Comparing peak of lactation from Automatic Milking Systems and Conventional Milking Systems

L. Fadul-Pacheco, G. Bisson, R. Lacroix and D.E. Santschi

Lactanet, Canadian Network for Dairy Exellence, 555 Boulevard des Anciens-Combattants, H9X 3R4, Sainte-Anne-de-Bellevue, Québec, Canada
Corresponding Author: lfadul@lactanet.ca

Abstract

Automatic milking systems (AMS) allows for variable milking frequency for individual cows within a herd, which is not the case for most other milking systems. A more frequent milking is desired at the beginning of the lactation to stimulate the mammary gland to produce more milk during the peak of lactation. The objective of this study was to evaluate the effect of more frequent milkings, as in the AMS, on milk yield at lactation peak. Lactation records were obtained from the Lactanet (Canadian Network for Dairy Excellence) database. A total of 7,706,954 records from herds with AMS and conventional milking systems (i.e., 2 milkings per day) during 4 years (2017-2021) were used for the analysis. Data were grouped by milking system and by parity (primiparous and multiparous). For the analysis the mean of milk production was calculated by 10 days in milk interval (e.g., 10, 20, 30…etc.) and the effect of the milking system was evaluated by a regression analysis. Results showed that at the beginning of the lactation (i.e., 10 days in milk) cows milked in AMS had a significantly lower milk production (2.2 kg/day; $P<0.001$) than the cows in conventional milking systems. However, when these cows attained the peak of lactation (50 days in milk) they reach the same milk production than those milked in conventional milking systems. During the first 40 days in milk (from 10 to 50 days in milk) cows milked in AMS increased milk production by 12.06 ± 0.6 kg, whereas the increase in the same period was of 7.7 ± 0.58 for cows milked in conventional milking systems. This indicates that for these 40 days period cows in AMS produced an extra of 4.36 ± 0.59 kg of milk ($P<0.001$) compared with the cows in conventional milking systems. Furthermore, the increase during this period was found for both primiparous and multiparous cows. These findings highlight the importance of monitoring the peaks of lactation in AMS, to adjust the available energy of the diets at the beginning of the lactation to ensure a high milk production by reducing the negative risks in health and reproduction, as it has been reported that the incidence of ketosis is 1.45 times greater in AMS compared with other milking systems.

Keywords: lactation curves, automatic milking systems, parity

Introduction

Automatic milking systems (AMS) allows for variable milking frequency for individual cows and can be adjusted for production level and stage of lactation (Svennersten-Sjaunja and Pettersson, 2008). Research on the effect of milking frequency on milk production is divided. Whereas some studies have reported and increase of milk production with more frequent milkings (Wagner-Storch and Palmer, 2003; Melin *et al.*, 2005) others have reported no effect on milk production (Speroni *et al.*, 2006; Gygax *et al.*, 2007). Furthermore, achieving an optimal milking interval could maximize milk production and minimize any risk of negative effects on udder health (André *et al.*, 2010). With AMS, it is possible to fine-tune milking frequency and number of milkings. It is desirable to have more frequent milkings in the beginning of lactation to stimulate

the mammary gland to produce more milk during peak lactation, whereas a decreased number and frequency of milkings is more desired towards late lactation. However, the effect of these variations of the number and frequency of milkings on the peak of lactation is unknown. Therefore, the objective of this study was to evaluate the effect of more frequent milkings, as in the AMS, on milk yield at lactation peak.

Material and methods

Lactation records were obtained from the Lactanet (Canadian Network for Dairy Excellence) database. A total of 7,706,954 records from herds with AMS and conventional milking systems (i.e., 2 milkings per day) over 4 years (2017-2021) were used for the analysis. There were 516 herds with AMS and 1,766 herds with conventional milking systems. Data was grouped by milking system and by parity (primiparous and multiparous). For the analysis the mean of milk production was calculated by 10 days in milk interval (e.g., 10, 20, 30…etc.) and the effect of the milking system and parity was evaluated by a regression analysis.

Results and discussion

At the beginning of the lactation (i.e., 10 days in milk) cows milked in AMS had a significant lower milk production than cows milked in conventional milking systems (29.8 vs 32 kg/day; P<0.001, respectively). However, when these cows attained the peak of lactation, at around 50 days in milk, they reach the same milk production than those milked in conventional milking systems (Figure 1). During the first 40 days in milk (from 10 to 50 days in milk) cows milked in AMS increased milk production by 12.06 ± 0.6 kg, whereas the increase in the same period was of 7.7 ± 0.58 for cows milked in conventional milking systems. This increase in milk production resulted on an extra 4.36 ± 0.59 kg of milk (P<0.001). Results also showed that the increase in milk production was for both primiparous and multiparous cows, but there were no significant differences among parities (P=0.64). Yet, the difference between the milking systems was significant (P<0.001).

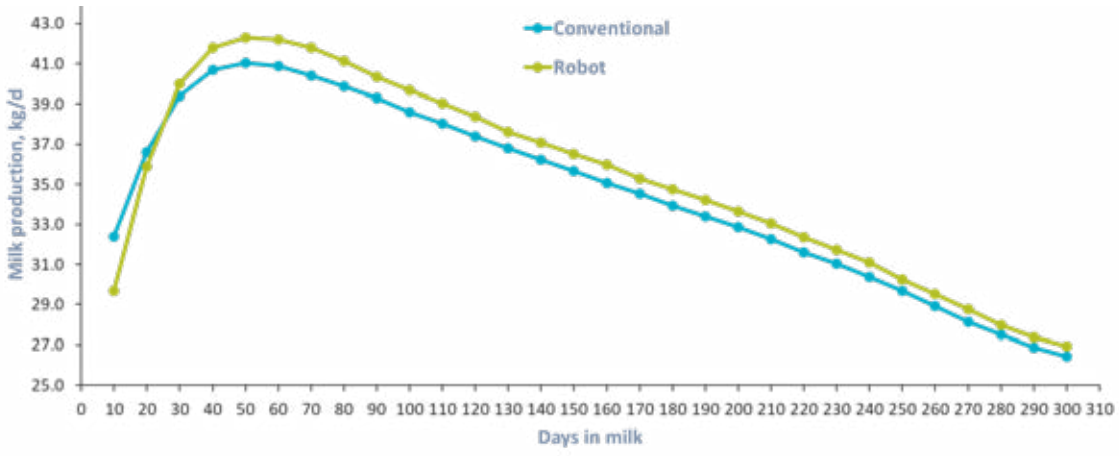

Figure 1. Milk production curves of cows milked in AMS (Robots) and conventional milking systems.

In addition, the daily increase in milk production on the first 60 days in milk for primiparous and multiparous cows milked in AMS was faster than for cows milked in conventional milking systems (55% and 46%, respectively; Figure 2). Primiparous cows milked in AMS had a daily increase in milk production of 0.20 kg milk/day whereas for cows milked in conventional milking systems the daily increase in milk production was 0.13 kg milk/day. For multiparous cows, the daily increase was 0.22 kg milk/day and 0.15 kg milk/day for cows milked in AMS and conventional system, respectively.

These findings highlight the importance of monitoring the peaks of lactation in AMS to provide adequate nutrients to ensure high milk production and reduce negative risks in health and reproduction, as studies have reported that the incidence of ketosis is 1.45 times greater in AMS compared with other milking systems (Tatone *et al.*, 2017). High concentrations of beta-hydroxybutyric acid (BHB) at the beginning of lactation have negative effects on production, reproduction, and health (Ospina *et al.*, 2010; Chapinal *et al.*, 2012; Santschi *et al.*, 2016). These studies reported that cows with elevated BHB (0.20 mmol/l) on the first test date had: an extra 24 days open; a reduction of 2.4 kg of milk on test date; are 27% less likely to be pregnant at 150 days in milk; are 2 times more likely to be culled by 100 days in milk, and are at increased risk of displaced abomasum and clinical ketosis, among others (Ospina *et al.*, 2010; Chapinal *et al.*, 2012; Santschi *et al.*, 2016). Lastly, there are economical losses not only related to the decline in performance but also related to the diagnosis, treatment and in the worst case the dead loss (McArt *et al.*, 2015).

Implications

Cows milked in AMS produce less milk at the beginning of the lactation, but then they exceed the production of cows in conventional milking system (2x). This rapid increase in milk production in AMS highlights the importance of monitoring the peaks of lactation in AMS, to adjust the available energy of the diets at the beginning of the lactation, to ensure a high milk production while reducing negative risks in health and reproduction.

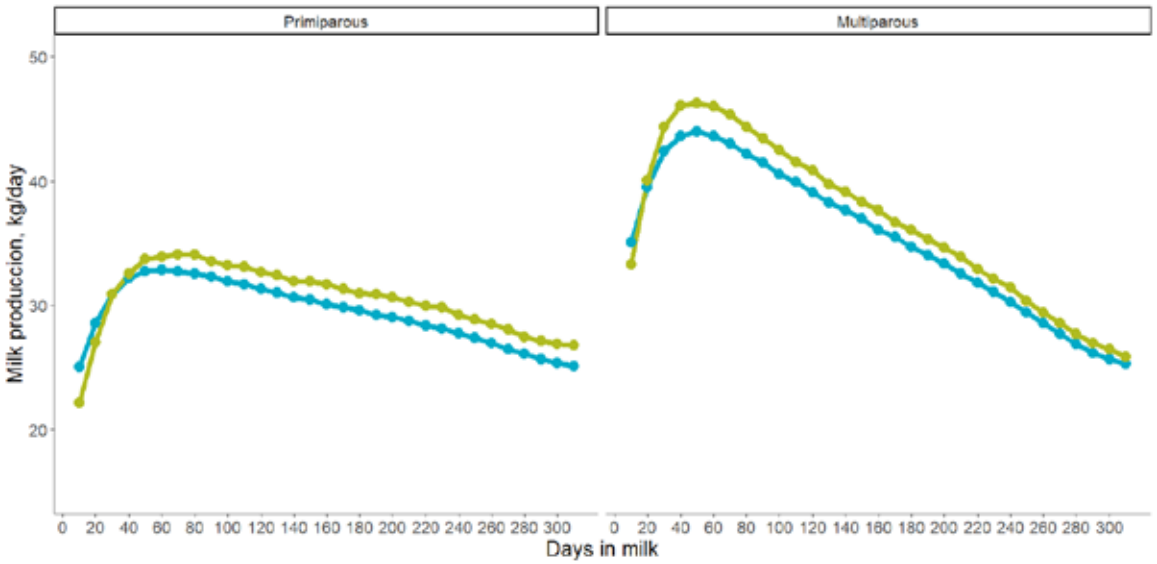

Figure 2. Milk production curves of primiparous and multiparous cows milked in AMS (Robots) and conventional milking systems.

References

André, G., P.B.M. Berentsen, B. Engel, C.J.A.M. de Koning, and A.G.J.M. Oude Lansink. 2010. Increasing the revenues from automatic milking by using individual variation in milking characteristics. J. Dairy Sci.93:942–953. doi:10.3168/jds.2009-2373.

Chapinal, N., S.J. LeBlanc, M.E. Carson, K.E. Leslie, S. Godden, M. Capel, J.E.P. Santos, M.W. Overton, and T.F. Duffield. 2012. Herd-level association of serum metabolites in the transition period with disease, milk production, and early lactation reproductive performance. J. Dairy Sci. 95:5676–5682. doi:10.3168/jds.2011-5132.

Gygax, L., I. Neuffer, C. Kaufmann, R. Hauser, and B. Wechsler. 2007. Comparison of Functional Aspects in Two Automatic Milking Systems and Auto-Tandem Milking Parlors. J. Dairy Sci.90:4265–4274. doi:10.3168/jds.2007-0126.

McArt, J. a. A., D.V. Nydam, and M.W. Overton. 2015. Hyperketonemia in early lactation dairy cattle: a deterministic estimate of component and total cost per case. J Dairy Sci 98:2043–2054. doi:10.3168/jds.2014-8740.

Melin, M., K. Svennersten-Sjaunja, and H. Wiktorsson. 2005. Feeding Patterns and Performance of Cows in Controlled Cow Traffic in Automatic Milking Systems. J. Dairy Sci.88:3913–3922. doi:10.3168/jds.S0022-0302(05)73077-0.

Ospina, P.A., D.V. Nydam, T. Stokol, and T.R. Overton. 2010. Associations of elevated nonesterified fatty acids and beta-hydroxybutyrate concentrations with early lactation reproductive performance and milk production in transition dairy cattle in the northeastern United States. J. Dairy Sci.93:1596–1603. doi:10.3168/jds.2009-2852.

Santschi, D.E., R. Lacroix, J. Durocher, M. Duplessis, R.K. Moore, and D.M. Lefebvre. 2016. Prevalence of elevated milk □-hydroxybutyrate concentrations in Holstein cows measured by Fourier-transform infrared analysis in Dairy Herd Improvement milk samples and association with milk yield and components. J. Dairy Sci.99:9263–9270. doi:10.3168/jds.2016-11128.

Speroni, M., G. Pirlo, and S. Lolli. 2006. Effect of Automatic Milking Systems on Milk Yield in a Hot Environment. J. Dairy Sci.89:4687–4693. doi:10.3168/jds.S0022-0302(06)72519-X.

Svennersten-Sjaunja, K.M., and G. Pettersson. 2008. Pros and cons of automatic milking in Europe1. J. Anim. Sci.86:37–46. doi:10.2527/jas.2007-0527.

Tatone, E.H., T.F. Duffield, S.J. LeBlanc, T.J. DeVries, and J.L. Gordon. 2017. Investigating the within-herd prevalence and risk factors for ketosis in dairy cattle in Ontario as diagnosed by the test-day concentration of □-hydroxybutyrate in milk. J. Dairy Sci.100:1308–1318. doi:10.3168/jds.2016-11453.

Wagner-Storch, A.M., and R.W. Palmer. 2003. Feeding Behavior, Milking Behavior, and Milk Yields of Cows Milked in a Parlor Versus an Automatic Milking System J. Dairy Sci. 86:1494–1502. doi:10.3168/jds.S0022-0302(03)73735-7.