

# Dairy RESEARCH REVIEW™

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Issue 22 – 2020

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

Selections in this issue include determination of the association between body weight and reproduction in dairy heifers, effect of bacterial contamination of colostrum on passive immunity and growth rates in calves, and relationship between energy balance and the metabolic profiles of plasma and milk in dairy cows during early lactation. Also included are two papers that address aspects of cattle welfare: the force required for broken tails and how welfare is affected by the type of management system.

We hope that you learn something new from reading this issue of **Dairy Research Review**. Your input is appreciated so please send 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.

### 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.



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## Body weight of dairy heifers is positively associated with reproduction and stayability

**Authors:** Hancock RC et al.

**Summary:** These NZ researchers studied the relationships between body weight (BW) and stayability, and between BW and calving pattern, for 189,936 dairy heifers. They found that heifers that were heavier at 6, 12, and 15 months of age were more likely to remain in the herd for first, second, and third calving, and were more likely to calve early for first calving compared with lighter heifers.

**Comment:** The weights of almost 190,000 NZ heifers were analysed and the reproductive performance followed for three seasons. A heifer had to have two recorded body weights prior to 12 months of age and two additional weights recorded between 13 and 24 months of age. A variable called “stayability” was also measured. Stayability is a measure of cow survival that does not require culling data to be recorded. It is the proportion of animals surviving to a defined age (if they had the opportunity to reach that age). Loss of heifers in NZ from 9 days of age to 17 months has been reported as between 4.8 and 9.8% in a research herd with heifers of low and high genetic merit for fertility. It has been found that the heritability of survivability is low, and that the environment has a greater effect of heifer survival than genetics, and heifer liveweight is a good place to start to improve. Stayability was measured as the proportion of cows calving as 2-, 3, and 4-year-olds. There were significant effects of body weight at 6, 12, and 15 months of age on the variables of stayability, calving rate, and re-calving rate. I have never done calculus so will struggle to describe the curves, but they are curvilinear. The rate of change in a variable with increasing weight at 15 months of age was greatest up to about 270kg then the rate of improvement slowed down and then appears to start to decline once they got over 370kg. The heavier heifers may have had poorer outcomes due to having too high a body condition score and being at greater risk of negative energy balance (both duration and severity), which may have resulted in poorer reproductive outcomes. This work supports the message from Dairy NZ that heifers need to be at 60% of mature liveweight by 15 months of age.

**Reference:** *J Dairy Sci.* 2020;103(5):4466–4474

[Abstract](#)

## Quantitative analysis of calf mortality in Great Britain

**Authors:** Hyde RM et al.

**Summary:** To provide information to national stakeholder groups to inform resource allocation, this study used data from the British Cattle Movement Services (BCMS) register to quantify the temporal incidence rate, distributional features, and factors affecting variation in mortality rates in calves since 2011. The results indicated that the BCMS register is an important resource for identifying neonatal mortality trends in the UK herd and providing ongoing cattle industry insights. Although environmental conditions appear to play a significant role in calf mortality rates, further research is needed to identify the specific environmental factors likely to reduce calf mortality rates.

**Comment:** In this study, data from the BCMS was analysed to get a handle on cattle mortality and at what age mortality occurs. When the on-farm deaths were looked at for dairy cattle, 54% of these deaths occurred before 24 months of age and 25% occurred before 3 months of age. Dairy calves experienced a 6% mortality rate from 0 to 3 months of age (males 7.37%, females 4.96%). What I considered most interesting was that a seasonal effect on calf mortality was found, with calves born in winter having a higher mortality rate than those born in the summer. Once all the modelling was done, environmental temperature, time of year, and calf sex and breed type accounted for 96% of the variation in on-farm mortality. To me, this suggests that calf mortality in NZ could well be reduced by optimising calf housing to increase the temperature in the sheds. This might be as simple as excluding drafts and making sure new sheds face the sun and are well drained. Perhaps something as simple as altering the colostrum management/ collection so it is fed a bit warmer/sooner after collection and hence will have the effect of warming a calf up a bit more? One limitation of this study was that it seems likely that still births or calves that died before being tagged might have not made it into the data set.

**Reference:** *J Dairy Sci.* 2020;103(3):2615–2623

[Abstract](#)

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## Effect of subclinical and clinical hypocalcemia and dietary cation-anion difference on rumination activity in periparturient dairy cows

**Authors:** Goff JP et al.

**Summary:** To test the hypothesis that hypocalcaemia in periparturient cows would reduce rumination activity, 26 Holstein cows entering their third lactation or more were fed a control diet [dietary cation-anion difference (DCAD) = +196 mEq/kg of dry matter (DM)] or a low DCAD diet supplemented with anions (DCAD = -9 mEq/kg of DM) prepartum. Rumination rate on the first and second day of lactation was strongly correlated with the cow's plasma calcium (Ca) concentration on the first day of lactation. Milk fever, which caused cessation of rumination for  $\leq 36$  hours, developed in four cows fed the control diet. On the first day of lactation, cows fed the low DCAD diet ruminated for 86 minutes longer than cows fed the control diet that did not develop milk fever, and 124 minutes longer than cows fed the control diet that did develop milk fever.

**Comment:** This paper followed cows from pre calving through to seven days post calving. What was surprising to me was the negative effect hypocalcaemia had on rumination time, which was depressed for  $\geq 3$  days after being treated for clinical milk fever. In fact, two of the four clinically affected cows had no rumination activity for 36 hours post treatment. Despite the apparent clinical recovery of a simple milk fever case (she gets up and burps), her rumination rate was depressed for three days. Maybe getting the cow up with a bag in vein and assuming she will be eating her lime flour is doing her a disservice and she should get some additional Ca supplementation that does not rely on her voluntarily ingesting it? The plasma Ca concentration taken half a day after calving was highly correlated with the rumination rate on the first day of lactation and even through to the second day (although less strongly). These findings reinforce to me the importance of milk fever as a “gateway disease”.

**Reference:** *J Dairy Sci.* 2020;103(3):2591–2601.

[Abstract](#)

## Measuring the torque required to cause vertebral dislocation in cattle tails

**Authors:** Laven RA & Jemy MC

**Summary:** In this *ex vivo* study, investigators estimated the torque required to cause vertebral dislocation of cattle tails. Based on the maximum torque required to break a tail being 20 Nm, and the minimum being 9.8 Nm, the researchers concluded that the torque required to break a cow's tail is unlikely to be applied accidentally if cattle are handled following recommended best practice.

**Comment:** I cannot imagine anyone reading this condones broken or dislocated tails and the last few prosecutions serve to remind us all in the dairy industry that it is socially unacceptable. This study put some numbers around the force required to dislocate a vertebral joint in a cow's tail. The maximum and minimum torque required to dislocate a vertebral joint in a tail was 20 and 9.8 Nm, respectively. These numbers to me mean very little to me but the torque you need to apply to the wheel studs on your work truck is likely to be in the region of 120 Nm (read the instruction book). I think this is roughly the same as me leaning heavily on a wheel brace. So, a fifth or even a tenth of this torque on a tail is very unlikely to be “accidental” and should never be normal practice.

**Reference:** *N Z Vet J.* 2020;68(2):107–111

[Abstract](#)

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**Animal Health publications are intended for those with a professional interest in the animal health sector.**

## Efficacy of ketoprofen for treatment of spontaneous, culture-negative, mild cases of clinical mastitis: a randomized, controlled superiority trial

Authors: Latosinski GS et al.

**Summary:** This randomised, controlled trial evaluated the efficacy of ketoprofen 3 mg/kg given as a single IM dose for the treatment of culture-negative, mild-to-moderate, clinical mastitis cases in Holstein cows that were not treated with antimicrobials. After exclusion of moderate cases (n=6), a total of 123 clinical mastitis cases were used for analyses. Compared with no treatment or placebo (n=58), sole treatment with ketoprofen (n=65) did not reduce time to clinical cure, relapse or recurrence of clinical mastitis, risk of subsequent intramammary infection (IMI), or milk somatic cell count (SCC).

**Comment:** Brazilian cows with culture-negative clinical mastitis (n=123 cases) either received 3mg ketoprofen or received no treatment or a placebo. Clinical cases were cultured on farm and results obtained in 24 hours. Clinical cure (absence of clinical signs at day 7), relapse of mastitis in 14 days, recurrence of mastitis in 15–90 days, risk of new IMI found by culture at day 14 or 21, and quarter SCC at 14 and 21 days were not different between groups. It would appear from this paper that, for the measures reported, ketoprofen does not improve outcomes for culture-negative mild mastitis. Ketoprofen may well improve cow welfare but the authors state that to their knowledge the distribution of ketoprofen in the mastitic mammary gland has not been reported nor has its elimination in milk (no milk withhold in NZ). There are papers cited that have shown a benefit to using ketoprofen though, such as in experimentally-induced *Escherichia coli* mastitis. Perhaps an effect was not found as the ketoprofen was given 24 hours after clinical signs had been detected and the inflammatory cascade was already under way. So, perhaps if ketoprofen does work it was given too late? As an aside, when the on-farm culture-negative milk samples taken at day 0 were cultured at a research laboratory 10% were found to be culture positive (i.e. a false-negative on-farm culture result). What this says about on-farm culture results in NZ I have no idea, as the cows in this study were housed on either sand or compost and milked three times a day so the aetiology of mastitis in these environments could well be very different.

Reference: *J Dairy Sci.* 2020;103(3):2624–2635

[Abstract](#)

## Relationship between energy balance and metabolic profiles in plasma and milk of dairy cows in early lactation

Authors: XU W et al.

**Summary:** The objectives of this study were to reveal the metabolic profiles of plasma and milk in dairy cows in early lactation and investigate the relationship between energy balance and the metabolic profiles of plasma and milk. A total of 24 dairy cows (parity 2.5 ± 0.5; mean ± SD) were studied in lactation week 2. From all plasma metabolites measured, 27 were correlated with energy balance and from all milk metabolites measured, 30 were correlated with energy balance. Nine metabolites detected in both plasma and milk were correlated with each other and with energy balance.

**Comment:** Just like hypocalcaemia, severe negative energy balance (NEB) early in lactation places a cow at increased risk of metabolic disease and compromised health and fertility. There are some well-known markers for NEB that we are all comfortable with, such as β-hydroxybutyrate. This paper looked at multiple metabolites in plasma and milk as potential indicators for NEB. The authors identified 27 metabolites in plasma and 30 metabolites in milk, of which nine were detected in both milk and plasma and correlated with each other and NEB. It seems probable that in the future we may access to a wider range of tests to monitor NEB and perhaps they will be available to be generated without additional sampling using milk test samples. In the meantime, β-hydroxybutyrate either in milk or plasma is as good as we can get. There is an amino acid called glycine (from the breakdown of muscle protein) that had the strongest correlation with NEB in both plasma and milk of all the markers measured. Keep an eye out for this in future?

Reference: *J Dairy Sci.* 2020;103(5):4795–4805

[Abstract](#)

## Assessing whether dairy cow welfare is “better” in pasture-based than in confinement-based management systems

Authors: Mee JF & Boyle LA

**Summary:** This literature review summarised current knowledge on dairy cow welfare in different management systems in Europe, North and South America, Australia, and New Zealand, with emphasis on aspects of relevance to veterinary practitioners. The review found that pasture and confinement systems are heterogeneous. In total confinement or only pasture, there can be important differences in animal welfare between systems. In hybrid systems, dairy cows experience elements of both confinement and pasture, which reduces the effects on their welfare. Measuring affective states in cows is likely to yield the best understanding of how to optimise cow welfare under all production systems.

**Comment:** Intensification is occurring in both confinement- and in pasture-based systems if the definition of intensification is obtaining the maximum yield from a limited area. According to the authors, the increase in intensification has brought animal welfare into focus. Welfare for this paper was assessed using the three-sphere framework of biological functioning, natural behaviour, and affective states.

*Biological functioning* includes disease (especially lameness and mastitis), reproductive performance (this might be enhanced by interventions that are perceived negatively by the public though), malnutrition (negative energy balance, body condition score, weights, macro and micronutrients, etc), and mortality and longevity. The second sphere of *natural behaviour* includes, social and oestrus behaviours, lying behaviour, feeding behaviour and behavioural synchrony, exercise and locomotory behaviours (what is too much or too little?), and behaviour in relation to the weather (ability to mitigate extremes of temperature and humidity, etc). The final sphere is the *affective state*. This is the cows' emotions. Affective state has proved hard to measure or quantify even for people who hopefully have high intelligence (IQ) and emotional (EQ) quotients. Despite its conclusion that “there are advantages and disadvantages to dairy cow welfare associated with each system of milk production” this is a great paper to start getting our heads around welfare, and what we might want to measure for farm audits, etc. Finally, to paraphrase the authors, “management of the system, may be as important as the system of management”.

Reference: *N Z Vet J.* 2020;68(3):168–177

[Abstract](#)

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## Sire selection and genetic improvement of dairy cattle assuming pure market competition

**Authors:** Lopez-Villalobos N et al.

**Summary:** With the aim of proposing an economic model and developing it for the evaluation of dairy sires, these NZ researchers applied the pure competition model (PUC) to evaluate the relationship between a profitability index based on the PUC approach compared with the traditional selection index approach for 330 sires comprising Holstein-Friesians, Jerseys, and Ayrshires. The correlation between the two selection indices was only 0.56, suggesting poor correlation between the conventional selection index and an index based on the PUC model.

**Comment:** I am always nervous about any conversations concerning bull selection and the ranking of bulls between different companies, etc., and try and avoid them. The introduction section of this paper summarises the controversy around the use of economic values that has been going on for years. If you have an interest or knowledge of economic theories then please read this paper. The conclusion of this paper is that the dairy industry would be better served using a pure competition model to select sires that were more efficient, rather than using the current system. Although this paper does not address some farmers' gripes about their favourite "type" of bull being "punished" on the breeding values, it does put some doubt into my mind as to whether the whole system is not truly fit for purpose. I am now going to be much more active in avoiding conversations about breeding values. Let us hope that Super Rugby is up and running by mating time so I can change the subject.

**Reference:** *J Dairy Sci.* 2020;103(5):4532–4544

[Abstract](#)

## Can bone measures of the bovine metacarpus predict humeral bone structure?

**Authors:** Gibson MJ et al.

**Summary:** The objective of this *ex vivo* study was to determine whether the metacarpal bone could be used to predict the structure of the humerus. The left humerus and metacarpal bones obtained from 57 cattle (aged 6 weeks to 8 years) were scanned at the mid-diaphysis using peripheral quantitative computed tomography (pQCT) to obtain measures of bone mass and material properties (as an indicator of strength). Strong correlations were observed ( $R^2=0.89-0.98$ ,  $p<0.001$ ) for pQCT measurements of bone mass and strength.

**Comment:** Unfortunately, I expect to see cases of spontaneous humeral fractures in first calvers again this spring, and some of you will have sent bones, liver, and blood samples up to the research group at Massey to help to understand this syndrome. Part of the approach to understanding this syndrome has been to see if a pQCT scan of the metacarpus can be used to predict the bone mass in the humerus (it is far easier to scan the metacarpus in a live heifer than the humerus). The scan data from a metacarpus is a good predictor of the humerus. What was found was the development of the metacarpus is likely to be completed by one year of age but the humerus continues to develop. A measure called the stress strain index (SSI) was found to be 3-times greater in the humerus than in the metacarpus. The higher SSI in the humerus means it is more resistant to a bending stress and implies the humerus is subjected to greater bending stress than the metacarpus (bones respond to the stresses they are exposed to). As the fractured humeri have smaller periosteal circumference and cortical bone thickness this might explain why these spontaneous fractures are seen in the humerus rather than more distal bones (e.g. the metacarpus). We will have to wait to find out why some heifers' humeri have cortices that are thinner and have a smaller circumference.

**Reference:** *New Zealand Journal of Animal Science and Production.* 2019;79:8–12

[Abstract](#)

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## Association of bacterial contamination of colostrum with passive immunity and growth rates in dairy heifer calves

**Authors:** Back PJ et al.

**Summary:** This paper reports the results from an observational study, conducted on a single commercial dairy farm, that determined the level of bacterial contamination in pooled fresh colostrum fed to the heifer replacement calves to see if there was an association between bacterial contamination of colostrum on subsequent IgG status and growth of heifer calves. Over a period of six weeks, 35 samples from daily pooled first-milking colostrum collected were tested for IgG level and bacterial contamination. No association between bacterial contamination of first-milking colostrum and heifer-growth rates was found. There was, however, a positive association ( $p<0.05$ ) between calf serum IgG level and growth.

**Comment:** Soon calves will be on the ground (or better still in a shed after quickly receiving an adequate quantity of quality colostrum). Bacterial contamination of colostrum may impair IgG absorption by mechanisms that are not clear but possibly due to the colostral IgG binding the bacteria and thus being unavailable for passive absorption. This study is an observational study done on calves and colostrum in 2014. The fresh, pooled first-milking colostrum was analysed and fed to the new-born calves within 24 hours of their birth. Half (49%) of the colostrum samples exceeded the level for bacterial contamination and 32% of the pooled colostrum samples failed the Brix test. One-fifth (19%) of calves were defined as having failure of passive transfer. There was no difference in the serum IgG levels in calves that were fed colostrum over or above the threshold used to define high bacterial counts. The bacterial load of the first colostrum feed did not influence subsequent growth rates either. Interestingly though, the calves' IgG levels did have a significant effect on live weight gain. Why an effect of feeding contaminated colostrum was not found (this effect has been found in other studies) may have been due to the timing of the first feed of colostrum or calves drinking of the dam prior to collection (a reality in our systems). Please do not read this paper and think hygiene is not important. What I took away from this study was that if you want to feed good quality colostrum then Brix testing individual cows rather than pooled colostrum (if it can be logistically managed) will give you the option of feeding quality colostrum every day – once it is pooled you can't separate the good from the bad.

**Reference:** *New Zealand Journal of Animal Science and Production.* 2019;79:149–152

[Abstract](#)

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