# Dairy RESEARCH REVIEW™

Making Education Easy

Issue 32 – 2022


## In this issue:



RESEARCH REVIEW™
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# Welcome to the latest issue of Dairy Research Review.

A prominent theme in this issue is dairy cow mobility in the form of three articles that address issues related to digital cushion thickness, spontaneous humeral fracture, and lameness, respectively. Two other papers discuss passive immunity, one in relation to the microbial composition of colostrum and the other in relation to its transfer in multisource co-mingled dairy calves. Also included is a review of available nutritional strategies to reduce enteric methane in dairy cattle.

We hope that the research featured in this issue of **Dairy Research Review** is of benefit in your daily practice. Your feedback is important. Please keep it coming!

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.

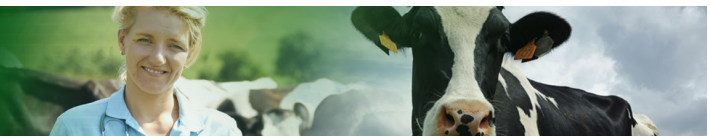

## Invited review: Selective use of antimicrobials in dairy cattle at drying-off

**Authors:** McCubbin KD et al.


**Summary:** The authors of this narrative review summarise current drying-off practices and their outcomes in the dairy industry. They specifically refer to antimicrobial treatment of existing intramammary infection (IMI) at drying-off and prevention of new IMI during the dry period to provide an overview of trends worldwide, including associations with udder health, production, economics, and antimicrobial resistance. Discussion of selective dry cow therapy (SDCT) and blanket dry cow therapy (BDCT) comparisons is limited to field trials and excludes studies comparing BDCT and no antimicrobials. The authors conclude that SDCT is a viable option for maintaining udder health and milk production in dairy cows at the same time as improving antimicrobial stewardship.


**Comment:** NZ has been pushing towards, or transitioning to, SDCT for as long as most of us have been practicing. For some context, BDCT is not permitted in the Netherlands or the "Nordic countries" and since January 28 this year prophylactic antimicrobial use has been forbidden in the EU. This being a review paper it does not give us any new information but it does reinforce the message that SDCT will not do any harm if done well. I think the main points were that herds selected for SDCT should have a lowish bulk tank somatic cell count, low levels of contagious mastitis, hygienic dry off practices, and good records. It also emphasised the importance of the cows (or quarters) that do not receive an antibiotic getting a teat sealant.


***Reference: J Dairy Sci. 2022;105(9):7161-7189***
Abstract



## Osteoporosis is the cause of spontaneous humeral fracture in dairy cows from New Zealand

**Authors:** Wehrle-Martinez A et al.

**Summary:** Anecdotally at least, humeral fractures are common in cows grazing on a diet that is predominantly fodder beet before parturition. The main aims of this case-control study, which used a convenience sample from fractured and non-fractured cows, were to evaluate histological and histomorphometric changes in cows affected by spontaneous fracture of the humerus; determine whether histological and histomorphometric changes in bones from cows grazing a diet of predominantly fodder beat over winter were different to cows that graze on a pasture-based diet over the winter; and describe the relationship between histological bone changes and liver copper (Cu) levels. Cows that were grazed on fodder beet had thicker growth plates with an abnormal appearance compared with cows grazed on pasture. Cows with low or marginal liver Cu levels had more resorption cavities in the distal humerus and thinner cortical bone compared with cows with adequate liver Cu levels. Lower trabecular density, abnormal cortical resorption, presence of woven bone formation in the proximal metaphysis, and the number of resorption cavities in the distal humerus were statistically significantly associated with a high probability of fracture.

**Comment:** It seems my clients are now at a stage where they just seem to accept that they occasionally might get a heifer (or more) that spontaneously gets a fractured humerus, as I do not get called about them now. But when I ask, they are still happening. It seems that fodder beet feeding and a lack of Cu have been the easy explanations, as we are all susceptible to confirmation bias and confusing association with causation. Here though is a paper that throws both of those assumptions "under the bus" or at least intense scrutiny. Of the 80 cases examined 33 were grazed on fodder beet and 28 had grazed on pasture in the preceding winter, the balance was wintered on other crops or the information on the diet was not provided. Interestingly though there were statistical differences in some of the histological findings between the heifers on fodder beet and pasture winter diets. Fodder beet humeri had thicker growth plates (26µm), the cortical thickness was less (by 35µm), and there were more resorption cavities in the distal humerus. In the 80 cases, 62% of affected heifers had low or marginal liver Cu levels (≤94 µmol/kg) compared with 18% of the control heifers. Regardless of fracture status, heifers with low liver Cu levels had more resorption cavities, and thinner cortices but the growth plate thickness was the same. The heifers with fractures were suffering from osteoporosis. There are two mechanisms by which osteoporosis occurs. The first is a failure to achieve peak bone mass, or excessive bone resorption, and/or low bone turnover (normal osteoclastic activity with reduced osteoblastic activity). "The histological and histomorphometric findings in this study, both failure of bone formation and excessive bone resorption, have contributed to the osteoporosis observed in affected cows". It seems from this paper that a period of inadequate nutrition and possibly inadequate Cu (evidenced by depletion of Cu reserves at the time of fracture) leads to some heifers not achieving peak bone mass and adequate bone strength. "Bone-related clinical signs in ruminants grazing Cu-deficient pasture include poor growth and weight gain, lameness, enlargement of joints, increased brittleness of bones, and increased incidence of spontaneous fractures" – this is not the clinical picture I have seen so I am not convinced Cu deficiency is a causative factor.

***Reference: Vet Pathol. 2022 Sep 12 [online ahead of print]***
Abstract

## Behavior of dairy cows managed outdoors in winter: Effects of weather and paddock soil conditions

**Authors:** Neave HW et al.

**Summary:** The primary aim of this observational study was to determine how weather and paddock soil conditions affect the lying behaviour of dairy cows managed outdoors in crop paddocks during winter. A secondary aim was to characterise the eating and ruminating behaviours of the cows during winter and how those behaviours were affected by weather and paddock soil conditions. Four groups (99 non-lactating, pregnant cows each) were managed on four outdoor paddock areas on the same NZ farm; the groups were fed pasture silage and grazed either kale (2 groups) or fodder beet (2 groups). Overall, the results showed that the cows displayed reduced lying time when paddock soil conditions deteriorated, especially on the day of and day after a rainfall event, leading to a rebound in lying time two days later. The majority of cows had <10 hours/day of lying time, and some <8 hours/day, suggesting that these cows may not have had access to comfortable lying surfaces. The most useful of the four paddock measures used to estimate the quality of the lying surface was the percentage of sites in the paddock with surface water pooling.

**Comment:** This study looked at the behaviour of cows wintered on kale or fodder beet. There were no great surprises but at least there are now some figures around what cows do during, and after, rain events. The major finding was that lying time became compromised with deteriorating paddock soil conditions, which were closely linked with rainfall events. Cows lay less on the day of, and the day after rainfall, but two days after rainfall lying time was greater than before the rainfall event. As usual the average does not tell the whole story as on the heavy rainfall days a third of the cows did not lie down at all. Temperature or rainfall did not adversely affect either eating time or rumination time. The paddock measure that had a significant effect on lying time was the percentage of sites with surface water pooling. This measure will not be directly associated with rainfall as soil types and topography will, along with rainfall, determine the percentage of the paddock with surface water pooling. It is great to have science about cows' interaction with the soil conditions, but I suspect ultimately society will decide what are acceptable winter grazing practices.

***Reference: J Dairy Sci. 2022;105(10):8298-8315***
Abstract

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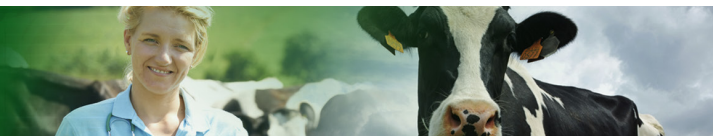


## Exploring the microbial composition of Holstein Friesian and Belgian Blue colostrum in relation to the transfer of passive immunity

**Authors:** Van Hese I et al.

**Summary:** The primary objective of this prospective cohort study conducted by Belgian investigators was to define and compare the bacterial composition of first-milking colostrum collected from healthy Holstein Friesian and Belgian Blue cows. The second objective was to assess the effect of cattle management parameters around parturition on the microbial composition of colostrum, the transfer of passive immunity, and health of the calf. The microbial composition of first-milking colostrum was analysed in 62 Holstein Friesian and 46 Belgian Blue cows and calves that received on three occasions 2L of their dam's colostrum within 24 hours of birth. The investigators found that the colostral microbial composition of Holstein Friesian cows differed significantly from that of Belgian Blue cows. Several microbial genera were found to be differentially abundant between colostrum of different quality within each breed. Microbial composition of colostrum was also found to affect immunoglobulin G (IgG) absorption in the calf.

**Comment:** We are well past thinking about colostrum quality and quantity in November and more focused on weaning, but this article does add something to discussion about colostrum. I tend to think about colostrum quality in terms of its IgG level. This study examined the microbial population of the colostrum and described the microbial population of colostrum from Belgium Blues and Holstein Friesian cows and whether specific microbial genera were associated with colostrum quality and IgG absorption in the calf. This study found a positive correlation between the quantity of antibodies the calf received and the serum IgG levels, which makes logical sense, but this accounted for only 15% of the variation between calves. It seems that the microbiome of the fed colostrum may account for some of the unexplained variation. The microbiome was different between breeds and varied within breed for colostrum of different quality (level of IgG). In the Holstein Friesian calves the colostrum microbiome that was fed to calves that had low serum IgG levels differed to the colostrum fed to calves which ended up with high serum IgG levels. It seems that the microbial population in the colostrum fed does influence passive transfer and is likely additional to bacterial overgrowth from poor storage. Until this is better understood I have no idea on how the use this information though.

***Reference: J Dairy Sci. 2022;105(9):7623-7641***
Abstract





## Improving parlor efficiency in block calving pasture-based dairy systems through the application of a fixed milking time determined by daily milk yield and milking frequency

**Authors:** Edwards JP et al.

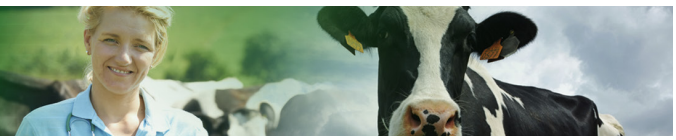
**Summary:** These researchers developed an alternative method for calculating milking efficiency (fixed milking time [FixedT]) whereby the average daily milk yield (kg/cow) is divided by the milking frequency (2 for twice-a-day [TAD], 1.5 for 3-in-2, and 1 for once-a-day [OAD]) to get the average yield per milking and using this to calculate the target milking time for all milking sessions. This study tested the hypothesis that FixedT could be applied at all milking sessions without compromising milk production or udder health for a range of milking intervals. To test the hypothesis, four experimental herds were established: (i) herd milked twice a day (TAD) using a 10- and 14-hour interval; (ii) herd milked TAD using an 8- and 16-hour interval; (iii) herd milked three times in two days using a 10–19–19-hour interval; and (iv) herd milked once a day (OAD). Each herd consisted of 40 cows and were established for two 6-week experimental periods, one in peak lactation and the other in mid-late lactation. Applying FixedT determined by daily milk yield and milking frequency, irrespective of milking interval and individual session yield, had no negative effect on milk yield. This was a result of residual milk from one milking likely increasing the proportion of milk in the udder cistern at the next milking session. However, fat yield was compromised when the percentage of the herd with a truncated milking exceeded an estimated 33% at a milking session. This occurred in the TAD 8–16 hour interval herd due to the deviation from the average milking interval of 12–12 hour. Although FixedT appeared to have no detrimental effects on udder health, a higher log10 somatic cell count and percentage of quarters with new intramammary infections were noted for the OAD herd in mid-late lactation.

**Comment:** Maximum milking time (Max T) sounds great but there are some practical issues due to the different milking intervals and amount of milk to be harvested at each milking if it is adhered to dogmatically – for example, at an afternoon milking a "cups on time" might be as low as 5.5 minutes and if you want to achieve this on a 60-bail rotary shed you are likely to need more people to milk/keep up. It might be efficient, but it could be costly. Additionally, for those with automatic cluster removers, most systems do not come with an option of setting different maximum milking times, requiring a manual change, sometimes at each unit, before each milking session. Cows within the experimental herds had their cups removed at pre-set flow rate (0.35 kg/min) or at fixed time based on the herds average daily amount of milk and the fixed-time criteria was applied at all milkings. There were two TAD intervals examined (8–16 hour and 10–14 hour intervals ) a 3-in-2 (10-19-19 hour intervals) and a OAD system. In was not until greater than 30% of cows had a milking being shortened by the Max T that yield was compromised (fat percentage). This occurred at the morning milking of the TAD herd milked at 8- and 16-hour intervals. In summary, using Max T so that no more than 33% of cows at a milking (check the morning milking in a TAD herd) have their milking shortened is unlikely be a problem.

***Reference: J Dairy Sci. 2022;105(9):7513-7524***
Abstract

### Independent Commentary by Hamish Newton

Hamish Newton graduated from Massey University with a BVSc 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.



## Genetic parameters and genome-wide association study of digital cushion thickness in Holstein cows

**Authors:** Barden M et al.

**Summary:** With the digital cushion having been linked to the development of claw horn lesions (CHL) in dairy cattle, the objectives of this prospective cohort study were to: (i) estimate genetic parameters for digital cushion thickness (DCT); (ii) estimate the genetic correlation between DCT and CHL; and (iii) identify candidate genes associated with DCT. A total of 2,352 Holstein dairy cows were enrolled on four farms and assessed before calving, immediately after calving, in early lactation, and in late lactation. The results indicated that DCT is a heritable trait that has a weak negative genetic correlation with the severity of sole lesions, although not with white line disease (WL). The strength of the genetic correlation between DCT and sole lesions depended on the stage of lactation at which both the digital cushion and sole lesions were assessed. A polygenic background to DCT was identified; candidate genes identified for DCT were associated with inflammation, fat metabolism, and bone development.

**Comment:** This study looked at the genetic parameters for DCT and estimated the genetic correlation between DCT and CHL. Importantly, the CHL were separated into solar lesions (ulcers and haemorrhage) and WL. This study like others done previously demonstrated that DCT is a heritable trait (in Holsteins) with a heritability of between 0.23 and 0.44 so is useful. Unfortunately for us in NZ "the genetic correlation between DCT traits and WL-severity was effectively zero". There was weak negative correlation between DCT and sole lesion (ulcers and haemorrhage) severity. Finally, as reminder of how to interpret correlations the authors state "correlation is a bidirectional relationship, and therefore, an alternative explanation also exists. The development of CHL has been hypothesized to use fatty acids from the digital cushion as inflammatory mediators, thereby reducing the adipose tissue in the digital cushion, causing a reduction in thickness and a presumed impairment of its functionality".

***Reference: J Dairy Sci. 2022;105(10):8237-8256***
Abstract

## Association between transfer of passive immunity and health disorders in multisource commingled dairy calves raised for veal or other purposes: Systematic review and meta-analysis

**Authors:** Abdallah A et al.

**Summary:** Most studies that have assessed the transfer of passive immunity in newborn dairy calves focused on calves delivered and raised on the same farms, which is a setting that differs from calves transported and commingled from different farms. The aim of this systematic review and meta-analysis was to describe the association between failure of passive transfer (FPT) and important health outcomes (mortality, bovine respiratory disease, and diarrhoea) in multisource commingled dairy calves raised for veal or other purposes. Nineteen studies were included in the analysis. FPT was found to be associated with mortality and diarrhoea in finishing facilities for multisource commingled dairy calves. With adjustment for publication bias, FPT was not found to be associated with increased bovine respiratory disease risk.

**Comment:** This review paper looked at the effect of FPT on the odds of respiratory disease, diarrhoea, and mortality of "multisource commingled dairy calves raised for veal production". This paper might be relevant for calf rearers who directly source calves from multiple properties, but perhaps less so for what I think you North Islanders call "feeder calves" from the Frankton Sales yards as I cannot see what they can do about ensuring they buy calves with good antibody levels? Failure of passive transfer was found to be associated with mortality and diarrhoea. The odds of suffering from diarrhoea was 3-times higher if found to have FPT and FPT calves were 2.5-times more likely to experience mortality.

***Reference: J Dairy Sci. 2022;105(10):8371-8386***
Abstract

### Using Dairy Research Review for CPD points

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## Fertility of dairy cows milked once daily or twice daily in New Zealand

**Authors:** Jayawardana JMDR et al.

**Summary:** These investigators evaluated the reproductive performance of NZ dairy cows with different milking regimens and parity number. Data on herd test milk yields, calving, mating and pregnancy diagnosis dates, and breed information of spring-calved dairy cows in the production year 2017–2018 were extracted from Livestock Improvement Corporation (LIC). Initial data sets contained data from 4,173 herds. Cows milked once daily (OAD) for the entire lactation were found to be more fertile than cows milked twice daily (TAD) for the entire lactation. Furthermore, there was no significant difference in the key reproductive metric of 'in calf by 6 weeks' (PR42) between herds milked OAD for part of the lactation or herds milked TAD. However, the metric of 'not in calf' (NIC) was significantly different between herds milked once daily during the mating period (OAD-M), once daily after peak lactation (OAD-P), and TAD.

**Comment:** This study classified herds as milking TAD, OAD for the whole season, or herds that switched to OAD-M, OAD-P, or milking at the end of lactation based of the data supplied at herd testing (herds had to be doing four tests). Data from the 2017–18 season was used from 2,500 herds using the LIC data base. The cows milked OAD had an average PR42 of 75% and 9% NIC rate compared the TAD cows with a 68% PR42 and 13% NIC. The PR42 was not significantly different between the cows milked TAD and those that switched to OAD during mating or after peak. The cows that switched to OAD during mating or after peak had a slightly better NIC though than the TAD cows. This study confirms that quickly switching to OAD if "the cows aren't cycling" will not really alter your 6-week in calf rate but it might have a small effect on the empty rate. This study only looks at the reproductive performance of the season the different milking regimens were implemented, not the subsequent mating period, so if switching to OAD resulted in cows calving at an optimal body condition score this benefit would not be reported here. The decision to switch to OAD part way through the season will only have a minor reproductive effect this season, so if switching to OAD for reproductive reasons any benefit will not occur until the next mating period.

***Reference: J Dairy Sci. 2022;105(11):8911-8923***
Abstract

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## Randomized clinical trial investigating the effect of exercise and standing on concrete prior to first calving on time to first lameness event in dairy heifers

**Authors:** Mason WA et al.

**Summary:** To investigate if an intervention immediately before the first calving event could reduce lameness incidence in pasture-based dairy heifers, 790 heifers across six farms in the Waikato region were randomly enrolled (1:1) into treatment or control groups. The treatment consisted of heifers walking approximately 1km from pasture along the farm race, standing on concrete for one hour, and then walking back to their paddock. This occurred once a day, five times a week, for 5 weeks before calving. The control heifers were managed solely at pasture before calving. Immediately prior to calving, both groups were brought together and managed as one group for the remainder of the study. Heifers were followed fortnightly for up to 28 weeks to identify animals with lameness. No associations were identified between treatment groups with respect to time to lame event, nor any of the secondary outcomes, which included milk solid production, change in body condition score during early lactation, time from onset of breeding season until conception, feasibility of the regimen, and change in sole soft tissue thickness and profile.

**Comment:** This trial was run on six Waikato dairy farms where half of the heifers, five times a week for 5 weeks, were walked to a concrete pad, held there for an hour, and then walked back to the paddock. The other half were managed at pasture. The idea was that by getting the feet used to hard surfaces they would adapt to the environment (probably by increasing the thickness of the digital cushion) and be less likely to become lame. This approach has been shown to work on housed cattle. In this study, lameness was not reduced by walking the heifers on and off concrete. This may be because the training or conditioning regimen was not long or intense enough. Alternatively, perhaps in pasture-based dairy systems the risk for becoming lame due to walking is proportionally more important than being on concrete compared to the systems where cows spend far more of their day on concrete?

***Reference: J Dairy Sci. 2022;105(9):7689-7704***
Abstract



## Symposium review: Effective nutritional strategies to mitigate enteric methane in dairy cattle

**Authors:** Hristov AN et al.

**Summary:** In this symposium review, the authors discuss successful enteric methane ($CH_4$) mitigation strategies including $CH_4$ inhibitors, alternative electron sinks, vegetable oils and oilseeds, and tanniferous forages, which are among the currently recommended strategies for reducing $CH_4$ emissions from dairy cattle. These strategies are also effective in reducing $CH_4$ emissions yield and intensity, despite potential negative effects on dry matter intake (DMI) and fibre digestibility. Also discussed is the strategy of feeding lactating dairy cows with the $CH_4$ inhibitor 3-nitrooxypropanol (3-NOP), which has demonstrated a 28–32% decrease in daily $CH_4$ emissions or emissions yield and intensity. It had no effect on DMI, milk production, or bodyweight change but was associated with a slight increase in milk fat concentration and yield. Results with the red macroalga *Asparagopsis taxiformis* are also encouraging; however, more research, particularly long-term studies, are necessary before this mitigation practice can be recommended. The authors' overall conclusion is that widespread adoption by the livestock industries of methane mitigation strategies with proven effectiveness will depend on cost, government policies and incentives, and consumer willingness to pay more for animal products with a lower carbon footprint.

**Comment:** This is a paper that gives a pretty concise review of what nutritional strategies are available to reduce enteric methane production. Before getting into detail, I think it worthwhile to directly quote from this paper, "Increasing forage digestibility and digestible forage intake has the potential for decreasing enteric $CH_4$ emission intensity ($iCH_4$; i.e., g/day of $CH_4$ per kg of product)", so if the same amount of product is produced by feeding more digestible feeds there is less methane produced. This paper has categorised the mitigation strategies as inhibitors, electron sinks, oils and fats, and finally tanniferous forages. Nitrates are the most widely published about electron sink but there is concern expressed about this approach for animal health and the increased urinary excretion of nitrates leading to $NO_2$ emissions. Lipids can decrease $CH_4$ emissions but potentially can reduce production – it seems their effect on $CH_4$ emission can be variable also. Feeding tannins resulted in a smaller reduction in $CH_4$ than other strategies described in this paper. The papers about feeding tannins that were summarised in this review did not report animal production from these diets (e.g. amount of milk) so the emissions intensity could not be reported. It is possible the reduced $CH_4$ emissions was due to reduced digestibility of organic matter and fibre. Two $CH_4$ inhibitors were discussed in some detail. The first was 3-NOP. This feed additive has been shown to be effective when fed once a day so could be used in a shed feeding system and does not seem to affect milk production and has even been shown to increase milk fat. The second inhibitor discussed was the macro algae of which the *Asparagopsis* spp. seem to be the only ones that have been confirmed to work *in vivo*. These contain a brominated halomethane called bromoform. This reduces $CH_4$ production but may also decrease dry matter intake. Other downsides are the concern about bromoform depleting the ozone layer and the effect of feeding the algae may diminish after feeding for more than nine weeks and it currently costs in the region of $US25 a day.

***Reference: J Dairy Sci. 2022;105(10):8543-8557***
Abstract