



Making Education Easy

Issue 18 – 2019

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## Welcome to the latest issue of Dairy Research Review.

Two studies in this issue investigate contrasting approaches to addressing animal welfare concerns associated with calf debudding. One study attempts to determine the degree of pain relief afforded by using a topical anaesthetic during the cornual nerve block procedure while the other study evaluates how genetically transitioning the dairy population can reduce the number of calves that require debudding. Two other topic-linked studies that feature in this issue deal with milk production: one assesses whether using teat sealant with antibiotic therapy has benefits for milk production and the other investigates the relationship between heifer bodyweight and subsequent milk production.

We hope that you enjoy this issue of **Dairy Research Review**. Your feedback is appreciated – 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.

## Acute pain responses in dairy calves undergoing cornual nerve blocks with or without topical anesthetic

**Authors:** Jimenez RE et al.

**Summary:** This US study determined whether a topical anaesthetic reduced calves' pain response to cornual nerve block, which is recommended practice to ensure local anesthesia during debudding. Calves were assigned to receive lidocaine-prilocaine cream at the sites of injection (n=10) or no cream (n=9). Thirty minutes after these treatments, the calves received a subcutaneous injection of 2% buffered lidocaine hydrochloride around the left and right cornual nerves. The results demonstrated that cornual nerve blocks with buffered lidocaine are painful and that a lidocaine-prilocaine cream was ineffective in reducing this pain and may even worsen it.

**Comment:** With the new regulations around calf debudding coming into effect on the 1<sup>st</sup> October this paper seems timely. It seems safe to assume that giving a cornual nerve block will cause some pain so the authors examined whether applying a topical anaesthetic cream prior to the injection would result in less pain associated with the application of the nerve block. Counterintuitively (to me at least), it did not reduce the measured signs of pain caused by application of the cornual nerve block. Eye temperature increased post nerve block in both groups of calves; however, this may possibly be due to the vasodilatory effect of the nerve block near the eye. Heart rate increased by 14 bpm in both groups post nerve block, which was similar to the rise in heart rate after surgical castration without anaesthesia (15 bpm) reported in a different study. Heart rate has been reported to increase by 35 bpm in calves debudded without anaesthesia in another study cited in this paper. Please don't take this to mean that surgical castration is as equally noxious as a cornual nerve block or vice versa. This paper does not support the use of a lidocaine-prilocaine cream 30 mins prior to the cornual nerve block. Other formulations may work though. Interestingly, the authors discuss the use of distraction, e.g. having a teat for the calf to suckle, which has been shown to result in steers struggling less during restraint. Distraction seems to work with children as well when they crash off a bike. Perhaps a teat mounted on a farmer's calf debudding crush might not be dumb idea?

**Reference:** *J Dairy Sci.* 2019;102(4):3431–3438

[Abstract](#)

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### The effects of herd size on the welfare of dairy cows in a pasture-based system using animal- and resource-based indicators

Authors: Beggs DS et al.

Summary: Of the many challenges facing good animal welfare on Australian pasture-based dairy farms, this study found that managing heat stress and the effect of increased time away from pasture on the ability of cows to lie down are noteworthy issues as herd sizes increase. Animal welfare assessments were conducted on 50 dairy farms of varying herd sizes: 16 small (<300 cows), 15 medium-sized (300–500 cows), 11 large (501–750 cows), and 10 very large farms (>751 cows).

Comment: This Aussie paper looked at welfare of pastured dairy cattle. I think it is likely that welfare assessments or audits will become a bigger part of a dairy vet's role at some stage. This paper describes animal-based measures of welfare (e.g. lameness, body condition score, faecal scoring for sub-acute ruminal acidosis [SARA]), which reflects what actually has happened but might not represent what happens at other time points in the year. It also describes resource-based measures (e.g. number of water points or sprinklers for cooling, amount of grain fed per cow per year, or SARA risk), which may give a better indicator of welfare over a longer time period, but of course just because a resource is available does not mean that it will be used, or misused. Hence, both animal- and resource-based measures should be included in an assessment or audit. Without going into all the results, there was no simple relationship between welfare and increasing herd size despite longer walks and increased likelihood of feeding more grain. I was surprised to read this lack of a relationship has been reported in a review of over 150 papers. It is stated that larger farms provided more opportunities to improve animal welfare but also created more risks. An audit that is used for compliance will need to be a very well thought out and comprehensive beast.

Reference: J Dairy Sci. 2019;102(4):3406–3420

[Abstract](#)

### Negatively controlled, randomized clinical trial to evaluate use of intramammary ceftiofur for treatment of nonsevere culture-negative clinical mastitis

Authors: Fuenzalida MJ & Ruegg PL

Summary: This randomised clinical trial compared the clinical outcomes of five days' intramammary treatment using ceftiofur with no antimicrobial treatment in non-severe culture-negative cases of clinical mastitis in a single herd. The results suggested that little financial or welfare benefit would be obtained by using intramammary ceftiofur.

Comment: We are all trying to reduce the amount of antibiotics used in dairy animals and I assume we all agree the best way to do this is by reducing the need to use antibiotics, but we will still be faced with cases of clinical mastitis that may require antibiotic therapy. This study followed 121 cases of "non severe" mastitis that were culture-negative on farm and assigned them to receive either no treatment or five days of intramammary ceftiofur (the most commonly used antimicrobial in US dairies). On the farm used for the study, non-treatment of non-severe culture negative mastitis did not result in more mastitis (quarter recurrence), culling, or reduced daily milk yields. It was modelled that, on this farm, adopting a policy of not treating these cases would result in 30% less antibiotic being used. Overall, 479 cases out of 714 were described as "non severe". Of the 312 cases from the 479 non-severe cases that had on-farm culture performed, 121 were no growth and could potentially in the future not receive antibiotics. Another use for on-farm culture systems?

Reference: J Dairy Sci. 2019;102(4):3321–3338

[Abstract](#)

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### Effect of energy source in calf milk replacer on performance, digestibility, and gut permeability in rearing calves

Authors: Amado L et al.

Summary: These Dutch researchers attempted to determine the effect of partially exchanging lactose for fat (on a weight-weight basis) in calf milk replacer (CMR) formulation on performance, digestibility, and gut permeability in calves (n=60) fed twice daily on a high feeding plane. The CMR formulations were isonitrogenous but not isoenergetic. The researchers found that exchanging lactose for fat in the CMR did not affect growth performance, total feed intake, or nutrient digestibility.

Comment: There seems to be little debate now that pre-weaning growth rates have an effect on life-time performance. In general, whole milk has higher levels of energy, enzymes, hormones, and growth factors compared with CMRs. CMRs tend to have higher levels of lactose and lower fat levels than whole milk, which may result in a lower energy-to-protein ratio for CMRs and an altered osmolarity. With a gradual swing away from feeding waste milk due to concerns about antibiotic residues, *Mycoplasma bovis*, and pasteurisation of large volumes on farm not yet being commercially available, this paper does give confidence in using CMRs that have been fortified with additional fat since they did not result in changed growth rates or digestibility of nutrients, i.e. the current formulations probably will not be improved by substituting lactose for fat.

Reference: J Dairy Sci. 2019;102(5):3994-4001

[Abstract](#)



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### Comparative analyses of estimated and calorimetrically determined energy balance in high-yielding dairy cows

**Authors:** Erdmann S et al.

**Summary:** These researchers compared the energy balance estimated (EBest) according to equations published by various energy feeding systems and the energy balance calculated by use of calorimetrically measured heat production (EBhp) of 20 high-yielding German Holstein cows at -4 weeks (pregnant, nonlactating) and 2 weeks (early lactation) relative to parturition. Multiple parameters of metabolic status were also measured. Based on the results of the study, the researchers concluded that because similar metabolizable energy intake and milk energy values were used for calculation of EBest and EBhp, the observed differences were mainly related to higher than predicted metabolizable energy maintenance values.

**Comment:** In this German study, pre- and post-calving energy requirements were calculated and cows also had their energy output measured in respiration chambers. While the cows studied (producing >10,000 litres of milk per 305d lactation) may not be the typical NZ cow, it was concerning to read that the equations used overestimated the energy balance pre-partum and underestimated the size of the energy deficit post-partum. It is likely that this was partially driven by an underestimation of the maintenance requirements of these cows by the equations used. With our uncontrolled environments (wind, rain, etc.), this paper to me highlights the importance of body condition score, assessing gut fill, measuring non-esterified fatty acids and/or  $\beta$ -hydroxybutyrate levels, and looking to see what is actually getting into the vat to validate the feed budget. Anything that we can do to reduce the duration and magnitude of the period of negative energy balance post calving should result in greater reproductive success. This obviously starts with a feed budget but at least for German Holsteins we may have been "short changing" them.

**Reference:** *J Dairy Sci.* 2019;102(5):4002–4013

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### Phosphorus content of muscle tissue and muscle function in dairy cows fed a phosphorus-deficient diet during the transition period

**Authors:** Grünberg S et al.

**Summary:** This Dutch-German co-authored study assessed the effect of dietary phosphorus (P) deprivation during late gestation and early lactation on muscle P homeostasis and muscle function in multiparous dairy cows in late gestation (n=36). The results of the study suggest that prolonged dietary P deprivation in transition dairy cows leads to marked sustained hypophosphatemia without altering the muscle tissue P homeostasis or causing clinical muscle function disturbances.

**Comment:** Many of our clients' cows will now be on fodder beet and in the spring we will likely see some down cows. On our differential list will be the possibility of P deficiency, especially in some localised areas. Cows in this study were allocated to receive either a low P diet or an adequate P diet for 4 weeks pre-calving and for four weeks into lactation. Electromyograms, muscle biopsies, and blood samples were taken to examine muscle function and measure blood P levels. The low P diet resulted in prolonged deficiency of P as measured by blood but this was not associated with any down cows or clinical signs of muscle weakness or reduction in P in the muscle biopsies. There were four cases of hypocalcaemia but all were in cows that were in the adequate P diet group. There were only subclinical effects detected by the electromyograms in the low P diet cows. Four of the low P diet cows had to be removed from the trial two to four weeks into the trial as they developed post parturient haemoglobinuria (PPH). This study did result in the treatment cows becoming deficient in P (as measured by blood and supported by the diagnosis of PPH) but did not result in clinical muscle weakness although there were sub-clinical effects detected on the electromyograms. I think it is far more interesting that cows developed PPH rather than become weak or recumbent. Perhaps when working up a case of down cows where low P is a differential, haematology might be as useful as serum P levels?

**Reference:** *J Dairy Sci.* 2019;102(5):4072–4093

[Abstract](#)

### Comparison of gene editing versus conventional breeding to introgress the POLLED allele into the US dairy cattle population

**Authors:** Mueller ML et al.

**Summary:** In this study, introgression (introgressive hybridisation) of the *POLLED* allele into both the US Holstein and Jersey cattle populations via either conventional breeding or gene editing (top 1% of bulls/year) was simulated for three polled mating schemes and compared with baseline selection on lifetime net merit alone, over a 20-year period. The simulations suggested that the use of conventional breeding methods to reduce the frequency of the *HORNED* allele will increase inbreeding and slow genetic improvement. The study also demonstrated how gene editing could be used to rapidly reduce the frequency of the *HORNED* allele in dairy cattle populations while maintaining the rate of genetic gain and constraining inbreeding, as well as addressing an emerging animal welfare issue.

**Comment:** This paper examines the possibility of increasing the frequency of the *POLLED* gene in the dairy population to reduce the number of calves that need debudding by gene editing. The frequency of the *POLLED* allele in the US is low in the dairy breeds and only three of over 3500 bulls registered with the National Association of Animal Breeders were polled (all were Holsteins) and had on average lower genetic merit. There is not, however, a direct relationship between genetic merit and being horned. Rather, the horned gene is a "hitchhiker" when selecting for elite dairy genetics. Due to the low frequency of the *POLLED* allele, a polled bull is unlikely due to chance to be a top ranked bull on dairy traits. If the industry as a whole decided to select for polled animals it would result in unacceptable levels of inbreeding and slow selection for other traits. This study demonstrated that gene editing to "introgress" the polled allele into the elite dairy genetics could be used to avoid inbreeding and allow genetic gain to still be made in other desirable traits. Something to think about when debudding calves or writing VOIs in the spring. Would NZ society be happy to allow this form of GM to improve welfare rather than increase production?

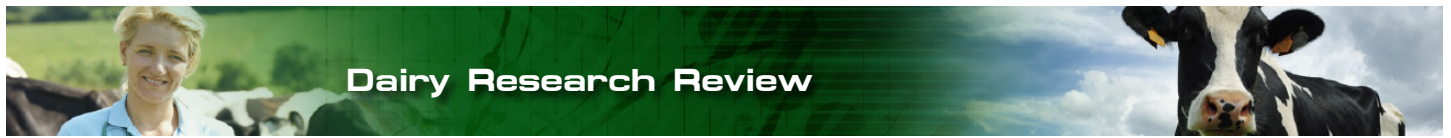
**Reference:** *J Dairy Sci.* 2019;102(5):4215–4226

[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.





## Randomized, controlled, superiority study of extended duration of therapy with an intramammary antibiotic for treatment of clinical mastitis

**Authors:** McDougall S et al.

**Summary:** These NZ investigators evaluated the efficacy of treatment of clinical mastitis following intramammary infusion of two durations of intramammary antibiotic therapy and analysed clinical and microbiology data at enrolment or within four days of commencement of treatment as potential predictors of subsequent clinical and bacteriological cure. A total of 304 glands were randomly assigned to intramammary treatment with a combination of amoxicillin, clavulanic acid, and prednisolone either three times at 12-hour intervals (n=156) or five times at 12-hour intervals (n=148). The researchers concluded that increasing the duration of treatment resulted in significantly fewer clinical failures, but had no effect on cure proportion, somatic cell count, or new infection rate. In addition, cow age, days in milk, and clinical signs were predictive of clinical and bacteriological cure proportion, which may provide guidance as to when to extend or recommence therapy.

**Comment:** This is a Waikato-based study that looked at extending treatment with Clavulox from three tubes to five tubes. Extended therapy resulted in fewer clinical failures; this seems logical. I think the take-home message from this trial is that making a decision about whether or not to re-start treatment could be made four days after starting treatment taking into account changes to the udder (heat and swelling), change in the California Mastitis Test score, and even a culture result if practical. Positive culture quarters at day 4 had a 44% chance of experiencing a repeat case of mastitis. With on-farm culture of mastitis samples becoming more readily available this is feasible.

**Reference:** *J Dairy Sci.* 2019;102(5):4376–4386

[Abstract](#)

## Effect of using internal teat sealant with or without antibiotic therapy at dry-off on subsequent somatic cell count and milk production

**Authors:** McParland S et al.

**Summary:** This study demonstrated how dry-cow therapy using teat sealant alone compared with teat sealant plus antibiotic resulted in higher somatic cell count (SCC) in the subsequent lactation in spring-calving, grazing dairy cows in three research herds in the south of Ireland. The increase in SCC was not large, however, indicating the potential for use of teat seal alone in low-SCC cows in herds.

**Comment:** This Irish study looked at grazing dairy cows with no history of clinical mastitis and no individual cow SCC >200,000 cells in the current lactation (low-SCC) who got either intramammary teat seal (ITS) alone or teat seal plus an antibiotic (AB+ITS) at drying off and were then followed through the whole of the following lactation. Cows that did not meet those criteria received AB+ITS and were classified as high-SCC. This is very similar to what many of us are advising for our clients right now. Low-SCC cows that received AB+ITS had the lowest subsequent somatic cell scores. The most commonly isolated pathogen in the study was *Staphylococcus aureus* so perhaps the criteria used here are in fact missing infected cows and this explains the apparent benefit of low-SCC cows getting AB had right through the duration of the subsequent lactation. Why this was seen all through lactation when all cows were run together is interesting but could suggest that contagious spread was minimal or that there is some mechanism by which antibiotic therapy in the dry period protects right through the lactation. On a more pragmatic level, the average SCC of the ITS cows was 81,000 versus 60,000 for the AB+ITS cows and the proportion of cows with a SCC >200,000 was similar for both low-SCC treatment groups throughout the lactation. Confusingly, despite the ITS cows having higher SCC they produced more milk than the AB+ITS cows. On balance this paper supports what we are doing here and any changes at a herd level are likely to be minimal in well managed/milked herds.

**Reference:** *J Dairy Sci.* 2019;102(5):4464–4475

[Abstract](#)



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## Positive relationships between body weight of dairy heifers and their first-lactation and accumulated three-parity lactation production

**Authors:** Hancock RC et al.

**Summary:** This study investigated the relationships between body weight and milk production of >140,000 NZ dairy heifers, which were classified into five breed groups: Holstein-Friesian, Holstein-Friesian crossbred, Jersey, Jersey crossbred, and Holstein-Friesian-Jersey crossbred. Body weights were assessed at intervals of three months from three to 21 months of age and their relationships with first-lactation and accumulated milk production over the first three lactations (three-parity) analysed. The study results demonstrated the potential to increase the milk production of NZ dairy heifers by increasing bodyweight during the rearing phase.

**Comment:** Any heifer that was heavier than another between 6 and 21 months old produced more energy-corrected milk in the first lactation than a lighter heifer. This was true for all breeds weighed at 3 months of age as well, with the exception of Friesian heifers. The effect lasted out to the third lactation. The relationship between body weight and production was defined as curvilinear, which put simply means that at a defined age the magnitude of the response to being heavier gets smaller the bigger the heifer was, i.e. a small 6-month-old heifer being 5kg heavier will result in bigger gain in production than a heavy heifer at 6 months of age being 5kg bigger. To me this suggests that we should be drafting on weight compared to the targets for each individual (although breed group did not have an effect in this paper) and preferentially feeding the lighter ones as this is where the biggest gains will come from if you have to decide where a limited resource should go, i.e. grass during a drought or purchased feed. As a note of caution, within the range of data reported here there was always a positive response in production to being heavier so please don't think just because they are "big" there won't be a benefit from being bigger.

**Reference:** *J Dairy Sci.* 2019;102(5):4577–4589

[Abstract](#)

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