



Dairy Research Review™

Making Education Easy

Issue 17 – 2019

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Welcome to the latest issue of Dairy Research Review.

This issue covers an interesting range of research into dairy cow production, including the effects of incomplete milking on reproductive performance, automatic heat detection and intensity and timing of ovulation, and genotype by environment interactions (G X E) for fertility-related traits. Also featured is research into the effects of drying-off individual quarters on production, effects of water intake on the growth and development of new-born calves, infection dynamics across the dry period, teat skin colonisation and intramammary infection, transmission of *Staphylococcus aureus* in dairy cattle herds, and the financial and epidemiological effects of intervention strategies for clinical contagious mastitis.

We hope that you learn something new from your reading of this issue of **Dairy Research Review**. We appreciate your input, so please keep sending us your comments and feedback.

Kind regards

Hamish Newton

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Research Review thanks AgriHealth for their sponsorship of this publication, and their support for ongoing education for animal health professionals.

A randomized controlled trial on the effect of incomplete milking during the first 5 days in milk on reproductive performance of dairy cows

Authors: Krug C et al.

Summary: This randomised controlled study involving multiparous Holstein cows (n=853) from 13 commercial herds in Canada evaluated the effects of an incomplete milking during the first five days in milk on the prevalence of luteal activity (weeks in milk 5 or 7) and on pregnancy risk. The results suggest that the incomplete milking protocol does not influence the prevalence of luteal activity but does increase the pregnancy risk in second-parity cows in herds that started their breeding period <55 days in milk. Additionally, no effect of early-lactation hyperketonaemia on luteal activity or on pregnancy risk was observed.

Comment: Excessive negative energy balance in early lactation has been associated with poorer reproductive outcomes although the underlying mechanisms are not fully understood. This study looked at reducing the energy demand of lactation not by reducing the frequency of milking but by reducing the amount of milk harvested in the first 5 days of lactation. The authors have previously shown that this practice reduces the odds of hyperketonaemia in the first 17 days in milk and increased the elimination of intramammary infection without altering lactation yields or milk composition. In this study, incomplete milking for the first 5 days did not alter the odds of getting pregnant except in second-parity cows getting pregnant in the first 87 days after a voluntary waiting period of <55 days, so perhaps really not important? This study did not look at first-lactation heifers though. In this study, β -hydroxybutyrate levels in early lactation were not associated with either luteal activity or pregnancy outcomes. Luteal activity and β -hydroxybutyrate levels were measured at different times and the authors suggest that non-esterified fatty acids might be a better measure to predict pregnancy outcomes.

Reference: *J Dairy Sci.* 2018;101(12):11330–11341

[Abstract](#)

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Effect of estrous expression on timing and failure of ovulation of Holstein dairy cows using automated activity monitors

Authors: Burnett TA et al.

Summary: In this second Canadian study, which used a total of 850 episodes of oestrus from 293 different Holstein dairy cows, the investigators demonstrated that the expression of oestrus, measured by two different automated activity monitor (AAM) systems, is important, not only for oestrus detection, but also for its effects on the interval from activity alert to ovulation, ovulation failure, and fertility. Stage of lactation and lameness were also found to influence the timing of ovulation relative to an oestrus alert.

Comment: This study aimed to see if the reduced fertility we notice with reduced expression of oestrus (due for example to lameness or low body condition score, etc.) is due to an altered timing of ovulation relative to the start of oestrus signs. The start of oestrus expression was defined by either leg- or neck-mounted AAMs and then the ovaries were scanned twice daily for up to 3 days to see when ovulation occurred. Cows were deemed in oestrus if there was a dominant follicle >15mm and no corpus luteum >20mm. Ovulation was deemed to have occurred when the follicle disappeared. The average time between the AAMs having an oestrus alert and actual ovulation was 25.8 and 24.7 hours for the neck- and leg-mounted AAMs, respectively. To describe the oestrus expression, two measurements were used, the duration of oestrus signs and the peak activity (percentage increase in activity above baseline). What I found most interesting was that of all the alerts almost 20% of alerts were false and of the remaining alerts 6.7% had ovulation failure. The duration of false positive alerts was 4.9 hours versus 11.8 hours and the intensity was less. If you have clients using AAM, this paper sets some realistic expectations of what this technology will draft out for artificial insemination.

Reference: *J Dairy Sci.* 2018;101(12):11310–11320

[Abstract](#)

Genotype by environment interactions in fertility traits in New Zealand dairy cows

Authors: Craig HJB et al.

Summary: These investigators studied genotype by environment interactions (G x E) in fertility-related traits using data from the NZ national dairy database, which contains records on 3,743,862 animals. Herds were classified into high-, mid-, or low-fertility categories or environments based on herd average fertility performance and the data was then analysed. The results did not support separate genetic evaluations of fertility in the different environments. The data did, however, indicate that low-fertility herds could benefit more from targeted selection of sires with higher fertility estimated breeding values (EBVs) than from selection based solely on the multi-trait national index. On the other hand, high-fertility herds could base their sire selection on traits other than fertility, as long as low fertility sires are avoided.

Comment: This paper looked at the interaction between cow genotype and the environment. "Environment" in this paper was whether the cow was from a herd defined as having low, medium, or high fertility, which was derived from the mean calving date of the second calvers in each herd. This allowed the authors to describe if a sire's fertility traits would have an effect of differing magnitude depending on whether the cow was in a herd with low, medium, or high fertility (environment). It turns out, as perhaps is intuitive, using higher fertility EBV bulls rather than bulls with low EBV results in a greater gain in cows in a low-fertility herd than cows in a high-fertility herd. Or that selection for fertility is likely to have a bigger effect in low-fertility herds than high-fertility herds where perhaps genetics are not such a limiting factor. If discussing sire selection with clients, this paper would suggest selecting bulls based on fertility EBVs is more likely effective if underlying herd fertility is poor and not likely to be so rewarding if the herd's fertility is already good.

Reference: *J Dairy Sci.* 2018;101(12):10991–11003

[Abstract](#)

The effect of individual quarter dry-off in management of subclinical mastitis on udder condition and milk production in organic dairy herds: A randomized field trial

Authors: Skarbye AP et al.

Summary: This Danish study, which was conducted in five commercial organic dairy herds, randomised 70 cows to either individual quarter dry-off (QDO) or continued milking. Inclusion criteria were an increase in somatic cell count (SCC) to >400,000 cells/mL at milk recording and identification of a quarter scoring of ≥3 and higher than the remaining quarters at California mastitis testing (scale 1–5). The results showed that the QDO treatment was associated with quarter swelling and increased quarter firmness at around day 10 following treatment start and that QDO was associated with quarter atrophy at around day 40 from treatment start. The QDO was associated with signs of pain related to the dried-off quarter. The production loss associated with QDO was 4.1 kg/day greater than for continued milking and depended on parity, days in milk, and prior yield on the quarter subjected to dry-off (Q1). For the majority of cows, the increase in production loss was <1 kg/day when the prior yield on Q1 increased by 1 kg/day.

Comment: We are coming up to the part of the season when we get asked about how to manage the high SCC cows. One option is to dry off offending quarters and continue to milk the rest of the quarters. It has previously been shown the production loss is less than expected due to the remaining quarters having a compensatory increase in production. This study looked at the effect of drying a quarter off on short-term production, development or not of clinical mastitis, and behavioural changes as a measure of pain. At 10 days post drying off, dried off quarters were swollen but this decreased to a level similar to continuously milked quarters and at treatment start point, by day 40. At day 40, the prevalence of atrophic quarters had increased in both continuously milked quarters (42%) and dried-off quarters (65%). In the week following drying off, a quarter's milk leaking was observed in 29% of cows. At 40 days post drying off, 35% of quarters were non-atrophic and only 6% were completely dry. So, even cows with dried off quarters 40 days ago still need to be identified easily as "3 titters".

Reference: *J Dairy Sci.* 2018;101(12):11186–11198

[Abstract](#)

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Drinking water intake of newborn dairy calves and its effects on feed intake, growth performance, health status, and nutrient digestibility

Authors: Wickramasinghe HKJP et al.

Summary: This randomised controlled US study measured water and feed intake, growth performance, health status, and nutrient digestibility in Holstein heifer calves offered drinking water from birth (n=15) compared with those offered drinking water at 17 days of age (n=15), when fed an *ad libitum* volume of milk. The two groups were balanced for parity of the dam, birth weight, and birth week. Overall, the results of this study showed that when offered water immediately after birth, new-born dairy calves drank a significant amount of free water, which could potentially improve growth performance, both pre- and post-weaning, possibly through a positive effect on rumen development and thus on nutrient utilisation efficiency.

Comment: It surprised me that it is not normal practice to provide *ad libitum* access to water to calves in the US until about 17 days of age. Calves in this study were fed 2L of milk three times a day for 14 days then 3.2L three times a day. So, these calves on the face of it were getting plenty of fluid. Calves were allocated to get no additional water for the first 17 days or *ad libitum* access to water. Calves offered water drank 750mL of water a day during the first 16 days if offered. The calves after being offered water after 17 days of no water, drank 59% more water for the rest of the pre-weaning period. There was a tendency for calves with free access to water to have a higher body weight pre-weaning. In our systems, where we tend to feed less milk than that described here, to not offer free access to water would seem crazy.

Reference: *J Dairy Sci.* 2019;102(1):377–387
[Abstract](#)



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Independent Commentary by Hamish Newton.

Hamish Newton graduated from Massey University with a BSc in 1998 and started working in mixed practice at the Veterinary Centre – Oamaru. He then worked in mixed practice in the UK before starting a PhD at Bristol University examining factors that influence the cure of intramammary infections in the involuting mammary gland. Upon completing his PhD in 2007 he returned to the Veterinary Centre – Oamaru and became a partner in 2008. He now spends most of his working time dealing with dairy cows.



Risk factors for antimicrobial use in veal calves and the association with mortality

Authors: Bokma J et al.

Summary: This retrospective cohort study was performed using antimicrobial registration data from the largest Belgian veterinary veal practice to identify risk factors for antimicrobial use (AMU) and to explore the relationship between AMU and mortality. The data set contained 295 production cycles from 78 farms, representing 146,014 calves and 8 veal companies. The average AMU was 32.3 defined daily dose animal per year, of which 76.2% was administered orally and 23.8% parentally. The AMU remained stable between 2014 and 2016. Use of almost all antimicrobial classes decreased during this period except for use of long-acting macrolides, doxycycline, and aminoglycosides, which increased significantly. Mortality risk did not increase with decreasing AMU. Analysis identified breed (higher use in beef calves versus dairy and crossbreeds), month of arrival (lower use when arrived in April or May versus winter months), and veal company as risk factors.

Comment: This study looked at the AMU of the largest veterinary practice in Belgium dealing with the veal calf industry (30% of the industry serviced by this practice). While we do not have a veal industry, this paper looks at factors that influence what was prescribed and highlights the importance we as vets have in reducing the AMU. This practice reduced the AMU usage by 46% compared with the data set from 2006 to 2009, which is very similar to what has been achieved in the Netherlands. Topical to NZ at the moment, but hopefully not in the future, was that respiratory disease was the main indication for AMU and was empirically directed towards *Mycoplasma bovis*. Over the study period, there was a shift towards parenteral treatment from oral treatment, which could partly explain the reduction in antimicrobial resistance found in indicator bacteria in Belgium. Despite the initial dramatic reduction in AMU, the usage “plateaued” between 2016 and 2018. This might reflect a “lack of motivation” to further reduce usage. Interestingly, breed was a factor for total AMU usage, with beef breeds and crosses receiving more antibiotics than dairy calves. This could partially be due to these animals having a higher value, so an increase in risk-averse behaviour when dealing with these animals could lead to more AMU. After a very dramatic reduction in AMU, the rate of reduction appeared to have decreased. Perhaps we will see the same in NZ – once the “low hanging fruit” of prophylactic AMU at dry off has become established, the next gains will be much harder to achieve. There was no increase in mortality reported with the reduced AMU in this study so perhaps further reductions are still possible without compromising welfare.

Reference: *J Dairy Sci.* 2019;102(1):607–618
[Abstract](#)

Infection dynamics across the dry period using Dairy Herd Improvement somatic cell count data and its effect on cow performance in the subsequent lactation

Authors: Lipkens Z et al.

Summary: In this second Belgian study, intramammary infection (IMI) dynamics across the dry period were assessed using test-day somatic cell count (SCC) data from 739 Holstein cows from 33 randomly selected commercial dairy herds that had blanket dry-cow therapy (DCT) applied at dry-off. The results demonstrated the importance of good udder health management during lactation to prevent IMI at dry-off rather than curing infected cows during the dry period to ensure optimal udder health in the subsequent lactation.

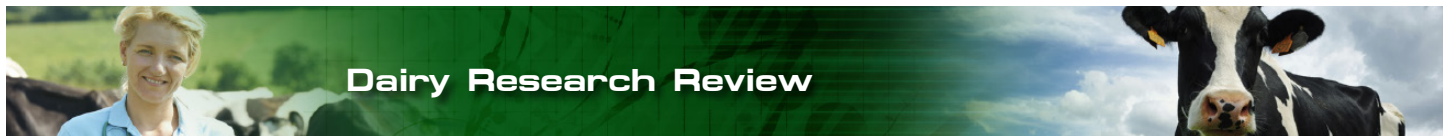
Comment: This paper looks at herd test data across the dry period. All cows in the study used blanket DCT. A cut-off of 200,000 cells/mL was used to define a cow as infected. Cows received blanket DCT and most also had internal teat sealant. Over the dry period, 57% remained healthy, 8.3% got a new infection, 23% cured, and 11% remained chronically infected. The risk of getting a new infection was 12.6% (uninfected to infected) and the risk of cure was 67% (infected to uninfected). Of the cows that had a second herd test, 84% of them had an SCC in the same category as the first test. What this paper highlighted to me was the importance of the last herd test of the season as a predictor of mastitis in the following season. If a cow entered the dry period with a high SCC, and she “cured”, she still had a 15% chance of mastitis and if she did not “cure” and remained chronic she had a 22% chance of clinical mastitis. Getting as many cows to the end of lactation with a low SCC will lead to a better result over the dry period. It reinforces the message that despite the dry period being very important it cannot be relied on to sort out mastitis problems – udder management during lactation cannot be ignored.

Reference: *J Dairy Sci.* 2019;102(1):640–651
[Abstract](#)

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Association between teat skin colonization and intramammary infection with *Staphylococcus aureus* and *Streptococcus agalactiae* in herds with automatic milking systems

Authors: Svennesen L et al.

Summary: To investigate the association between teat skin colonization and intramammary infection (IMI) with *Staphylococcus aureus* or *Streptococcus agalactiae* at the quarter level in herds with automatic milking systems, these Danish researchers collected milk and teat skin samples from 1,142 quarters from 300 cows with somatic cell counts >200,000 cells/mL that were from eight herds positive for *S. agalactiae*. The overall results suggested that *S. aureus* and *S. agalactiae* on teat skin may be a risk factor for IMI with the same pathogens and that appropriate teat skin hygiene is therefore also recommended in automatic milking systems.

Comment: This study looked at the colonisation of the teat skin with *S. aureus* and its association with IMI in cows milked with automatic milking systems. This paper also looked at *S. agalactiae* and cows were not enrolled unless from herds positive for this pathogen so might not be directly applicable to our herds. As cows milked with robots are likely to come into indirect contact with many more cows via cups than conventionally milked cows, it seems likely that the disinfection of the cups and the cows' teat is going to have increased importance. The other scenario is that as they are not coming into contact with human milker hands the risk of spread may be less. *S. aureus* was identified from 8.1% of quarter milk samples and 6.6% of skin samples from 300 cows. *S. agalactiae* was only found in 7.4% of milk samples and 0.26% of skin samples. Quarters that had *S. aureus* cultured from the teat skin were 7.8-times more likely to have an IMI with *S. aureus*, but oddly this association was not found in the subset of quarters that were subsequently diagnosed by PCR. Perhaps the PCR was detecting *S. aureus* at levels lower than an infective dose or detecting non-viable bacteria? Still, this is more evidence to support teat hygiene/teat spray.

Reference: *J Dairy Sci.* 2019;102(1):629–639

[Abstract](#)

Transmission dynamics of *Staphylococcus aureus* within two Danish dairy cattle herds

Authors: Kirkeby C et al.

Summary: This second group of Danish investigators analysed the transmission dynamics of *Staphylococcus aureus* in two dairy herds participating in a longitudinal study. The two herds had 180 and 360 milking cows, respectively, and animals were tested at quarter level once per month over a period of 1 year. The quarter-level prevalence and transmission rate were estimated to be 34% and 0.0132 cases/quarter-day for herd 1 and 2.57% and 0.0077 cases/quarter-day for herd 2. The estimated duration of infection was 91 and 64 days and reproductive ratio was 1.21 and 0.52 for herds 1 and 2, respectively. The investigators proposed that their data could be used to inform models simulating the spread of *S. aureus* to assess the cost effectiveness of strategies to manage intramammary infection caused by *S. aureus* within dairy cattle herds.

Comment: This longitudinal study followed cows from two Danish dairy herds with very different prevalence of *S. aureus* in them. One farm had an average bulk milk somatic cell count (BMSCC) of 294,000 and the other 280,000. All quarters were sampled approximately monthly. Despite the two farms having similar BMSCC, the quarter prevalence was vastly different (34% vs 2.57%) and the rate of transmission differed also (0.0132 and 0.0077 cases/quarter-day). The reproductive ratio (number of new infections arising from an infected quarter) differed also (1.21 and 0.52). Despite these being different farms, it surprised me that the difference in measures described above was so marked despite the BMSCCs being similar. All these values will most likely be used develop models but to me they highlight what we see clinically, that sometimes for unknown reasons a Staphylococcus problem in a herd "snowballs" out of control. Once the prevalence gets high enough, the rate of transmission (reproductive rate) also increases.

Reference: *J Dairy Sci.* 2019;102(2):1428–1442

[Abstract](#)

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Economic and epidemiological impact of different intervention strategies for clinical contagious mastitis

Authors: Gussmann M et al.

Summary: To evaluate the economic and epidemiological impact of different intramammary infection (IMI) intervention strategies for clinical mastitis, this third group of Danish investigators modelled cow- and pathogen-specific IMI transmission for a herd with 200 dairy cows. Strategies were compared for farm parameters, including the number of clinical IMI cases, culled cows, and antibiotic doses. The results showed that nearly all of the intervention strategies could reduce the number of IMI cases compared with a standard intervention. This occurred together with either increased antibiotic usage or an increased number of cows culled in relation to IMI. A slightly higher net income was noted for strategies with more antibiotics or reactive culling.

Comment: This study modelled a Danish dairy farm and modelled nine strategies that could be used to manage clinical IMIs caused by *Staphylococcus aureus*. The two broad approaches were more antibiotics or reactively cull cows. In the model, if a simulated cow had a somatic cell count >200 in the last 3 months of lactation her milk was sent for PCR testing to determine if she got antibiotic dry cow therapy (DCT) or no DCT. The herd was modelled to have an annual incidence of clinical mastitis of 21%, mainly caused by *S. aureus*. The basic strategy was to treat with intramammary antibiotics for 3 days, other antibiotic strategies were to treat for ≥5. Six strategies involved culling as an intervention at time of clinical mastitis based on different criteria (predicted chance of cure, reproductive status, repeat case) or culling after not curing. The authors point out that the best approach to take is to reduce transmission of infection. The cost effectiveness of reactive culling over the long term (5 years) was generally beneficial especially when the relative value of milk to a cull cow was high.

Reference: *J Dairy Sci.* 2019;102(2):1483–1493

[Abstract](#)

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