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Welcome to this issue of Dairy Research Review.

A prominent theme in this issue is clinical mastitis, with articles covering risk factors, antibiotic usage, and treatment in general. Another theme is milking, including the effects of vacuum pressure on milking performance and teat condition during machine milking and the effects of missed milking on production. Other articles deal with colostral IgG as a predictor of serum IgG, measuring the health and performance of pre-weaning calves, and re-synchronising cows after the first mating.

Research Review is ten!! The first ever issues of Research Review were delivered to inboxes in February 2006. Fast forward ten years and we now publish 48 regular reviews to which there are over 160,000 subscriptions. We're grateful to each and every one of you for your support and are looking forward to even bigger and better things over the coming years.

We hope that there are many learnings in this issue of Dairy Research Review that will benefit your practice. We look forward to receiving your feedback and comments.

Kind regards
Hamish Newton
hamishnewton@animalhealthreview.co.nz

Treatment of clinical mastitis in dairy cattle

Authors: Breen J

Summary: The basis of this research-focussed editorial article is the ongoing debate around the treatment of clinical mastitis in lactating dairy cows due to often disappointing cure rates, despite intensive antimicrobial therapy, and increased pressure on the dairy industry to reduce the amount of antimicrobials used. It concludes that, because of an excess of treatments available for clinical mastitis and the large number of pathogens capable of causing intra-mammary infection, approaches to treatment will vary between individual veterinary advisers as well as between practices, regions, and countries. Awareness of adherence to current 'best practice' by veterinary advisers and factors that influence treatment decisions will be important in shaping future approaches to treatment of clinical mastitis.

Comment: This is an editorial from the *Veterinary Record* giving a summary of some recent research. There is a discussion on in-house laboratory diagnosis and mention of some poor positive and negative predictive values for certain tests. There were some interesting comments on the value of "no growths" in herds experiencing gram negative mastitis and the implications of electing to not treat with antibiotics as untreated cases took longer to cure both clinically and bacteriologically. It was also stated that the 18–24 hour delay in starting treatment while waiting for an answer will have a detrimental effect on the chances of a cure regardless of pathogen or treatment protocol. A recent UK paper that showed only 13% of *S. aureus* were phenotypically resistant to penicillin, which is much lower than previously reported (and much lower than here?) is cited. As we know, cow factors such as parity, somatic cell count history, and pathogen affect the chances of cure. These factors often result in different treatment protocols being suggested. This paper points to some studies that show the benefits of more intensive treatments, not necessarily outweighing the additional treatment costs. Another study cited also pointed out the cost of mastitis is greatly affected by the risk of transmission of infection, and this outweighs the cost of drugs and discarded milk. This is a bit of a "State of the Nation" summary and has some nuggets of information that could help guide our thinking for prescribing and advice.

Reference: Vet Rec. 2016;178(10):238–9
Abstract

Mastitis prevention and control practices and mastitis treatment strategies associated with the consumption of (critically important) antimicrobials on dairy herds in Flanders, Belgium

Authors: Stevens M et al.

Summary: These researchers assessed the extent to which variations in herd-level antimicrobial consumption can be explained by: i) differences in management practices that are consistently effective in the prevention of (sub)clinical mastitis; and ii) differences in mastitis treatment strategies. Antimicrobial consumption data were obtained using "garbage can audits" and expressed as antimicrobial treatment incidences for all compounds combined and for the critically-important antimicrobials for human health separately. Face-to-face interviews performed during herd visits were used to obtain data on mastitis prevention and control practices. The results demonstrated that implementing effective udder health management practices does not necessarily imply low antimicrobial consumption and vice versa. Herds participating in a veterinary herd health management programme and herds selectively drying off cows used fewer antimicrobials versus herds not participating in such a programme or applying blanket dry-cow therapy. In addition, herds treating (some) (sub)clinical mastitis cases with intra-mammary homeopathic substances consumed fewer antimicrobials than herds not applying such homeopathic treatments.

Comment: This study aimed to examine the amount of antimicrobials used on a farm and what mastitis control or management practices are used on the farm. This was because the authors had previously reported the amount of antimicrobials used was associated with the dry cow strategy used (whole herd or selective) and the incidence rate of treated mastitis. The antibiotic use was measured by "garbage can audits". This is where the drug containers used for treating mastitis were collected and then standardised doses were calculated. Mastitis control and prevention practices were collected via face-to-face interviews. In the final multivariable model, not surprisingly, blanket use of DCT was associated with more antibiotic usage compared to farms that used selective DCT. Only two other factors remained in the model. These were if a "veterinary herd health management programme" was in place and if a homeopathic intra-mammary remedy was used in at least some cases of clinical or subclinical mastitis. This paper to me highlights the trend in Europe to quantify the amount of antibiotics used and presumably in the future to find ways to reduce it.

Reference: J Dairy Sci. 2016;99(4):2896–903
Abstract

Evaluation of udder health parameters and risk factors for clinical mastitis in Dutch dairy herds in the context of a restricted antimicrobial usage policy

Authors: Santman-Berends IM et al.

Summary: Following the implementation of many changes on Dutch dairy farms, mainly around antimicrobial usage, the objective of this study was to quantify clinical mastitis (CM), subclinical mastitis (SCM), and risk factors associated with CM in Dutch dairy herds. A questionnaire on management factors potentially associated with CM was completed by 224/233 randomly selected dairy farmers who used a conventional milking system and had complete records of CM in their herds. Analysis of this data revealed a median CM incidence of 28.6 per 100 cows at risk per year, SCM incidence of 70.1 per 100 cows at risk per year, SCM prevalence of 15.8%, and bulk tank milk somatic cell count (SCC) of 171 × 10^3 cells/mL. Factors that were significantly associated with a higher CMI incidence were cleaning slatted floors only once per day versus >4 times a day (i.e. mechanical), a higher percentage of Holstein Friesian (HF) cows present in the herd, treating <50% of the cows with CM with antimicrobials, post-milking teat disinfection, and treatment of cows with elevated SCC with antimicrobials.

Comment: Dutch herd sizes have increased, the antimicrobial usage has decreased (as measured by average animal defined daily dose), and the use of antimicrobials as preventative during the dry period is prohibited. This study quantified both clinical and subclinical mastitis and risk factors with clinical mastitis. Cleaning slatted floors four times a day compared with once a day was associated with a lower clinical mastitis incidence. An increasing percentage of HF cows in the herd, post-milking teat disinfection, and treating high SCC cows during lactation were also associated with higher incidence of clinical mastitis. The post-milking disinfection finding and treating high SCC cows was discussed and it was suggested it could be due to reduction in the minor pathogens that might have a protective effect or these practices were instituted in response to a high number of clinical cases. Treatment of >50% of clinical mastitis cases with antimicrobials was also associated with a lower incidence of clinical mastitis. The authors suggest that in the Dutch situation the decision to treat is sometimes based on severity. The mean clinical mastitis incidence in this survey was increased only slightly compared to that reported prior to the changes listed in the first sentence. Whether this is due to increased herd size (less culling), changes in the use of antibiotics at dry off, differences in study methodology, or yearly variation remains unclear. It is reassuring to see some evidence that if the prophylactic use of antibiotics is banned here there is some evidence that at a national herd level we will be OK.

Reference: J Dairy Sci. 2016;99(4):2930–9
Abstract

Vacuum levels and milk-flow-dependent vacuum drops affect machine milking performance and teat condition in dairy cows

Authors: Besier J & Bruckmaier RM

Summary: This study investigated the effects of high system vacuum and extremely low claw vacuum during milk flow on milking performance and teat condition after milking as recorded by ultrasound. Treatment 1 (the control) used a system vacuum of 42 kPa and a minimum claw vacuum during milk flow of 33 kPa; treatment 2 used system vacuum of 50 kPa and a minimum claw vacuum similar to treatment 1 (34 kPa); and treatment 3 represented the same system vacuum as treatment 1 but with a claw vacuum drop during milk flow down to 24 kPa. Total milk yield was similar in all treatments; however, strip yield was lower in treatment 3 than in the other treatments. Milk flow was similar in treatment 1 and treatment 2; however, it was reduced in treatment 3 resulting in a prolonged milking time. Teat wall thickness was higher and teat cistern diameter was lower in treatment 2 versus the other treatments.

Comment: This study examined the milking characteristics and effects on the teats of three different vacuum levels and degree of vacuum drop during peak milk flow. Setting #1 had a system vacuum of 42 kPa dropping to 33 kPa during peak milk flow (9 kPa drop). Setting #2 — system vacuum of 50 kPa dropping to 34 kPa (16 kPa drop). Setting #3 — system vacuum of 42 kPa dropping to 24 kPa (drop of 18 kPa). All three treatments resulted in adequate emptying of the udder as there were no significant differences between total milk yields or "main milk yield". Strip yields at the end of milking were reduced in treatment #3 suggesting low teat end vacuum was good for completeness of milk out. Milk flow rates did differ between treatments with the cows in treatment #3 having reduced milk flow rates showing it is the minimum vacuum at the teat end during main milk flow that influences milk flow rate rather than the system vacuum. This resulted in longer milking times for treatment #3. This paper also looks at removal of cups at different milk flow rate thresholds, so is relevant if you have clients with automatic cup removers or are not yet convinced about "Tmax". The reduction in yield between cup removal at 1000 g/min compared to 200 g/min was only a few percentage points of the "main milk yield" yet the milking time was reduced by over a minute. The effects on the teats in his study showed the teat walls were thicker in treatment #2 resulting in reduced cistern diameter (a "normal setup for a highline shed"). This was due to the high system vacuum when it acts on the teat — at the end of the milking. Yet another argument for earlier cup removal?

Reference: J Dairy Sci. 2016;99(4):3096–102
Abstract

Individual responses of dairy cows to a 24-hour milking interval

Authors: Charton C et al.

Summary: The objective of this French study was to assess the average and individual responses in terms of loss and carryover effects of an extended milking interval of 24 hours (24hr-MI) on milk yield. A total of 292 Holstein-Friesian cows were evaluated over 3 successive periods: 1 week of twice-daily milking (TDM) as a control; one 24hr-MI; and then 13 days of TDM. The 24hr-MI was associated with reductions in milk yield of 23% (7.8kg on average) and milk lactose content by 2.6 g/kg on the 24hr-MI day. Milk fat content, protein content, and somatic cell score were increased by 3.0 g/kg, 0.5 g/kg, and 0.4 units, respectively. No significant carryover effect was found of a 24h-MI on milk yield or milk composition 2 weeks after resumption of TDM. There was considerable variation (coefficient of variation 62%) in milk yield loss and recovery; the relationship between milk loss and milk recovery also showed substantial variation (residual standard deviation 2.1 kg/day). Cows with a greater milk potential level lost more milk yield but recovered more milk. Lost milk yield was recovered more quickly in cows in early lactation.

Comment: The effect of missing a milking that resulted in a 24-hour interval was examined here. On average, a cow's production was reduced by 24% but had fully recovered by 2 to 3 days post the missed milking. Cows that had a missed milking early in their lactation recovered on average more milk than was expected and those in late lactation recovered less milk than expected. As mammary epithelial cell (MEC) apoptosis does not increase in the first 24 hours after a missed milking it was assumed that the changes seen were due to secretory activity (increasing in early lactation and decreasing in late lactation). First calvers also recovered better than parity three or greater cows. This finding was attributed to greater udder plasticity. This paper suggests that a missed milking, due to a power failure for example, will not have a major effect on subsequent production especially if it occurs in early lactation.

Reference: J Dairy Sci. 2016;99(4):3103–12
Abstract

The use of herb mix and lucerne to increase growth rates of dairy heifers

Authors: Handcock RC et al.

Summary: These researchers determined the effect of feeding forage crops on the growth rate of dairy heifers in their first summer. Sixty 6-month-old dairy heifers grazed on one of three treatments for a 63-day period: pasture, lucerne, or a mixed-herb crop. Both lucerne- and crop-fed heifers had similar ($p>0.05$) average daily live-weight gains (0.80 ± 0.02 and 0.75 ± 0.02 kg/day, respectively), which were greater ($p<0.05$) than those of pasture-fed heifers (0.53 ± 0.02 kg/day). Lucerne-fed heifers had a greater ($p<0.05$) increase in body length (18.4 ± 1.3cm) than heifers fed pasture (14.7 ± 1.2cm). In addition, heifers fed lucerne had higher ($p<0.05$) concentrations of urea in plasma (4.9 ± 0.1 mmol/L) than heifers fed crop (4.1 ± 0.1 mmol/L), which had greater ($p<0.05$) concentrations of urea in plasma than heifers fed pasture (2.5 ± 0.1 mmol/L).

Comment: This study, which was conducted at Massey's Riverside farm, examined heifer growth rates of 6-month-old dairy replacements offered either a Ryegrass white clover pasture, a chicory plantain and white clover crop, or straight lucerne. All animals were drenched for parasites every 3 weeks. The trial lasted 63 days. The calves were transitioned for 16 days onto their crops. Calves at enrolment (D_{-30}) were behind target weights (approx. 114kg; target 132kg). The heifers fed lucerne, once they were transitioned, grew faster than the pasture-fed heifers and by day 21 had caught up with the heifers fed the chicory mix. At day 63, the lucerne-fed heifers' weights were not significantly different from the pasture fed animals. However, once all animals were fed the same pasture for 7 days and weighed again at day 70, the lucerne-fed heifers were the heaviest group (183.4kg), followed by chicory- (174.9kg), and then pasture-fed (162kg) animals. This change in ranking is likely due to reduced gut fill of the heifers when they were fed a diet of lucerne. The average daily gains from D_{-30} to D_{70} were all significantly different from each other: 0.68 kg/day with lucerne, 0.60 kg/day with chicory, and 0.47 kg/day with pasture. This study shows the benefits of summer crops and highlights the importance of gut fill when weighing calves and the need to consider this when monitoring calf growth rates and organising calves in and out of yards for weighing.

Reference: Proceedings of the New Zealand Society of Animal Production. 2015;75:132–135
Abstract

Colostral immunoglobulin G as a predictor for serum immunoglobulin G concentration in dairy calves

Authors: Coleman LW et al.

Summary: These researchers attempted to characterise immunoglobulin-G (IgG) concentrations in colostrum from the first milking in NZ dairy cows, examine IgG status of the calves, and evaluate the use of a refractometer for estimating the quality of colostrum in terms of IgG concentration. Heifer calves were fed pooled first-milking colostrum ≤8 hours of entering the shed at age 0–24 hours; blood samples were taken the following morning. Cows were individually milked and samples from individual and pooled colostrum were analysed. IgG concentration of serum and colostrum samples were determined by turbidimetric immunoassay and estimated using a handheld refractometer. There were no differences in the concentrations of IgG in colostrum from the different breeds, or from multiparous and primiparous cows, and there was also no interaction between breed and parity. IgG concentration was adequate (≥3000 mg/dL) in 70.1% of individual colostrum, 80.0% of pooled colostrum, and 82.5% of calf serum samples. There was no relationship between calf serum and IgG concentration in dam or pooled colostrum. The refractometer was a good predictor of IgG concentration in serum ($r=0.64$, $p<0.0001$) and colostrum both in dam ($r=0.87$, $p<0.0001$) and pooled ($r=0.81$, $p<0.0001$) samples.

Comment: At this year's Society of Dairy Cattle Veterinarians' Conference, Emma Cuttance and Katie Denholm will be speaking about colostrum quality and transfer. This paper will give you a bit of background. Contrary to what I liked to believe, in this paper, there was no effect of breed or parity on colostrum IgG concentration. Colostral quality was deemed adequate in 70% of individual cow samples and 80% of pooled colostrum samples. 82.5% of calves had adequate serum IgG levels when measured 24 hours after entering the shed yet 17.5% of calves had inadequate serum IgG despite having received adequate quality colostrum from either their dam or from pooled colostrum. There was no relationship found between the level of IgG in the dam's or pooled colostrum and the calves' serum IgG concentration. This highlights that there are other factors that influence a calf's serum IgG other than quality of colostrum. It is worth noting that the cows in this study were milked once a day so the levels of IgG reported here are low compared to other published data and this may be because of the delay to first milking. However, in many situations newly calved cows are only brought in at the first morning milking regardless of whether it is a once a day or twice a day milking system. This study also demonstrated that the use of a Brix refractometer is a good tool for measuring both colostrum and serum IgG.

Reference: Proceedings of the New Zealand Society of Animal Production. 2015;75:3–8
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.

Measuring health and performance in pre-weaning dairy calves

Authors: Sherwin V et al.

Summary: The objective of calf rearing is to produce healthy calves that are achieving target growth rates. This article summarises how calf mortality rate and daily liveweight gain, which are appropriate bottom-line 'output' measures for evaluating the success of a calf-rearing programme, can be monitored. The article also highlights how some key inputs to the calf-rearing process can be assessed when output targets are not met.

Comment: This is an article from the UK and intended for that audience so the growth rate targets etc. are not appropriate for us but the ideas are still valid. The paper gives targets for mortality for the perinatal period right up to first calving. They do remind us though that mortality rates are not always a good indicator of welfare as many diseases can have a high morbidity rate but a low mortality rate, e.g. pneumonia and sometimes diarrhoea. The discussion on target growth rates mentions the concern about high growth rates leading to reduced yields in the first lactation but note that there is increasing evidence that high live-weight gain in early life promotes better calf health and improved productivity as an adult. Interesting perhaps but these guys are requiring average daily liveweight gain of 800 g/day to reach a target calving weight of 640kg (80% of 800kg mature weight) at 24 months. There was a large section on weighing calves and how to present that data — not too relevant to us if you get access to MINDA weights. There is a section on colostrum quality and the different tests used to assess this. It is looking as though the Brix refractometer is going to be the standard field tool. The authors remind us that when testing for failure of passive transfer it is a tool to be used at a population level and it is unreliable at the individual calf level to assess colostral transfer. Some of the facts and figures are not directly applicable but if you are considering setting up a calf-rearing monitoring or measuring service this article would provide a good place to start.

Reference: In Practice. 2016;38:113–22
Abstract

Reproductive management strategies to improve the fertility of cows with a suboptimal response to resynchronization of ovulation

Authors: Giordano JO et al.

Summary: The aim of this study was to compare the reproductive performance of lactating Holstein cows managed using the Ovsynch protocol with exogenous progesterone (P4) supplementation or pre-synchronization with GnRH seven days before Ovsynch to treat cows without a corpus luteum (CL), a CL <15mm, or cystic at the time of the PGF2α injection of Resynch (GnRH-7 d-PGF2α-56 h-GnRH-16 to 20 h-TAI). Following a preliminary analysis to define a cut-off value for CL size that better predicted fertility after timed artificial insemination (TAI), a randomised study was conducted in which cows were enrolled in a management strategy that used Ovsynch with P4 supplementation [Ovsynch+P4; GnRH and controlled internal drug release device (CIDR)-7 d-PGF2α and CIDR removal-56 h-GnRH-16 to 20 h-TAI] or a PreG-Ovsynch protocol [PreG-Ovsynch; GnRH-7 d-GnRH-7 d-PGF2α-56 h-GnRH-16 to 20 h-TAI] to treat cows without a CL, a CL <15mm, or cystic at non-pregnancy diagnosis and the PGF2α of Resynch. Overall, the results showed that the Ovsynch+P4 and PreG-Ovsynch treatments for cows without a CL, a CL <15mm, or cystic at the PGF2α injection of Resynch led to P/AI similar to that of cows with a CL ≥15mm, and that both management strategies resulted in similar time to pregnancy.

Comment: This American study examined re-synchronising cows after the first mating. It followed cows that were pre-synchronised with either GnRH seven days prior to an Ovsynch programme or an Ovsynch programme with a CIDR (Ovsynch+P4). Cows were then mated to fixed time AI and the non-returning cows were enrolled into an Ovsynch programme at about 32 days after AI (i.e. received GnRH at day 32). Seven days later a pregnancy test was conducted and pregnancy status diagnosed. If non-pregnant, the size of the CL determined whether a cow got the PG shot followed by GnRH and fixed time AI (i.e. completed the Ovsynch programme if CL>15mm). Non-pregnant cows with a CL <15mm were enrolled into an Ovsynch+P4 programme or a GnRH injection followed by Ovsynch seven days later. All this sounds far more complicated and expensive than what we are ever likely to be doing but the findings regarding the size of a CL and a cow's subsequent reproductive performance are relevant. This paper will interest you if you are making decisions on anoestrus treatments or phantom cow treatments based on ovarian scanning findings.

Reference: J Dairy Sci. 2016;99(4):2967–78
Abstract