ASSESSMENT OF ROBOTIC MILKING IN WISCONSIN

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Abstract. *Changes in milking performance and milk quality were followed on 45 multiparous Holsteins before and after implementation of a robotic or automatic milking system (AMS). After an initial monitoring week, approximately half of the herd was randomly assigned to be milked with the robot; the remaining half remained as control cows and continued to be milked twice daily in the parlor. Records of milking performance were followed for a total of four weeks on all cows; records of milk quality were followed for a total of three months on all cows. No significant changes in milk yield were observed between the robot and control cows during the first three weeks of AMS use; however, average daily machine-on time increased significantly for the robot cows in weeks two and three while average flow rate decreased significantly for the robot cows in week two. No significant differences were found in the geometric mean of individual cow somatic cell counts between the robot and control groups after one and two months of AMS use.*

Keywords. *Robotic milking, automatic milking, milk quality, milk yield, milking time, average flow rate, SCC, CMT.*

INTRODUCTION

This paper provides some preliminary data on the milking performance and milk quality of the second robotic milking installation in the US, located at the University of Wisconsin's Emmons Blaine Dairy Cattle Research Center in Arlington, WI. This study is reports initial findings of a comparison trial between cows milked with a robot, or automatic milking system (AMS), and cows milked in a conventional parlor.

Past studies on robotic milking with a robot herd and control herd have found either significantly less daily milk yield with robotic milking (Kremer and Ordolff 1992) or no significant changes in milk yield (Svennerstein-Sjaunja et al. 2000, Ordolff and Artmann 2000). Ordolff and Artmann (2000) report no significant changes in machine-on time or milk flow rate with robotic milking. Pomiès and Bony (2000) found no significant changes in SCC between of cows milked with a robotic system and cows milked in a conventional parlor.

OBJECTIVE

The objective of this study was to document and compare changes in milking performance and milk quality of cows milked in an AMS as compared to a conventional milking parlor.

MATERIALS AND METHODS

The milking performance and milk quality of 45 multiparous Holsteins in mid-lactation was monitored for a total of three months. Initially, all cows were milked twice daily in a double-six herringbone parlor. After the initial week (week 0) approximately half of the herd was randomly assigned to be milked by the robot; the remaining half remained as control cows and continued to be milked twice daily in the parlor. All cows were housed in the same 100-cow freestall barn within two separate pens.

The robot is a single-box system with voluntary cow traffic encouraged by two one-way gates at each end of the barn. Cows must pass though the AMS to move from the resting area to the feeding area. Concentrate is fed in the AMS to encourage entry and keep cows calm during unit attachment. Cows with milking intervals of more than 12 hours were forced through the robot, which ensured all cows were milked at least twice daily. Average daily milk yield, average daily machine-on time and average daily milk flow rate was followed on both groups for a total of four weeks; geometric mean of individual cow somatic cell count and California Mastitis Test (CMT) scores were also followed for both groups for three months. The SCC was obtained through DHIA records; a CMT was performed two to three times weekly on each cow at milking time.

RESULTS AND DISCUSSION

MILKING PERFORMANCE

Average Daily Milk Yield

The average daily milk yield for robot and control cows is shown in Table 1. Though not statistically significant, during the first week of robotic milking the 19 cows milked robotically averaged 5 kg less daily milk yield than the control group. No drop in yield was apparent in the second week when 10 more cows were added to the robotic milking group and there were no significant differences in daily milk yield between cows milked in the parlor and the robot during weeks 2 and 3. This finding agrees with previous work of Svennerstein-Sjaunja et al. (2000) and Ordolff and Artmann (2000).

Table 1. Average daily milk yield of control (parlor) and robot cows. All cows were milked in parlor during week 0.

	Control		Robot	
	Yield (kg)	no. of cows	Yield (kg)	no. of cows
Week 0	32.3 ± 4.0	16	31.4 ± 1.7	29
Week 1	31.6 ± 4.1	16	26.8 ± 2.4	19
Week 2	32.0 ± 3.3	16	31.0 ± 1.8	29
Week 3	30.8 ± 3.3	16	31.3 ± 2.1	28

Average Daily Machine-on Time

The average daily machine-on time is shown for robot and control cows in Figure 1. Contrary to Ordolff and Artmann (2000), average daily machine-on time increased significantly for the robot cows in weeks two and three. This finding seems logical as the robot cows were being milked more frequently than the control cows. Table 2 illustrates the milking patterns of the robot herd.

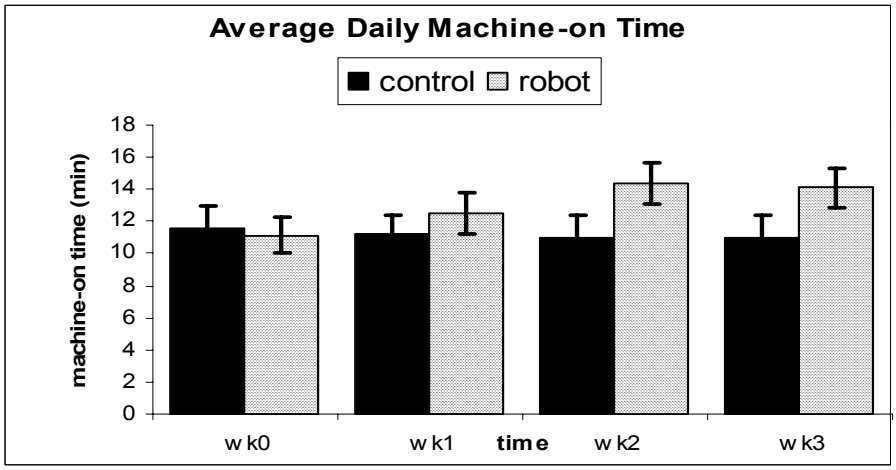

Figure 1. Average daily machine-on time for control and robot cows.

Table 2. Milking pattern of robot cows.

	Week 1	Week 2	Week 3
Herd size (no. of cows)	19	29	28
Average number of milkings	3.2	3.4	2.8
Percentage of cows visiting more than twice daily	63%	90%	64%

Since the robot cows were forced through the robot if they have not been milked in the past 12 hours, more than half of the herd was visiting voluntarily at least once daily for the entire three-week testing period. This finding is consistent with the findings of van't Land et al. (2000) who reports visits ranging from 2.9 to 2.7 milkings per cow per day with semi-free and controlled cow traffic.

Average Daily Milk Flow Rate

The average daily milk flow rate is shown for robot and control cows in Figure 2. Contrary to Ordolff and Artmann (2000), average flow rate decreased significantly for the robot cows in week two and was extremely close to a significantly lower flow rate in weeks one and three. Since flow rate was calculated for each milking, it is uncertain why the flow rate was decreased for the robot cows.

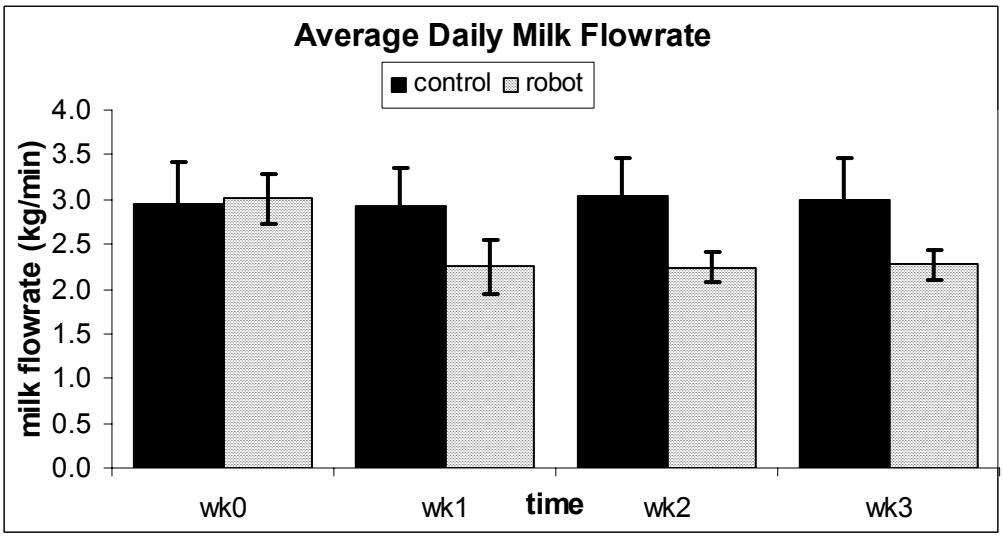

Figure 2. Average daily milk flow rate for control and robot cows.

MILK QUALITY

Somatic Cell Count

The geometric mean of individual cow somatic cell counts before starting the trial and after one month of milking is shown in Figure 3. Similar to the findings of Pomiès and Bony (2000), there were no significant differences within the control group, within the robot group or between the robot and control groups. The upward trend for both robot and control cows is most likely due to the entry of infected cows into both groups during the second month of milking.

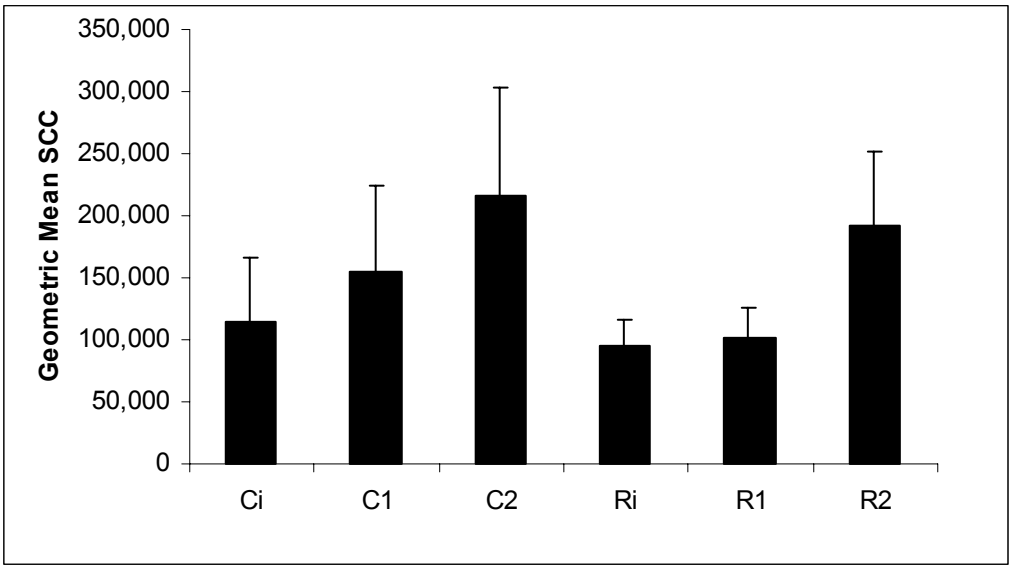

Figure 3. Geometric mean and standard error of control cows before entry (Ci) and after one month (C1) and 2 months (C2) and Robot cows before entry (Ri) and after one month (R1) and 2 months (R2).

CMT Scores

Distributions of CMT scores for cows entering the experiment and after 4 and 8 weeks of milking are presented in Figure 4. In the eighth week of milking, 3% of the quarters in the control group changed from uninfected to infected status (CMT score of trace or above) and 15% of quarters changed from infected to uninfected status (CMT score changed from trace or above to negative). In this same time period, 8% of quarters in the robot group changed from uninfected to infected status and 10% of quarters in the robot group changed from uninfected to infected status.

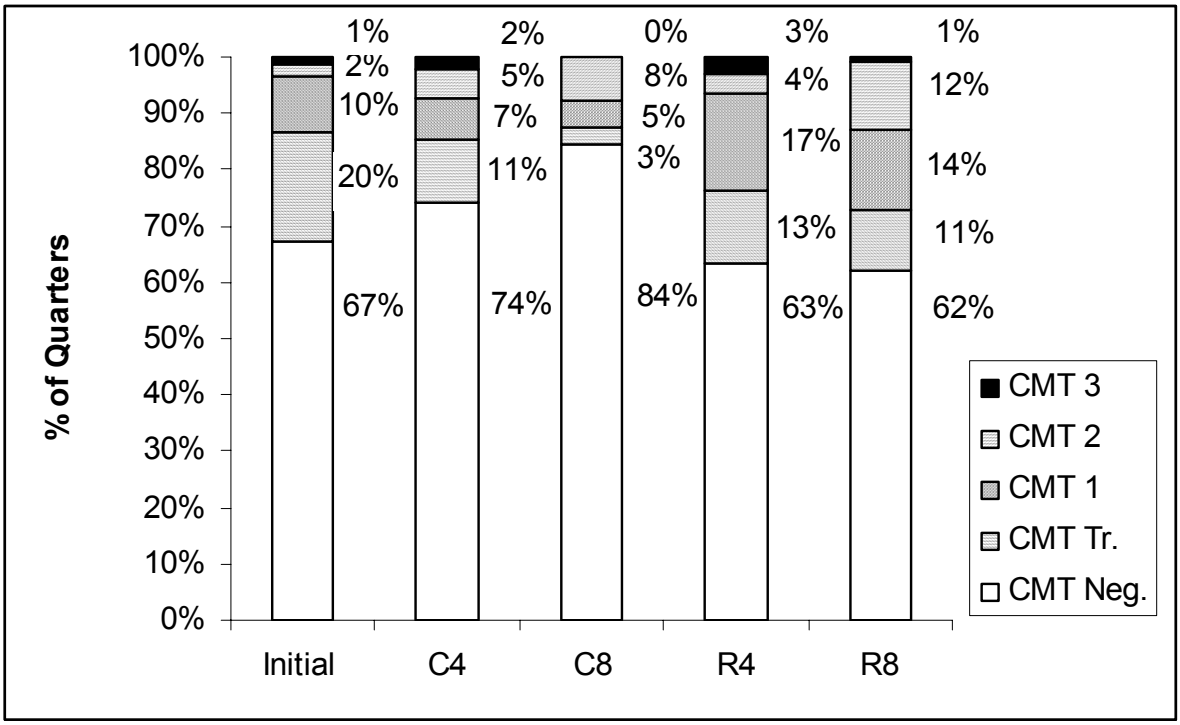

Figure 3. Distribution of CMT scores (Negative, Trace, 1, 2, and 3) for cows entering barn (Initial, n =204 quarters), Control cows after 4 weeks (C4, n = 96 quarters) and 8 weeks (C8, n = 64 quarters) and Robot cows after 4 weeks (R4, n = 136 quarters) and 8 weeks (R8, n = 100 quarters) of entry.

CONCLUSIONS

While it is too early to draw firm conclusions, it appears that there are not large differences in milk quality or yield between cows milked by the robotic versus conventional milking system.

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