	NS
Cistern diameter	-5.85 [a]	-4.31 [b]	.46	0.001	-7.23	-6.23	0.63	NS
Wall thickness	2.21 [a]	1.26 [b]	.32	0.01	2.67	2.59	0.32	NS
Teat length	7.7	5.5	2.85	NS	7.34	4.89	1.84	NS

[ab] Means, within rows, with different superscripts differ significantly P<0.05 for milking system

References

Gleeson, D.E., O'Callaghan, E.J., Rath,M., 2003: Effect of vacuum level on bovine teat-tissue and milking characteristics. Irish Journal of Agricultural and Food Research. 42; 205-211.

Hamann, J.,Mein, G.A., Wetzel, S., 1993:Teat tissue reactions to milking: effects of vacuum level. Journal of Dairy Science 76:1040-1046.

O'Callaghan, E., 1998: Measurement of vacuum in the cluster, using a milk-flow simulator. Irish Journal of Agricultural and Food Research. 37; 137.

Zecconi, A., Hamann, J., Bronco, V., & Ruffo., G., 1992: Machine induced teat tissue reactions and infection risks in dairy herds free of contagious mastitis pathogens. Journal of dairy research 59;265-271.