Effect of Agent-Specific Clinical Mastitis on Milk Yield in Dairy Cows.

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SUMMARY

Our aim was to estimate agent-specific (*Streptococcus* spp., *Staphylococcus aureus*, *Staph.* spp., *Escherichia coli*, *Klebsiella* spp., 'no agent isolated') clinical mastitis (CM)'s effects on weekly milk yield (MY) in 3071 cows in 2 New York farms. We fit a mixed model and classified MYs as to when they occurred in terms of CM onset.

In Parity 1 cows 'no agent isolated' caused the largest losses; in older cows *Klebsiella* spp. was most detrimental. In all cows MY fell most just after diagnosis (AD). The tendency for higher producers to contract CM may mask its impact on cow health and production. This study may help clarify CM's effect on MY.

INTRODUCTION

CM is common (1). Earlier we fit a mixed model to study how CM (without agent identification) affects MY (2); losses varied with time of CM onset. Our aim in this study was to estimate the effects of agent-specific CM (*Strep.* spp., *Staph. aureus*, *Staph.* spp., *E. coli*, *Klebsiella* spp., 'no agent isolated') on MY in 2 NYS farms.

MATERIALS AND METHODS

We had 1277 cows in Farm A and 1794 cows in Farm B. Data were collected from 10/1/1999-7/31/2001 (A) and from 10/1/1999-3/31/2001 (B). Milk samples were taken from cows at CM onset and were sent to QMPS for microbiological culture.

To study the agents' effects on daily MY, we used PROC MIXED (3) with an auto-regressive covariance structure: MYs closer in time are more highly correlated than MYs further apart. For each agent we made an index to group MYs in relation to CM onset (Table 1). Losses due to an agent were compared to agent-free cows' MY.

Parity 1 and 2+ cows were analyzed separately, as their lactation curves differ. After restricting followup to the 1st 50 wk in milk in the mixed model analysis, we had 1028 Parity 1 cows (24,411 MYs) and 2004 Parity 2+ cows (44,929 MYs).

RESULTS AND DISCUSSION

The lactational incidence risk and median DIM of CM by farm and parity, by agent, are in Table 2. CM was more common in older cows. The lower incidence of CM in Farm B may be due to management: only more severe cases were cultured there.

Milk Losses Among Parity 1 Cows (Table 3)

Cows with *Strep.* spp. had a drop in MY AD. The largest and only significant drop was just AD. Median time of diagnosis was 2 DIM; most losses were early in lactation. Recovery occurred some weeks AD. *Strep.* spp. did not adversely affect MY beyond one wk AD.

Until just before diagnosis (BD), *Staph. aureus* did not affect MY. It then dropped and did not fully recover. CM cows gave 8 kg/d less milk in the 2 wk AD; MY then increased, but was still less than non-CM cows' MY. This agent is detrimental to MY: it caused large losses long AD.

The largest drop in MY associated with *Staph.* spp. was in the week AD, but was not statistically significant. Daily losses then fluctuated from 1-3 kg/d, but were not statistically significant. *Staph.* spp. thus do not appear to be highly costly.

E. coli cows gave 6.7 kg less milk daily in the 1st wk AD, and about 5 kg/d less the next 3 wk. Cows with *E. coli* did not completely recover their production.

Klebsiella spp. cows' MY dropped in the 1st wk AD, recovered a bit, and fell 6 wk later. Although difficult, CM control programs should attempt to control this agent.

For 'No agent isolated', milk loss was significant and persistent. Significant milk loss began the week BD. Losses were >7 kg/d the next 2 wk and remained high. This shows that cases of CM with no agent isolated include severe cases.

Milk Losses Among Parity 2+ Cows (Table 3)

BD, cows with *Strep.* spp. gave more milk than non-CM cows; the largest difference was 3-4 wk BD. One wk BD, the opposite trend arose: cows with *Strep.* spp. gave less milk than non-CM cows. Higher yielding cows may be susceptible to *Strep.* spp.

Cows with *Staph. aureus* had a milk loss pattern akin to that of *Strep.* spp., but their MY BD did not differ much from non-CM cows' MY. The worst drop was in the wk AD, followed by smaller losses. *Staph. aureus* caused no milk loss BD.

Staph. spp. had no adverse effect on MY; indeed, cows with *Staph.* spp. CM had higher MY. This agent is therefore not associated with milk loss in older cows.

Cows with *E. coli* gave more milk BD than non-infected cows, but AD, the former's MY dropped sharply. In the 1st wk alone, cows with *E. coli* lost 13 kg of milk each day. Losses then tapered off slowly. *E. coli* is thus an important agent in dairies.

Klebsiella spp. had no effect on MY BD. The largest drop was in the week AD; later losses were smaller, and still significant. Based on the large, persistent milk losses, *Klebsiella* spp. is a cause for concern among older cows.

CM cows with no agent isolated produced much more milk BD, but for several weeks AD, they had significant milk loss. Losses were then smaller; by 43 d AD, they were insignificant. This type of infection does not seem as important as others.

CONCLUSIONS

Milk loss due to CM varied by agent. A subclinical effect often arose BD, as MY began to drop. The milk losses were greatest soon AD, and for some agents persisted long AD. The study may help farmers by seeing when in lactation which agents are most detrimental to cows, in terms of their milk production.

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Table 1. Values of mastitis index variable[1] for sample CM cow, for analyzing effect of mastitis on MY.

DIM	Day of CM	Value of Mastitis index	Interpretation of mastitis index
11	42	1	Milk yields (MYs) recorded ≥29d before diagnosis
18	42	2	MYs recorded 22-28d before diagnosis
. . .	. . .	. . .	. . .
39	42	5	MYs recorded 1-7d before diagnosis
46	42	6	MYs recorded 0-7d after diagnosis
53	42	7	MYs recorded 8-14d after diagnosis
. . .	. . .	. . .	. . .
109	42	15	MYs recorded 64-70d after diagnosis

[1]Another level, the reference, was for cows that did not have the type of CM being modeled.

Table 2**.** Lactational incidence risk (and median DIM) of agent-specific CM by parity, in 2 NYS farms.

Agent							
Farm	Parity	*Strep.* spp.	*Staph. aureus*	*Staph.* spp.	*E. coli*	*Klebsiella* spp.	None isolated
A	1	6.7% (1)	1.9% (1)	2.4% (1)	6.2% (76)	0.8% (260)	4.0% (12)
	2+	10.5% (105)	5.4% (106)	2.5% (83)	11.1% (104)	5.6% (110)	8.8% (101)
B	1	1.1% (96)	1.1% (97)	0.6% (55)	1.5% (86)	0.8% (108)	1.5% (58)
	2+	3.1% (74)	1.6% (105)	2.1% (160)	3.8% (96)	3.4% (104)	2.3% (82)

Table 3. Effects of (*Strep.* spp., *Staph aureus*, *Staph.* spp., *E. coli*, *Klebsiella* spp., 'none isolated') CM on MY (kg/d) in Parity 1 (1st number in each cell) and Parity 2+ cows (2nd number) in 2 NYS farms.

Effect	*Strep.* spp.[a]	*Staph. aureus*	*Staph.* spp.	*E. coli*	*Klebsiella* spp.	None isolated
≤29d pre	0.8, 2.7*	1.0, 1.8	-2.0, 2.3*	1.0, 1.6*	2.3, 1.3	-2.1, 3.0*
22-28d pre	0.2, 3.1*	-0.9, 0.6	-2.8, 2.7*	1.5, 2.1*	1.3, 1.0	-0.7, 2.8*
15-21d pre	2.6, 2.7*	-1.1, 0.3	-1.5, 2.6*	2.0, 2.4*	2.2, 1.5	-0.8, 2.5*
8-14d pre	0.2, 2.2*	0.7, 1.0	-1.3, 2.4*	2.6*, 2.3*	0.2, 0.8	-0.9, 3.0*
1-7d pre	1.04, -1.5	-2.7, -0.2	0.3, 2.0	0.7, 0.1	0.2, -1.7	-3.3*, 0.1
0-7d post	-2.5*, -5.6*	-8.4*, -5.5*	-3.2, 0.2	-6.7*, -13.1*	-7.6*, -9.9*	-7.2*, -5.5*
8-14d post	-1.2, -4.1*	-8.0*, -3.7*	-1.6, 1.4	-4.7*, -7.2*	-4.7*, -7.8*	-7.0*, -4.1*
15-21d post	-1.7, -4.4*	-6.4*, -3.3*	-2.1, 1.2	-4.9*, -4.6*	-4.3, -6.2*	-6.4*, -2.5*
22-28d post	-1.7, -3.8*	-4.4*, -3.6*	-1.3, 0.2	-5.0*, -4.2*	-2.8, -4.8*	-5.4*, -2.5*
29-35d post	-1.1, -3.3*	-3.5, -3.8*	-2.3, 0.8	-2.7*, -2.9*	-4.4, -4.1*	-5.7*, -2.1*
36-42d post	-1.04, -2.9*	-5.4*, -4.3*	-3.2, 1.8	-2.7*, -2.8*	-3.3, -3.9*	-5.3*, -1.9*
43-49d post	-0.4, -2.6*	-4.5*, -3.2*	-2.7, 1.9	-3.4*, -1.8	-7.0*, -3.2*	-4.1*, -1.3
50-56d post	1.1, -1.8	-3.7*, -2.3	-2.6, 1.0	-2.6*, -0.9	-6.7*, -2.7*	-3.5*, -1.7
57-63d post	1.2, -2.3*	-3.3, -2.2	-3.1, -0.4	-2.2, -1.5	-5.3, -1.9	-4.1*, -0.6
64-70d post	1.1, -2.2*	-1.8, -2.7*	-2.1, -1.1	-1.5, -2.1*	-5.2, -2.6*	-3.2*, -0.1

[a]Values are the amount of milk (kg) lost (or gained) per day in the week shown. E.g., Parity 1 cows with *Strep.* spp. produced 2.5 kg less milk per day in the 1st week after diagnosis, compared to cows without *Strep.* spp. A positive value indicates that CM cows produced more milk than non-CM cows.
*p<0.05