

Dairy RESEARCH REVIEW™

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Issue 23 – 2020

In this issue:

- Dropped hock syndrome
- Antimicrobial use and milking systems
- Zinc supplementation for calves
- Mastitis: bismuth and bacterial growth
- Properties of bovine sole ulcers
- Effects of prepartum negative DCAD in dairy cows
- Treatment of phantom cows
- NEFA and BHB for breeding purposes
- NEB and dairy cow feeding behaviour
- Yearling weight and milk production in heifers



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Welcome to the latest issue of Dairy Research Review.

Several papers in this issue address diet and metabolic matters including zinc supplementation to prevent diarrhoea and improve growth in calves, how diet-induced negative energy balance affects the feeding behaviour of dairy cows, and the effects of a negative dietary cation-anion difference diet prior to calving on immune function and calcium levels in transition dairy cows. Other papers contribute to our understanding of bismuth for clinical mastitis, bovine sole ulcers, dropped hock syndrome in dairy cows, and treatment of phantom cows.

We hope that you enjoy this issue of **Dairy Research Review**. We value 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.

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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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An overview of dropped hock syndrome cases in New Zealand cattle

Authors: Topham IA et al.

Summary: These authors reviewed data from 47 outbreaks of dropped hock syndrome (DHS) that were reported by veterinarians to the Ministry for Primary Industries (MPI) over a 5-year period. In total, there were 181 affected dairy cows from 44 farms. Of 151 cases with records, hindlimb weakness (n=117), shortened gait (n=112) and dropped hocks (n=106) were most commonly reported, with 110 cases being bilaterally affected. Post-mortem data were available from 26 cases, with muscle necrosis and haemorrhage of the origin of the gastrocnemius muscle being the key gross findings. However, a more standardised and systematic approach to investigating cases and recording case data is required before reliable recommendations for preventing outbreaks of DHS can be made.

Comment: This paper describes the reports on data collected by MPI on DHS between 2012 and 2017. Unfortunately, MPI stopped collecting information on the syndrome in 2018. The clinical signs of bilateral elongation of the common calcanean tendon, loss of function of the reciprocal apparatus, shortened gait, and lameness were consistent across all reported cases, although the severity of these signs varied greatly between cases. Most cases occurred in the late autumn/winter period. Pathological findings revealed degenerative changes “primarily affecting the connective tissues of the hind limb, especially at the dense collagen interfaces of the gastrocnemius muscle”. This paper reports on incomplete data collected for the cases. Part of this was due to non-standardised data collection and incomplete survey responses. There was no control population so it is not possible to come to any conclusions about risk factors but it is possible to describe the features of the affected cows. They were mainly 2- to 3-year-old cows in the winter months from the South Island and more likely to be Jersey. Serum copper levels were below normal in 13 of 22 cows tested and the liver copper levels were below detectable levels in 9 of 10 cows tested. It does appear a proportion of affected cows can recover with good nursing care; so, if the animal’s welfare can be managed, there is hope for some of these cows.

Reference: *N Z Vet J.* 2020;68(4):247–254

[Abstract](#)

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Antimicrobial use and farmers’ attitude toward mastitis treatment on dairy farms with automatic or conventional milking systems

Authors: Deng Z et al.

Summary: The study compared antimicrobial use (AMU) on automatic milking system (AMS) and conventional milking system (CMS) farms in the Netherlands to identify variables associated with AMU and to describe the distribution of mastitis-causing pathogens and their antimicrobial resistance (AMR) patterns. AMU data was collected for a total of 42 AMS and 254 CMS farms. The data showed that AMU was similar on AMS and CMS farms except that AMS farmers tended to apply more injectable and fewer intramammary antibiotics during lactation. The distribution of mastitis-causing pathogens and their AMR were comparable across both farm types.

Comment: AMU in food-producing animals is coming under increased scrutiny due to AMR. This paper examined if antibiotic usage differed between Dutch farmers using AMS and those milking conventionally. The authors point out that a diagnosis is the first step in the chain of events that results in an antibiotic being used. The method of diagnosis of mastitis does differ between AMS that rely on sensors and conventional milking where people detect mastitis. Automatic and conventional milking farms used similar amounts of antibiotic, but the automatic milking farms used more injectable antibiotics and fewer intramammary antibiotics. The reason for more injectable use on automatic milking farms may not be solely due to mastitis, or to not being present at milking and giving intramammary tubes not being as convenient to use if not present at milking. The reason for giving an injectable was not included in the data set. I think the most relevant take-home message from this is that if we are interested in reducing the risk of AMR then reducing the usage of antibiotics is important and that as the first step in the chain of events that results in antibiotics being used is a diagnosis this needs to be considered along with drug selection, etc. There may well be on some clients’ farms an opportunity to reduce antibiotic usage by examining their diagnostic decision process.

Reference: *J Dairy Sci.* 2020;103(8):7302–7314

[Abstract](#)

Effects of different types of zinc supplement on the growth, incidence of diarrhoea, immune function, and rectal microbiota of newborn dairy calves

Authors: Chang MN et al.

Summary: Although zinc is an effective anti-diarrhoeal agent, high doses pose an environmental risk. These researchers evaluated the effects of low-dose zinc supplementation versus no supplementation for 14 days on the growth, incidence of diarrhoea, immune function, and rectal microbiota of 30 newborn Holstein dairy calves. Zinc supplementation promoted growth performance and reduced the incidence of diarrhoea prompting the researchers to propose zinc supplementation as an alternative to antibacterial agents for the treatment of diarrhoea in newborn calves.

Comment: Newborn calves were supplemented with elemental zinc 80 mg/day, either as zinc oxide (ZnO) or zinc methionine (Zn-Met), or else received no supplementary zinc (control group). The outcomes of clinical relevance were the incidence of diarrhoea [$\% = (\text{diarrhoea calves in each group} \times \text{diarrhoea days}) / (\text{total calves in each group} \times \text{experimental days}) \times 100$] and the average daily weight gain. Despite no difference in the dry matter intake of calves between groups, the Zn-Met calves grew, over the 14 days of the trial, significantly faster than the control group by 120 g/day. The ZnO group grew 60 g/day faster than the control group but this difference was not statistically significant. The authors point out that methionine is one of the limiting amino acids for ruminant growth. The incidence of diarrhoea also reduced with ZnO supplementation for the first three days and over the whole 14 days for the Zn-Met group compared with control group. The authors looked at the bacterial populations of faeces produced by the calves and did not find a difference between treatment groups. They also looked and the immune function of the calves by measuring IgA, IgG, and IgM. ZnO significantly increased the concentration of IgG and IgM, while Zn-Met did not. The reasons behind the reduced incidence of scours and increased weight gains are still unclear to me. This paper seems to support the use of zinc in neonatal calves but frustratingly does not definitively explain by what mechanism it works. The quote of the day from this paper is: “zinc is a gatekeeper of immune function”.

Reference: *J Dairy Sci.* 2020;103(7):6100–6113

[Abstract](#)

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Effect of bismuth subnitrate on *in vitro* growth of major mastitis pathogens

Authors: Notcovich S et al.

Summary: To assess the effect of bismuth subnitrate on the growth of major mastitis-causing bacteria, a strain of *Streptococcus uberis* (SR115), two strains of *Staphylococcus aureus* (SA3971/59 and SA1), and a strain of *Escherichia coli* (P17.14291) were tested *in vitro* for their ability to grow in the presence or absence of bismuth subnitrate. Reduced growth in the presence of bismuth subnitrate occurred for all strains tested; however, strain and species variations in the extent of growth inhibition were observed.

Comment: This paper looks at the possible antibacterial effect of bismuth subnitrate in teat sealants. I suspect we have all to some extent glibly said that teat sealants act as a physical barrier to the bacteria entering the teats and have not really thought too long about why the bismuth subnitrate is in these products. Well, surprise surprise it does appear to have a function as these authors have shown that, at least in the laboratory, bismuth subnitrate does appear to inhibit bacterial growth in the strains of bacteria they tested. Perhaps most interesting is that the amount of growth inhibition was least for the *S. aureus* strain compared with the *S. uberis* and *E. coli* strains. I wonder if this helps to explain the odd case of *S. aureus* mastitis post sealing.

Reference: *J Dairy Sci.* 2020;103(8):7249–7259

[Abstract](#)

In vitro biomechanical properties of sole tissues: comparison between healthy and ulcerated bovine claws

Authors: Marchionatti E et al.

Summary: In this study, cylindrical samples were harvested from zones 4 and 6 (as described by the international foot map) from hind lateral healthy (n=12) and ulcerated bovine claws (n=8) and the tissue biomechanics and morphology evaluated. The results confirmed that sole soft tissue of the bovine claw behaves as a viscoelastic material and showed that clinical and histological signs of sole ulceration were not associated with reduced strength of the supportive apparatus of the distal phalanx in zone 4. Interestingly, ulcerated claws had a higher prevalence of exostoses compared with healthy ones (33% vs 8%).

Comment: While I do not see many (if any) true sole ulcers, this paper is still of interest as it describes what we know (or do not know) about claw horn disruption lesions. It seems that these lesions are degenerative rather than inflammatory, so unless we are looking at a horse's foot, we need to forget about the word laminitis. A large proportion of this paper taken up describing the limitations of this study so I will not go into that. Despite macroscopic and histologic signs of sole ulceration, the mechanical properties of the sole soft tissues were not consistently different between healthy and ulcerated samples tested. What was consistent was a high prevalence of exostoses in ulcerated feet, suggesting these lesions were chronic and supports earlier papers showing this as a mechanism for lame cows being at increased risk of another episode of lameness.

Reference: *J Dairy Sci.* 2020;103(7):6412–6421

[Abstract](#)

The effect of prepartum negative dietary cation-anion difference and serum calcium concentration on blood neutrophil function in the transition period of healthy dairy cows

Authors: Couto Serrenho R et al.

Summary: These investigators assessed the effects of a negative dietary cation-anion difference (DCAD) diet before calving on phagocytosis (Pc) and oxidative burst (OB) function of circulating neutrophils in transition dairy cows and also assessed serum ionised (iCa) and total calcium (tCa) levels in relation to Pc and OB function. From three weeks before expected parturition until calving, 38 healthy multiparous cows from three farms were assigned to negative DCAD treatment or a control diet. The expected improvement in Pc and OB function in healthy multiparous cows fed a negative DCAD was not observed, possibly because the treatment did not increase blood calcium levels after calving. Only weak associations of serum iCa and tCa with neutrophil function were observed.

Comment: I suspect I am not the only one who shivers like a cow responding to IV calcium when I read the words DCAD, calcium, and neutrophils in one place. Cows were fed a total mixed ration diet to reach a targeted DCAD of either -100 (treatment group) or 100 (control group). Cows could only remain in the study if they remained healthy (no calcium treatments, retained foetal membranes, or metritis). Treatment had no effect on neutrophil function, or on the ionised or total calcium levels. These results were not expected. The authors speculated the magnitude of the difference in the DCAD between the different treatment groups of only 200 units may not have been large enough despite the urine being acidified. The authors also point out that in a meta-analysis of 41 trials that looked at the calcium levels of multiparous cows and DCAD treatment, 21 of the papers found no difference (the 95% CI included zero). There may well have been bias in this study as the cows that were removed from the study due to disease were all from the control group. Maybe the way to think about these results is to go to the authors' definition of subclinical milk fever: "Subclinical hypocalcaemia (SCH) is defined as a blood calcium level below a threshold associated with increased **risk** of an undesirable outcome, but without visible signs". Did all the SCH cows get removed from this study as they succumbed to an undesirable outcome?

Reference: *J Dairy Sci.* 2020;103(7):6200–6208

[Abstract](#)

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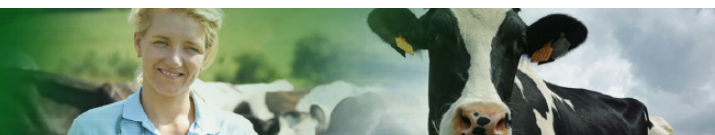


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Effect of treatment of phantom cows with a progesterone-based synchrony programme

Authors: Chambers GP et al.

Summary: This randomised controlled study evaluated the effect of a progesterone-based synchrony programme on the daily hazard of conception and the probability of being pregnant at the end of the mating period in phantom cows on 14 seasonally-calving NZ dairy farms. A total of 378/4,214 cows (9.0%) that presented for pregnancy diagnosis were diagnosed as phantom cows. A functional corpus luteum was diagnosed in 257/362 phantom cows (71%). Median predicted enrolment to conception intervals were 33 (95% CI: 30–45) and 30 (95% CI: 28–33) days for cows in the control and treatment groups, respectively. The odds of being pregnant at the end of mating were 1.7-times (95% CI: 1.34–2.1; $p < 0.001$) greater for treated than untreated phantom cows.

Comment: This study looked at treating phantom cows. Like other studies in NZ looking at these cows, on average a herd has 10% phantom cows but there was a large range (4–16%). Phantom cows that were treated were more likely to be pregnant at the end of the mating period than phantom cows that were not treated (72 vs 60%). Treatment of phantom cows did not reduce the mean time to conception though, but it did result in more pregnancies. Factors that increase the chance of a cow being diagnosed as a phantom cow (low BCS, previous treatment for anoestrus, 2-year-olds or ≥ 6 -year-olds, pure bred) did not, in this study, impact the reproductive performance of phantom cows beyond day 49 after mating start date. Of interest was that in the control group 6% of cows had a pregnancy < 35 days old at the time of enrolment and 4% had a pregnancy > 35 days of age; presumably the proportion of cows with a pregnancy < 35 days was the same in the treated group. Be aware of the farmer's record keeping (and drafting accuracy?) and your own pregnancy testing ability.

Reference: *N Z Vet J.* 2020 Apr 5 [Epub ahead of print]

[Abstract](#)

Heritability estimates of predicted blood β -hydroxybutyrate and non-esterified fatty acids and relationships with milk traits in early-lactation Holstein cows

Authors: Benedet A et al.

Summary: The objective of this study was to estimate the heritability of blood β -hydroxybutyrate (BHB) and non-esterified fatty acids (NEFA) predicted from milk mid-infrared (MIR) spectroscopy and to assess their phenotypic and genetic correlations with milk production and composition traits in early-lactation Holstein cows. It was found that blood BHB and NEFA levels have genetic variation that maybe useful for breeding purposes. Both traits should be considered if selection against metabolic issues is pursued.

Comment: A total of 22,000 milk samples from 13,000 Holstein cows collected between 5 and 35 days in milk were analysed to predict blood NEFA and BHB levels. The aim was to estimate the heritability of blood NEFA and BHB from milk samples and assess the genetic correlation with milk production traits in the first month of lactation, i.e. can something that is relatively easy/convenient to measure/collect in the milk be used to predict a cow's genetic ability to produce more or better milk? Ancestry was traced back six generations. There were positive correlations with BHB and NEFA and milk production supporting the idea that high-producing cows are more susceptible to metabolic disease. The greatest BHB and NEFA levels occurred in the first 10 days of lactation and this also coincided with the highest heritability estimates. Interestingly, the correlation between BHB and NEFA was only "moderate" so if these traits are to be used in a genetic index both are likely to be needed if selecting against metabolic issues. Whether this technology will ever be applicable in NZ where we have less frequent herd testing only time will tell.

Reference: *J Dairy Sci.* 2020;103(7):6354–6363

[Abstract](#)

Effect of diet-induced negative energy balance on the feeding behaviour of dairy cows

Authors: Moore SM & DeVries TJ

Summary: These investigators determined how the feeding behaviour of dairy cows changes in response to diet-induced negative energy balance (NEB), and if this response varies depending on dietary particle size distribution. The results showed that cows alter their total mixed ration (TMR) sorting behaviour in response to experiencing a diet-induced period of NEB and that the severity of NEB was associated with the extent of the change in feed sorting.

Comment: This study was designed to see how cows at about 60 days in milk would change their feeding behaviour when the TMR was formulated to provide about 20% less energy and if any changes were different with different chop lengths in the diets. None of this I think is very relevant to us, but what is interesting are the changes in blood non-esterified fatty acids (NEFA) and beta-hydroxybutyrate (BHB) levels. The average NEFA levels took four days to peak (at about 0.6 mmol/L) after the restricted feeding period began, they then returned to a baseline level (0.3 mmol/L) in another four days. The average BHB peaked (at about 1.1 mmol/L) after one day of dietary restriction and remained elevated for the duration of the restricted feeding period. It seems that these metabolites are insensitive indicators of a feed restriction that was finally calculated to result in 14–16% less energy available for milk production. It is not until you look at the proportion of cows exceeding the accepted thresholds of 0.7 mmol/L and 1.2 mmol/L for NEFA and BHB, respectively, that they suddenly appear to do what they are meant to do and be indicators of NEB. During the period of feed restriction, 37% of cows experienced a NEFA value ≥ 0.7 mmol/L and 63% of cows experienced BHB levels ≥ 1.2 mmol/L — a timely reminder that averages often do not tell whole the story.

Reference: *J Dairy Sci.* 2020;103(8):7288–7301

[Abstract](#)

Increased yearling weight as a proportion of 21-month weight was associated with increased milk production in dairy heifers

Authors: Handcock RC et al.

Summary: This study examined the relationship between liveweight (LWT) at 12 months as a proportion of LWT at 21 months of age and first lactation and cumulative 3-year milk production in NZ dairy heifers. Milk production records included first lactation ($n=140,113$) and cumulative 3-year ($n=67,833$) milk solids and energy-corrected milk (ECM) yields. The results indicated that heifers that were a greater proportion of their 21-month LWT at 12 months of age produced higher first lactation and cumulative 3-year milk yields than heifers that were a lesser proportion of their 21-month LWT at 12 months of age.

Comment: LWT targets of 60% mature LWT at 15 months (mating) and 90% at 22 months assume an almost linear rate of growth, which we struggle to attain. Growth rates typically fluctuate depending on the availability and quality of feed and climatic conditions. This study divided heifers into quintiles nicely described as tiny, small, average, big, and huge within their breed, based on their weight at 21 months of age. And then within these quintiles heifers were categorised based on what percentage of their weight at 21 months of age they had attained by 12 months of age, e.g. 45%, 55%, or 65% LWT(12/21)%. Heifers that were larger at 21 months subsequently produced more milk and the heifers that attained a greater percentage of their 21 month weight by 12 months produced more milk, i.e. it is good to be big at 21 months of age and it is better still to have attained over half of this weight (or more) by 12 months of age. Take-home message is that the amount of growth in the first 12 months is important for subsequent production.

Reference: *N Z Vet J.* 2020;68(5):272–282

[Abstract](#)