Information and precision technologies used for improving the milking routine performance

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Abstract

Most of Brazilian farmers are not able to identify the impact of the milking routine procedures on the milking performance, usually because the information required is not ready available. Thus, the information and precision dairy technologies usage can help the farmer to collect, measure and analyze the data to support them on this subject. Fifty seven dairy crossbred Holstein × Gyr cows were milked in a double-4, herringbone parlor, fitted with electronic milk meters, automatic cluster remover and Alpro dairy manager system software (Alpro, DeLaval, Stockholm, Sweden). Data of total milking time, number of cows milked/hour, total milk production, milk yield/milker/hour, milking cluster attachment time, milk yield/cow, and number of automatic milking cluster removal was automatically provided by the milking system software. The experimental was performed during 21 days according to a factorial 2×2 design to evaluate milker (A or B) and milking routine (non-standardized or standardized) effects. Comparisons among treatments were conducted with orthogonal contrasts and statistical significance was considered at $P<0.05$. The results showed interaction between milking routine procedure and milker factors ($P<0.05$). Within both milking routine, the Milker A showed better performance for most milker performance parameters compared to Milker B ($P<0.05$). Within milker, the Milker A improved the milker performance parameters to the standardized compared to non-standardized milking routine procedures ($P<0.05$), whereas no difference were observed within Milker B ($P\geq0.05$). These results highlight the importance of precision dairy technologies usage to identify failures in the milking routine procedures, and hence improve the milking performance once the milker is committed to the procedures improvement.

Keywords: automation, data management, milk quality, sensors system, udder health

1. Introduction

Farmers are becoming more acquainted to adopting the precision dairy farming technologies available in some conventional milking systems (Borchers and Bewley, 2015; Steeneveld and Hogeveen, 2015). The main reasons for its adoption are related to usefulness of the information provided by the management system for reliable decision-making, and also reduction of the milking labor (Butler *et al.*, 2012; Dela Rue, 2008). The use of milking equipment integrated with sensor and herd management systems are increasing on Brazilian dairy farms. According to Rasmussen (1993) and Jago *et al.* (2010), these milking systems allows to verify individual data of milking and milker performances parameters such as total time spent to milking each cow included the beginning and end times, cluster attachment time, use of automatic or manual/forced cluster removal, milk yield/cow, among others. For Borchers and Bewley (2015), the production parameters associated to economic ones can help the farm manager to identify failure points during the milking routine that usually leads to inefficiency in production and labor costs. The present study aimed to evaluate the milking performance parameters of standardized and non-standardized milking routines, comparing the work of two milkers, by usage of the precision technologies available in conventional milking system.

2. Materials and methods

The experiment was conducted at Multi-use Complex on Livestock Bioefficiency and Sustainability, Brazilian Agricultural Research Corporation (Embrapa Dairy Cattle), located in Coronel Pacheco, Minas Gerais. Fifty seven dairy crossbred Holstein × Gyr cows were housed in a free stall barn, grouped by stage of lactation (1 to 3), and were from 100 to 200 days in milk. All cows were milked in the morning between 06:00 and 08:00 and in the afternoon between 14:00 and 16:00. The cows were milked in a double-4, low-line, herringbone parlor, fitted with MM27 electronic milk meters, MPC 580/680 controllers, Automatic Cluster Remover (ACR), and Alpro Manager System software (Alpro, DeLaval, Stockholm, Sweden). The treatments differed in the milking routine steps performed by each milker. The non-standardized milking routine was performed without a repeatable sequence and the use of ACR was determined freely by each milker. The standardized milking routine was implemented the day after the milkers training day on the new milking routine procedure. The standardized milking routine consisted in to follow a fixed steps beginning from first to last cow, where one side of the milking parlor had the routine finished before starting the opposite side as follows: (1) forestripping and pre dipping all teats with chlorine sanitizer moving from first to last cow; (2) backwards to the first cow, wiping and attaching the milking cluster, move forward to next cows; (3) mandatory use of ACR and once the milking cluster was automatic removed the teats were immediately pre dipped in an iodine solution. The informations provided by the milking system software based on the sensor systems were: (1) total milking time/day; (2) number of cows milked/hour; (3) total milk production; (4) kg of milk/milker/hour; (5) milking cluster attachment time; (6) milk yield/cow; and (7) number of automatic/manual milking cluster removal. Each treatment had the data recorded and analyzed for 21 days. Statistical analyses were performed according to a completely randomized 2×2 factorial design including the fixed effect of treatments (milking routine, milker and milking routine × milker) and the random effect of daily data collection. Comparisons among treatments were conducted with orthogonal contrasts, which included an overall comparison between milking routine procedures and milkers. The correlations among variables were evaluated with Pearson correlation coefficients. Statistical significance was considered at $P<0.05$.

3. Results and discussion

The results showed interaction between milking routine procedure and milker factors ($P<0.05$) indicating that the results for each milking routine procedure were influenced by the milker results (Table 1). Within both milking routine, the milker A showed shorter total milking time and milking cluster attachment time and higher number of milked cows/hour and kg of milk/milker/hour ($P<0.001$) compared to milker B (Table 1). The premilking routine presents great influence on the milk ejection reflex (Bruckmaier and Blum, 1996) which in turn has the milking cluster attachment time as an important parameter involved in the measure of the milking routine efficiency (Rasmussen *et al.*, 1990). Additionally, we found a high and positive correlation between the milking cluster attachment time with the total milking time ($r=0.91$, $P<0.01$), inversely to the number of cows milked/hour ($r=-0.94$, $P<0.01$) and to kg of milk/milker/hour ($r=-0.92$, $P<0.01$). The correlation results explain the importance of the milking cluster attachment time to the overall milking performance. Within milker, the Milker A showed better performance to milking cluster attachment time ($P=0.02$) and number of automatic cluster removals ($P=0.04$) for standardized milking routine compared to non-standardized. The milking cluster attachment times for milker A decreased from 162 to 94 seconds comparing the period before and after the milkers training day on the new milking routine procedure, respectively (Table 1). Nielsen and Rasmussen (1987) found an interval of 1.0 to 1.5 min from the beginning of udder preparation until milking cluster attachment to be optimal, which is in accord to our study. It represents a great impact to the farm economics. This type of evaluation is essential to strategic decisions regarding the choice of the milker profile and performance evaluation. Another important milker performance parameter concerns to the number of automatic cluster removal. An ACR device tends to improve the udder health by decreasing the number of over milking (Rasmussen, 1993). The number of automatic cluster removals to the milker A increased from 35 to 109 automatic removals ($P<0.05$) comparing the non-standardized milking routine procedure with standardized, respectively. No improvements were observed within Milker B to the parameters aforementioned ($P\geq0.05$), as the milking cluster attachment times increased from 217 to 225 seconds and the number of automatic cluster removal decreased from106 to 101 automatic removals, respectively (Table 1). Those results showed a strong interaction ($P<0.01$) of the milker factor over the milking routine procedures, in which the willingness to change for a new procedure can be determinant to the success of the milking routine performance. The production parameters as number of milked cows and total milk production did not present difference ($P\geq0.05$). Conversely, Rasmussen *et al.* (1990) reported an increased in the total milk production, which was not observed in our study. Differences between studies may be related to herd size, milking facilities, management practices, labor efficiency, and stage of lactation adopted in each study. The use of precision dairy farming technologies as described in this study turns the identification of problems in the milking routine procedure less laborious and more reliable. Moreover, these technologies allows the farmer to take the control (proactively) of the operation, taking faster decisions (in real time), aimed to increase the bioeconomic performance of the dairy system production (De Koning, 2004) with a great impact observed in the time and costs related to the routine activities like milking cows.

Table 1. Average results of milking and production performance parameters, by milking routine procedure and milker.

Parameters	MR				SEM	*P*-value		
	NSP		SP			MR	M	MR×M
	MA	MB	MA	MB				
Number of milked cows/day [2]	113	115	114	105	0.98	NS	NS	NS
Total milking time/day (min)[1]	235	266	204	279	7	NS	***	*
Number of cows milked/hour[1]	29	26	34	23	0.99	NS	***	**
Total milk production/day (kg)[2]	1,098	1,104	1,104	1,038	12.11	NS	NS	NS
kg of milk/milker/hour[1]	281	249	324	223	9.37	NS	***	*
Milking cluster attachment time (sec)[1]	162	217	94	225	14	*	***	*
Number of automatic cluster removal[1]	35	106	109	101	11	*	NS	*

[1] Milker performance parameters.

[2] Production parameters; MR: milking routine; NSP: non-standard procedure; SP: standard procedure; M: milkers; MA: milker A; MB: milker B; NS: not significant; $*P<0.05$; $**P<0.01$; $***P<0.001$.

4. Conclusions

The use of information and precision dairy technologies can help farmers to identify deviations in the milking routine procedures and hence improve the milking routine performance through adoption of standardized procedures. However, the success of any new milking routine procedure adoption depends on the milker willingness to change about the old habits. This can be a key factor for the success of the activity once the milk production and udder health parameters can be impacted negatively by a non-standardized milking routine.

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Welcome

Precision Dairy Farming is one of the major topics that influences dairy farming developments world-wide. After three successful North American Precision Dairy Farming Conferences (in Toronto, Canada (2010) and Rochester, USA (2013 and 2015)), the first International Precision Dairy Farming Conference will be organized in 2016, in Leeuwarden, the Netherlands. Leeuwarden is the capital of the province Fryslan and the centre of dairy farming in the Netherlands.

We developed a program on the crossroads of science and practice and aim at a conference that brings together the scientists who are interested in applied Precision Dairy Farming technology, technology manufacturers who will be the key drivers in product and service development, and veterinarians/advisors who are the key users in the latest scientific developments. Of course the conference will be open for all who are interested in Precision Dairy Farming developments.

The call for Abstracts is now closed. We received over 120 abstracts and the scientific committee reviewed the abstracts. A program with 4 key note presentations and 20 sessions with in total 71 presentations is now available.

The fee for the conference is €400 (including welcome reception, conference dinner and visiting Precision Dairy farms). Registration is now open!

We are happy to announce that there will be a shared session with DairyCare on the 21th of June. DairyCare will

This conference is organized by:

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