One Health & One Welfare Village

Chlorate residues in milk and dairy products

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Summary

- Chlorate was detected in milk, cream and natural, blueberry, strawberry and raspberry yoghurts
- Chlorate was not detected in butter and cheese
- Mean chlorate levels detected in milk and dairy products were compliant with the existing EU MRL for chlorate in 'ready-to-consume' milk

Introduction

Chlorate has emerged as a residue of concern in the European Union (EU) in recent years due to its goitrogenic properties and the associated risk to human thyroid function. This risk is particularly relevant to those with an underdeveloped thyroid, i.e., infants and young children. Chlorate results from the chemical degradation of chlorine and has been identified as entering the dairy production and processing chain via two primary pathways, i) use of chlorine-based detergents and disinfectants used to clean and disinfect both milking and processing equipment and ii) use of chlorinated water during processing and cleaning. The Irish dairy industry mitigated against chlorine residues by prohibiting use of chlorine-based chemicals for cleaning and disinfection on farms and in processing plants from 1 January 2021. An EU maximum residue limit (MRL) of 0.10 mg/kg has been applied to milk in its 'ready to use state'. However, a specific MRL of 0.01 mg/kg is in place for specialist nutrition products, e.g., infant milk formula (IMF). While raw milk is routinely tested for chlorates by milk purchasers, little is known about the levels of chlorate present in dairy products. Therefore, the objective of this study was to establish the levels of chlorate in a range of dairy products produced and consumed in Ireland.

Selection of dairy products, sampling protocol and measurement of chlorate

Based on consumption data from the most up to date National Adult Nutrition Survey, the five most popular dairy products produced and consumed in Ireland were identified as whole milk, cream, butter, cheese and yoghurt. Milk from eight, cream from five, butter from six, cheese from four and yoghurt from four, manufacturers were sampled. In total, the samples of milk (n = 317), cream (n = 199), butter (n = 178), cheese (n = 144) and yoghurt (n = 440) were collected from five of the most prominent grocery outlets in Ireland (having a market share of >90%) and were sampled from as many different geographical locations as possible. Samples were transported in a frozen state to the Teagasc Food Research Centre in Ashtown, Dublin for chlorate analysis. This analysis was conducted using ultra-performance liquid chromatography coupled with tandem mass spectrometry (UPLC-MS/MS). The reporting limit for milk and cream was 0.0020 mg/kg and 0.01 mg/kg for butter, cheese and yoghurt.

Chlorate levels in dairy products

The proportion of samples tested in which chlorate was detected ranged from 47–60 % across milk, cream and yoghurt. Cheese and butter were exceptions as only a small proportion (≤1%) of respective cheese and butter samples displayed reportable levels of chlorate (> 0.01 mg/kg). Chlorate tends to partition with the water phase of milk, and this partly explains the low incidence of chlorate in butter and cheese as removal of water is a key step in the manufacture of both products. The levels of chlorate detected ranged from 0.0020–0.0940 mg/kg in milk, 0.0022–0.0240 mg/kg in cream, 0.012–0.230 mg/kg in natural yoghurt, 0.011–0.260 mg/kg in blueberry yoghurt, 0.01–0.50 mg/kg in raspberry yoghurt and 0.01–0.69 mg/kg in strawberry yoghurt. The presence and levels of chlorate varied between manufacturers for certain products, such as milk and cream. In the case of natural yoghurt, there were no significant differences in chlorate levels between manufacturers. However, for fruit yoghurts, including blueberry, raspberry, and strawberry, chlorate levels did differ noticeably depending on the manufacturer. The levels of chlorate detected in milk may be due, in part, to some farms continuing to use chlorine on an intermittent basis. However, levels detected in milk were considerably lower than levels detected in fruit yoghurts.

In the case of yoghurt chlorate detection may also be a consequence of the addition of ingredients required to achieve the desired quality and type of yoghurt. Examples include skimmed milk powder and whey protein concentrate which may be purchased from manufacturers outside of the Republic of Ireland and thus still using chlorine-based cleaning, and fruit. In fruit infused yoghurts the fruit portion has the potential to contain chlorate as a consequence of horticultural management practices; mainly the use of water-soluble fertilisers and chlorinated water for washing and sanitising post-harvest.

To ensure that the EU MRL is consistently achieved, regular monitoring programs for chlorate in dairy products should be established at individual manufacturer, industry or governmental level. Moreover, a more comprehensive range of dairy products, e.g., low-fat and fortified dairy products, should be included, alongside those sampled as part of this current study to ensure maximum accuracy of data and ultimately, the establishment of an appropriate MRL.

Conclusion

The adoption of 'chlorine-free' cleaning on dairy farms and in processing plants has facilitated within-target chlorate levels in milk and further enabled the manufacture of within-target chlorate levels in dairy products. Chlorate residue was not detected in butter and cheese products but found to be present in other consumer dairy products tested, in particular yogurts, but the mean levels detected were all compliant with the existing EU MRL for chlorate in 'ready-to-consume' milk.

Acknowledgements

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Impact of chlorine-free cleaning practices on the microbial quality of milk on dairy farms

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Summary

- The application of chlorine-free cleaning protocols was evaluated on 102 commercial dairy farms
- Suboptimal 'chlorine-free' cleaning practices are employed on a large number of dairy farms
- Of farms using insufficient volumes of 'chlorine-free' detergent when "hot washing" (n=39), 62% had "build-up" on the internal surfaces of claw-bowls
- Probability of a TBC >15,000 cfu/ml and a thermoduric count >200 cfu/ml was numerically higher when insufficient volumes of acid were used in solution
- It is critical that chlorine-free washing protocols are correctly implemented

Introduction

Mandatory chlorine-free cleaning of milking machines was introduced in the Republic of Ireland (ROI) in 2021. New washing protocols were developed to facilitate appropriate 'chlorine-free cleaning' of milking machines of different sizes on farms with varying water hardness. Data on the microbial quality of milk (total bacterial count [TBC]) from 2021 – 2023, was supplied by milk processors from commercial dairy farms in the ROI. This data showed a considerable range in TBC with 81% of monthly figures >15,000 cfu/ml; processors also reported high thermoduric bacteria levels (>1,000 cfu/ml) over the same time period. This indicated a potential scenario where 'chlorine-free' cleaning protocols were not being implemented as recommended on some dairy farms. Therefore, a study was undertaken to firstly, ascertain if the essential elements of 'chlorine-free' cleaning were being employed as recommended on commercial dairy farms in the ROI, and secondly, to establish how failing to employ 'chlorine-free' cleaning as recommended could impact upon the microbial quality of farm bulk milk delivered to the processor.

Materials and methods

The application of the 'chlorine-free' cleaning protocols and microbial milk quality data were evaluated on 102 commercial dairy farms. Milks from these farms were supplied to 11 different milk processors (milk purchasers); the number of farms evaluated from different milk processors was representative of the total number of farms supplying milk to individual processors. The average TBC of the bulk milk from the 102 farms visited was 32,882 cfu/ml. The processors graded the various milk supplies (of the 102 farms) as being of 'High' or 'Low' microbial quality. The 'High' milk quality standard was defined as TBC ≤15,000 cfu/ml and thermoduric bacterial count ≤200 cfu/ml. The 'Low' milk quality standard was defined as TBC >15,000 cfu/ml and thermoduric bacterial count >200 cfu/ml. Fifty-three farms (52%) were within the high milk quality category (average 7,925 cfu/ml), with the remaining farms classified within the low milk quality category (average 64,041 cfu/ml). At the farm visit, detergent/acid usage rates, water hardness levels and water temperature were measured.

Results

For effective chlorine-free cleaning, sufficient volumes of detergent (0.5% with hot water and 1% with cold water), acid (1%) and hot water with a starting temperature > 75 °C are necessary for successful cleaning. However, 38%, 53% and 69% of participating farms, respectively were not meeting these requirements. Of the farms that were using insufficient volumes of 'chlorine-free' detergent when "hot washing" (n=39), 62% had "build-up" present on the internal surfaces of claw-bowls (Figure 1).

Figure 1. *Inorganic (mineral) and organic (milk) deposits on claw bowl surfaces*

The probability of having a TBC >15,000 cfu/ml and a thermoduric count >200 cfu/ml was numerically higher when insufficient volumes of acid were used. Among the 55 farms identified with hard water, 62% utilised insufficient acid descaler, and 47% exhibited dirty claw-bowls with associated 'Low' microbial quality milk. Hard water can impact the effectiveness of detergent and formation of biofilm on stainless steel surfaces; it can be counteracted by additional acid washes or the installation of a water softener. Water hardness levels may be determined as shown in Figure 2.

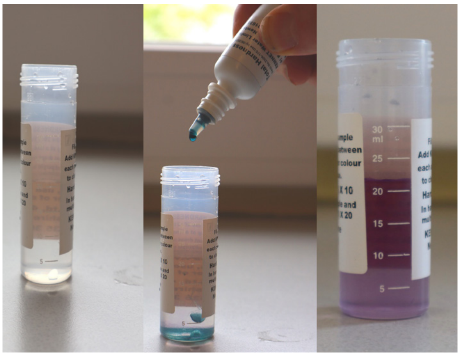

Figure 2. *Fill tube with 20 ml of water; add one drop of KW15 at a time, mixing between drops; number of drops required to change colour (red to blue) indicates hardness. Hardness equals (drops KW15 used) x 10*

Conclusion

Achieving 'High' grade microbial quality milk when using 'chlorine-free' cleaning is dependent on consistent implementation of the recommended protocols, i.e. sufficient volumes of detergent, acid and hot water (starting temperature >75 °C).

Acknowledgment

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Guidelines to minimize thermoduric bacteria in bulk tank milk

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Summary

- Thermoduric bacteria are organisms capable of surviving pasteurisation which results in negative effects for milk processing
- Thermoduric bacteria are widespread in the farm environment, e.g. soil/faeces
- The major entry routes of thermoduric bacteria into milk are dirty teats, poor milking parlour hygiene and poorly washed milking equipment
- To ensure minimal thermoduric bacteria in milk, present a clean cow for milking and follow recommended equipment cleaning protocols

Introduction

Milk is a nutritious medium that can support the growth of a large selection of bacteria, which can utilise the proteins, fats, carbohydrates and vitamins in milk for their growth and metabolism. Bacteria that contaminate milk include thermoduric bacteria which can survive pasteurisation and subsequently grow in pasteurised milk or contaminate other dairy products. Thermoduric bacteria can limit shelf life and cause 'bitty cream' in pasteurised milk and result in late blowing of cheese. Thermoduric bacteria exist in the dairy cow's environment on-farm, e.g. in soil, bedding and faeces. These bacteria contaminate milk produced on-farm largely via soiled cow teats during milking. Inadequate cleaning of the milking machine, bulk tank, and overall milking plant can lead to the buildup of bacteria within the equipment, allowing ongoing contamination of the milk. The presence of thermoduric bacteria is indicative of ineffective cleaning along the milk production process (environment, cow, milking plant). Therefore, the critical control points for minimising thermoduric bacteria in milk are:

- A clean cow environment
- A clean cow
- An effective cleaning regime for the milking machine and bulk milk tank

Cow and milking hygiene

Ensure that teats are clean and dry before milking. If the milk sock is soiled after milking, then teat preparation is inadequate. Teats that are washed or treated with teat disinfectant pre-milking should be dried with paper before cluster attachment. Maintain cows in a clean environment – collecting yards and approach roads should be cleaned regularly. Trim cow tails and udder hair at least three times per year. Keep hands/gloves and milking clusters clean during milking. Do not wash down clusters while still attached to a cow.

Effective milking machine cleaning regime

An effective milking machine wash routine will help to prevent residue build up or biofilm formation on plant surfaces. Having the correct concentration of detergent is vital for successful cleaning. When liquid detergent is used with hot water a 0.5% detergent solution is generally adequate if the detergent product has a concentration of sodium hydroxide greater than or equal to 24%. However, if cold water is used the solution concentration must be increased to 1%. The amount of liquid detergent required for a specific machine-washing procedure may be calculated as follows: volume of water in the wash trough multiplied by concentration of solution required (0.5 or 1%) divided by 100. Hot water provides a greater microbial kill than cleaning with cold water. A rise in temperature of 10°C was shown to increase the reaction rates of chemicals by between two and eight times. Therefore, for effective cleaning, a start temperature of 75 °C (in the filled wash trough) and an end of cycle temperature of ≥ 50 °C is required. The detergent wash cycle should not exceed 10 min, longer periods will result in temperature drops which will facilitate soiled material re-sticking to plant surfaces. Alternative cleaning protocols, which involve the use of powder detergent require a solution concentration of 0.5% and a lower frequency of hot washing due to the high concentrations of sodium hydroxide present in those products (75 to 80%) as compared to liquid products with much lower concentrations (12 to 30%) of sodium hydroxide. Regardless of detergent product type a sufficient volume of detergent/water solution must be used to ensure that all surfaces will be in contact with the detergent solution (9 litres/milking unit). Adequate turbulence is important (air injection every 30 to 40 seconds for large plants), as is vacuum level during the wash cycle (not drawing in air in the wash trough). Acid descalers should be used to prevent any build-up of mineral deposits on equipment surfaces, as these deposits facilitate the establishment of thermoduric bacteria within the milking plant. Generally, acid descalers are used at a usage rate of 1% and can be used with either hot or cold water. Milking equipment should be acid washed three times weekly and more regularly (7 times per week) if the water supply is considered hard and a water softener is not in-place. The inclusion of a disinfectant such as peracetic acid in the final rinse has been shown to be effective in reducing thermoduric bacterial levels in milk and is especially beneficial where the microbial count of a farm water supply is considered unsatisfactory. Thermoduric bacteria can survive in perished rubber-ware so milk liners should be replaced twice yearly and milk tubes when cracked or worn.

Effective bulk milk tank cleaning regime

- Disinfect the bulk milk tank outlet regularly
- Ensure sufficient volume of detergent wash solution for the size of the bulk tank, generally a water supply of 1% of tank size
- An acid wash should be carried out after every second or third collection, on alternative days use sodium hydroxide detergent
- Blocked suck-up detergent tubes will result in insufficient detergent usage, replace these tubes annually
- Cool milk to 3/4 °C ideally within 30 min of the completion of milking, as some thermoduric bacteria will multiply at temperatures above 4 °C

Conclusion

Critical control points for minimising thermoduric bacteria in farm milk include a clean cow and clean cow environment with an effective milking equipment cleaning regime.

Exploring SCC cut-points and alternative selection criteria to reduce antibiotic use at dry-off and SCC in lactation

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Summary

- This study evaluated three SCC thresholds (≤150,000, ≤100,000, and ≤65,000 cells/ml), the California Mastitis Test and on-farm culture to identify cows eligible for treatment with internal teat sealant alone at dry-off
- There were no significant differences in quarter SCC after calving between the five selection criteria

Introduction

Recent EU regulations have placed limitations on preventive antibiotic use, prompting a shift from blanket dry cow therapy to selective dry cow therapy (SDCT), where only infected cows are treated with antibiotics. However, SDCT success hinges on accurate identification of uninfected cows. Traditionally, SCC has been used as a proxy for intramammary infections (IMI), with cut-points typically ranging from ≤150,000 – ≤200,000 cells/ml, with lower cut-points (≤100,000 – ≤65,000 cells/ml) suggested to improve detection of IMI's. Farmers without access to cow-level SCC data from milk recordings will need to use alternative methods for IMI detection, such as the California Mastitis Test (CMT) or on-farm culture (OFC). The CMT offers a subjective visual SCC estimation, whereas OFC enables bacteriological confirmation of IMI.

Experimental design

This study evaluated SCC cut-points (≤150,000, ≤100,000, ≤65,000 cells/ml) and alternative methods (CMT, OFC) to identify cows suitable for receiving internal teat sealant (ITS) alone at dry-off. Across three herds, cows were randomly assigned to one of five selection criteria. Cows below their assigned cut-point were included and final group sizes were: ≤150,000 (n=35), ≤100,000 (n=28), ≤65,000 (n=28), CMT (n=20), and OFC (n=31). Quarter samples were collected two days before dry-off and 4–11 days post-calving to assess SCC and IMI.

Results and discussion

Before dry-off, 83% of cows had no IMI, 16% had *Staph aureus* IMI, and 1% were contaminated. After calving, 73% had no IMI, 21% had *Staph aureus* IMI, 3% *Strep uberis* IMI, 1% *Strep dysgalactiae* IMI, and 2% were contaminated. The CMT group had 30% of cows with IMI at dry-off, followed by 23% in the ≤150,000 group. 18% of cows in the ≤100,000 and ≤65,000 groups had an IMI at dry-off (Figure 1). On-farm culture group had no IMI, as any cows testing positive were excluded to meet the selection criteria.

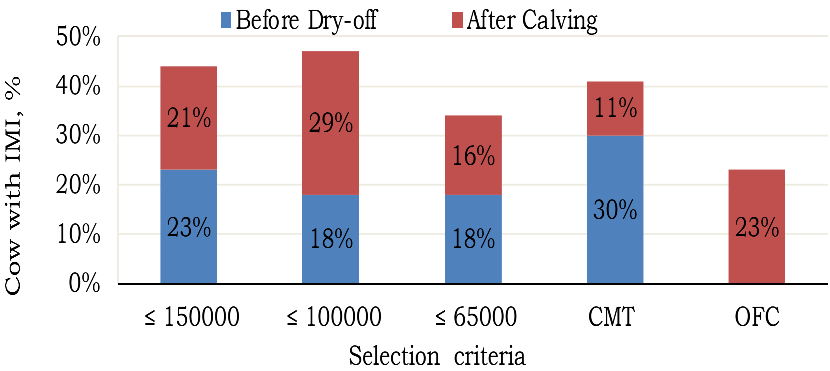
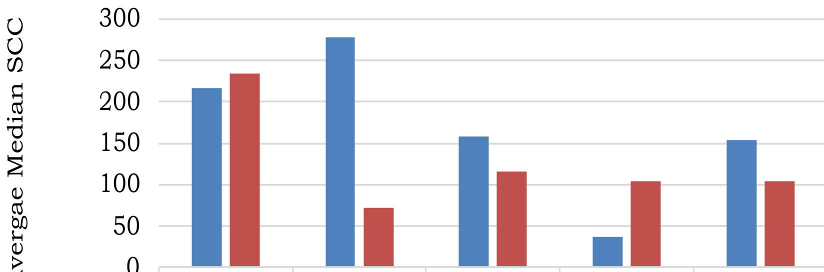


Figure 1. *Percentage of cows with IMI at dry-off and 4–11 days post-calving, based on selection for internal teat sealant alone using one of the following criteria: SCC ≤150,000, ≤100,000, or ≤65,000 cells/ml, CMT-negative, or OFC-negative*

Average quarter SCC at dry-off was >200,000 cells/ml in both the ≤150,000 and ≤100,000 groups, while all other groups was <160,000 cells/ml (Figure 2). The ≤100,000 group had the highest average quarter SCC before dry-off (278,000 cells/ml) but showed the greatest reduction after calving (73,000 cells/ml). In contrast, the ≤150,000 group had elevated median SCC both before (216,000 cells/ml) and after calving (235,000 cells/ml). The CMT group had the lowest SCC before dry-off (37,000 cells/ml) and a higher SCC post-calving (104,000 cells/ml). Meanwhile, the ≤65,000 and OFC groups demonstrated relatively stable SCC patterns.



	≤ 150000	≤ 100000	≤ 65000	CMT	OFC
Before Dry-Off	216	278	158	37	154
After Calving SCC	235	73	117	104	104

Figure 2. **Median of average quarter SCC** *before dry-off and after calving across different treatment groups based on selection criteria: ≤150,000, ≤100,000, ≤65,000 SCC thresholds, CMT, and OFC*

The data revealed substantial variability in infection rates across the groups after calving, despite their IMI status at dry-off. This highlights the possibility of new IMI's either at dry-off, the dry period, or shortly after calving. More data will be collected using milk recording SCC to evaluate the impact of these selection criteria on SCC.

Conclusion

This study found variable levels of accuracy to detect IMI with the different selection criteria. The preliminary analysis showed that the quarter SCC post calving was not significantly influenced by the selection method.

Effect of dry-off procedure on somatic cell count

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Summary

- We compared a guidelines-based dry-off (GDO) procedure that had extra teat disinfection steps and a greater focus on infusion technique with a common practice dry-off (CDO) procedure which was normal practice at the farm
- Cows treated with internal teat sealant (TS) and dried-off with a GDO procedure had lower SCC than the TS cows dried off with a CDO procedure
- Pay special attention to hygiene and infusion technique at dry-off when only treating cows with TS to help avoid negative impact on SCC

Introduction

The mammary gland is more susceptible to intramammary infections (IMI) during the early and late dry periods. Many dairy farms, including those in Ireland, are moving away from widespread antibiotic dry cow therapy, opting instead for TS alone for uninfected or low SCC cows. Irish studies found that low SCC cows treated with TS alone had higher odds of having increased SCC and IMI in the following lactation compared to those treated with antibiotics. This suggests that dry-off procedures or management during the dry and early lactation periods may make TS-treated cows more susceptible to infections. An observational study reported that cows cleaned with surgical spirit swabs at dry-off had lower SCC, and a second study showed that partial insertion of the antibiotic tube at dry-off resulted in fewer new IMIs compared to full insertion. However, there is limited controlled research on dry-off procedures. This study aimed to evaluate the impact of two dry-off procedures and two dry-off treatments on SCC during the following lactation.

Experimental design

This study was conducted between October 2023 and December 2024 at the Teagasc Moorepark research herd, which follows a pasture-based spring calving system with 326 cows. Weekly individual SCC recordings are conducted in this herd. During the dry period, cows were housed in cubicle sheds with daily cleaning and disinfecting. Cows with monthly SCC ≤100,000 cells/ml and no clinical mastitis during the lactation were eligible for the study.

Two dry-off procedures were explored: a guidelines-based dry-off (GDO) and a common practice dry-off (CDO) procedure. Also, two dry-off treatments were tested: antibiotic plus internal teat sealant (AB+TS) or TS alone. The GDO procedure followed strict hygiene, disinfection, and partial insertion of both the antibiotic and TS tube (Figure 1). The CDO procedure was the farm's usual practice following simpler disinfection steps (Figure 1). Sixty cows were randomly assigned to one of the four possible treatment combinations (GDO-AB+TS, GDO-TS, CDO-AB+TS, CDO-TS), resulting in 15 cows per group.

At dry-off, cleanliness and TS visibility from the outside after dry-off were assessed by an independent staff member. We evaluated the impact of the combination of dry-off technique and treatment on SCC during the first 30 days in milk (DIM).

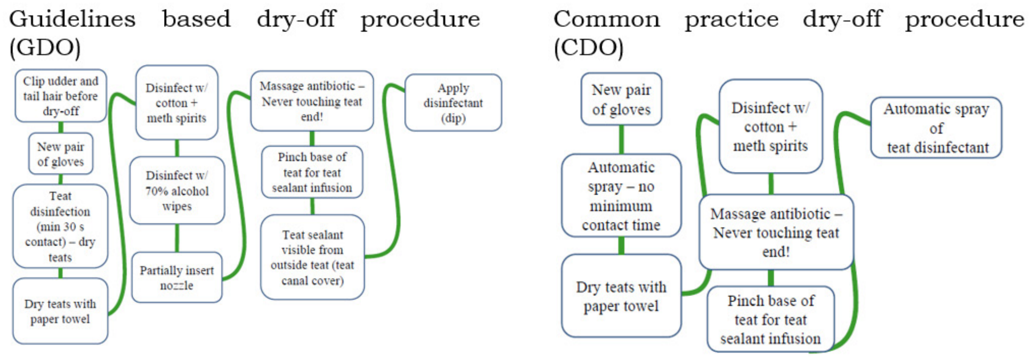

Figure 1. *Steps of the two dry-off procedures studied. GDO: Guidelines-based dry-off procedure. CDO: common dry-off procedure*

Results

Cows treated with TS alone and dried-off with the CDO procedure had significantly higher SCC in the first 30 days of the next lactation compared to the other groups (Figure 3). 61.7%, 56.3%, 60.4% and 30.6% of teats were deemed 'Clean' in the GDO-AB+TS, CDO-AB+TS, GDO-TS and CDO-TS groups, respectively. 85%, 31.3%, 95.8% and 19.4% of TS was deemed 'visible' (Figure 2) in the GDO-AB+TS, CDO-AB+TS, GDO-TS and CDO-TS groups, respectively.

Figure 2. *Visible teat sealant at teat-end post-infusion, creating an effective barrier*

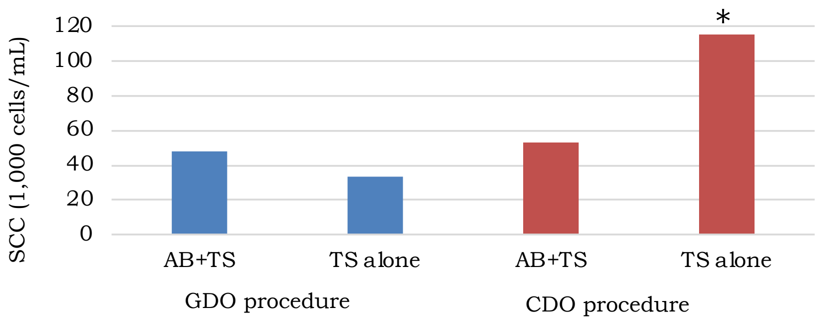

Figure 3. *Average SCC in the first 30 days in milk for the dry-off procedure (GDO, CDO) and dry-off treatment (AB+TS, TS) combinations*

Conclusion

This study showed the importance of a clean and accurate technique for applying dry-off treatments, especially for cows being treated with TS only. In the context of widespread selective dry cow therapy, farmers should observe a high hygiene standard to dry-off cows.

Current clinical mastitis bacteriology patterns on Irish dairy farms

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Summary

- Identifying the patterns of the predominant causal agents of clinical mastitis on Irish dairy farms can contribute to implementing measures to prevent and control it
- Determining the associated mastitis pattern per farm will allow identification of the associated risk factors and aid the design of targeted prevention strategies
- Preliminary results show Streptococci species caused most of the infections associated with clinical mastitis

Introduction

Mastitis is an inflammation of the mammary gland. Mastitis has two classifications: 1) clinical mastitis (CM), when visual changes to the milk and/or the udder are observed. Abnormalities in the milk include flakes, clots, or a watery appearance. Visible symptoms include swelling, heat, redness or pain of the infected quarter, as well as potential for illness or death of the cow; 2) sub-clinical mastitis (SCM) which has no visible clinical signs as the udder and milk appear normal despite the presence of infection indicated by a rise in somatic cell count.

Most mastitis is caused by bacterial infection. The main bacteria are *Staphylococcus aureus, Streptococcus uberis and Escherichia coli.* Some less common bacteria like coagulase-negative *Staphylococci* can also cause it.

The type of bacteria found can vary from farm to farm, and each may be linked with different risk factors. These risk factors include poor milking hygiene, dirty housing conditions, or poor teat disinfection. Understanding the link between specific bacteria and these potential risk factors allows for better-targeted control measures. By focusing on the risks, farmers can reduce cases of clinical mastitis and improve both milk production and overall cow health.

The objectives of this study were to evaluate the prevalence of clinical mastitis on Irish dairy farms and the pathogens involved in those clinical mastitis cases.

Clinical mastitis research study

83 commercial dairy farms across Ireland were enrolled in this study from April 2024 to May 2025. The average herd size of these farms was 127 cows ranging from 46 to 455 cows. Three on farm visits were conducted, in April 2024, November 2024 and March 2025. These visits involved carrying out assessments of hygiene in the milking parlour, the cows and the farm facilities and management of the farm facilities and cows, as well as conducting a questionnaire in person with the farmer. The questionnaire focused on questions relating to cow management, general farm management practices, the dry period and the calving period and many more areas. During the first visit, farmers were trained on taking aseptic quarter milk samples, the farmers were instructed to sample every case of clinical mastitis that they detected. Clinical mastitis samples which were collected by the farmer were immediately frozen. These frozen samples were collected every two to three months and transported back to Teagasc Moorepark for analysis. Bacteriological results were used to identify the bacteria causing mastitis in the cow. These results were also shared with the farmer.

Results

70 out of 83 of the herds enrolled in this study submitted clinical mastitis samples. Sample submission per farm ranged from 0 to 37 samples.

The preliminary results in Figure 1 show *Streptococcus* species were the predominant pathogen causing approximately 20% of the intramammary infections in the samples collected. This was followed closely by *Escherichia coli* (12%) and *Staphylococcus aureus* (approximately 10%), both of which are well-known mastitis-causing pathogens. 'No growth' accounted for approximately 25% of samples submitted. This finding is not uncommon in mastitis diagnostics and can be due to antibiotic treatment prior to sampling or the cows' immune system may have successfully cleared the infection before bacterial detection was possible. Finally, the 'Mixed species/Unknown' accounted for around 18% of the samples submitted. This category accounts for samples that had two species identified (mixed samples) and also samples that grew unknown species that could not be identified. The samples of unknown species will undergo further testing to determine the possible bacteria present from that sample. The variation in bacterial species highlights the complexity of mastitis aetiology and the need for targeted control strategies based on predominant pathogens identified in individual herds.

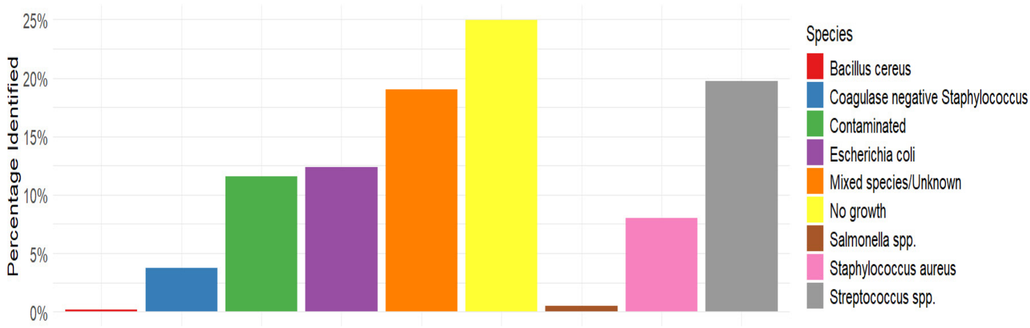

Figure 1. *Preliminary results of bacterial species identified from clinical mastitis milk samples from 70 farms*

Conclusion

This study provides valuable insights into the different bacteria responsible for clinical mastitis on Irish dairy farms. These findings highlight the need for farmers to implement targeted mastitis control strategies based on the most common pathogens affecting their herds to aid in reducing clinical mastitis incidence on farm.

Future work will analyse the results obtained from the farm assessments and questionnaires to identify the risk factors associated with clinical mastitis. This will contribute to identifying control strategies, which could be implemented to reduce the overall incidence of clinical mastitis on Irish dairy farms.

Acknowledgments

We acknowledge the 83 farmers who took part in the trial as without them it would not have been possible.

Putting a price on mastitis control

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Summary

- The hidden costs of mastitis are some of the largest ones. The extra profit for a herd with an SCC of 150,000 instead of 250,000 cells/ml is worth 1.3c/l, or over €7,000 p.a. for a 100-cow herd
- Understanding the source and spread of mastitis infection can help us develop appropriate and effective control plans. Multi-disciplinary support for mastitis challenges is available through the TASAH-funded Cell Count Solutions Consult
- Any mastitis control plan must include hygiene, good milking routines, milking machine function and maintenance, post-milking teat disinfection and regular milk recording - you can't manage what you don't measure!

Introduction

Do you believe your herd could be more profitable? Did you know that improving mastitis control is one way to do that? Mastitis can cause significant losses on any farm. While there are some costs that are very obvious, such as the cost of treatments used, penalties incurred and the value of the discarded milk, these are only the tip of the iceberg. If we want to really understand the opportunity that exists from reducing mastitis in our herds, we also need to consider the "hidden" costs, which are actually some of the largest.

What does a high SCC cost you?

When a cow has an infected quarter (or quarters) she cannot produce milk to her full potential. This lost potential or production is one of the largest costs associated with mastitis. Culling as a result of mastitis is also a significant, and often avoidable cost. Finally, if you supply a co-op that pays a premium for high quality milk, then missing out on that bonus is another large and unnecessary loss.

The impact on profit from having a herd with an average somatic cell count (SCC) of 150,000 cells/ml instead of 250,000 cells/ml is worth 1.3 cents/litre. There are benefits for the broader industry too, with research showing better quality raw milk yielding greater returns for milk processors due to product quality and quantity. However, this same research has also found that the financial opportunities that exist from lower SCC milk are in a ratio of 3:1 in favour of the farmer i.e., the financial gain within the farmgate is approximately three times greater than the benefits the processor will see.

Other benefits to better mastitis control are more difficult to put a figure on. Herds with good udder health are reported to be easier to manage with simpler and quicker milking routines, easier to recruit and retain staff and generally less stressful. Farmers take great pride in what they do and in their herds, and maintaining good udder health is an integral part of this sense of achievement.

What is a good SCC target to aim for?

At an individual cow level, an SCC greater than 200,000 cells/ml means there is a high probability of at least one infected quarter. At a herd level, having an average SCC under 200,000 cells/ml is generally an indication of good mastitis control. The SCC of these herds is usually quite constant with minimal variation; any changes in SCC are easy to see and act on quickly. If we remember that mastitis infections happen when bacteria gain access to the cow's quarter through an open teat canal, then we can minimise the chances of that happening with some simple strategies. Some of the key things to bear in mind when it comes to preventing and managing mastitis, are "source" and "spread". Knowing what the "source" is means knowing if the bacteria causing the infections are coming from other cows, or from the environment that the animals are exposed to, while the "spread" is understanding how the infection is passed on and what practices are facilitating this spread.

We can find this out by taking milk samples from infected cows and getting a lab to grow the bacteria that are the culprits, and by using milk recording information and other farm records to look at the patterns of infection. That determines where we should focus our efforts at control; for example, if we know that other cows are the source, and spread is happening within the parlour, then prioritising the milking routine and machine instead of focusing on housing details is likely to be more effective.

So what is the secret to good udder health? It is important to keep in mind that there is no silver bullet. Being brilliant at the basics and consistent is what we see on farms that are successful in preventing mastitis infections. A survey carried out with the winners of the *CellCheck* Milking for Quality awards in 2024 showed that there was no rocket science to having the best udder health in the country. These winners focussed on good hygiene and milking routines, regular milk recording and using that information to take action and inform their decisions.

Conclusion

The "non-negotiables" when it comes to preventing mastitis include the following:

- Hygiene
- A good milking routine
- A well maintained and functioning milking machine
- Good post-milking teat disinfection
- Regular milk recording

Herds that milk record have been shown to have 178 litres additional milk yield, 29 kg more milk solids and €39 higher gross margin per cow. Without whole herd milk recording, it is impossible to make informed decisions about your herd. It is essential information for making breeding decisions, monitoring udder health, identifying cows that require an antibiotic dry cow treatment and ensuring that you have the most efficient herd possible. The *CellCheck* Technical Working Group recommends that all farmers should milk record at least six times a year. It may take a little time (and extra help) to get comfortable with the recording process, but the information it provides is invaluable. Don't forget, there are plenty of service providers such as your vet, or farm advisor that can help you with interpretation of the results and reports, and help you draw up suitable action plans.

How to register for a funded consult?

Any farmer that needs help addressing a mastitis issue can access that help through a TASAH-funded Cell Count Solutions Consult. While this free consult is delivered by a trained veterinary practitioner, the goal of the consult is to work with the herdowner to identify and connect with other service providers (Co-op milk quality advisor, farm advisor, milking machine technician etc.), who can also provide ongoing support to the farmer after the consult.

The consult will explore all relevant areas, including the cows, milking routine, environment, records etc. During the consult the veterinary practitioner and farmer will identify and agree mastitis-related goals and actions. The farmer nominates their preferred trained team members, who will all have access to these agreed actions following the consult. For more information, and to register for a free consult, see https://animalhealthireland.ie/programmes/cellcheck/cellcheck-cell-count-solutions-tasah/

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Internal and external factors that can affect pre-weaned calves' behaviour

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Summary

- As calves age, they spend less time lying down and more time ruminating and eating
- Calves spend more time consuming their bedding than forage from the feeder
- Low ambient temperatures (<4 °C) in the calf shed reduced calf activity and feeding behaviours, highlighting the important of proper calf house temperature management

Introduction

Animal welfare can be inferred from their behaviour, as an animal's behaviour represents the combination of internal factors (i.e. age or breed) and external factors (i.e., ambient temperature or relative humidity). The aim of this study was to determine how age and ambient temperature affected the normal behaviour of group-housed calves during the pre-weaning period. Forty-seven female dairy calves were allocated to one of three pens based on birth date and reared under conventional Irish management conditions; after three to four days in individual pens, calves were moved into group pens where they had ad-libitum access to forage (hay), water, and concentrates. Milk replacer (6 L/d) was fed through an auto-feeder; calves were gradually weaned from days 42 to 84. Each calf's behaviour was recorded using cameras fitted within each pen for one day per week, every 10 minutes, for eight consecutive weeks. Behaviours recorded included posture (lying or standing) and activities (ruminating, eating concentrates, eating bedding, eating forage, drinking water and walking). Only the behaviour of healthy calves was used in the analysis.

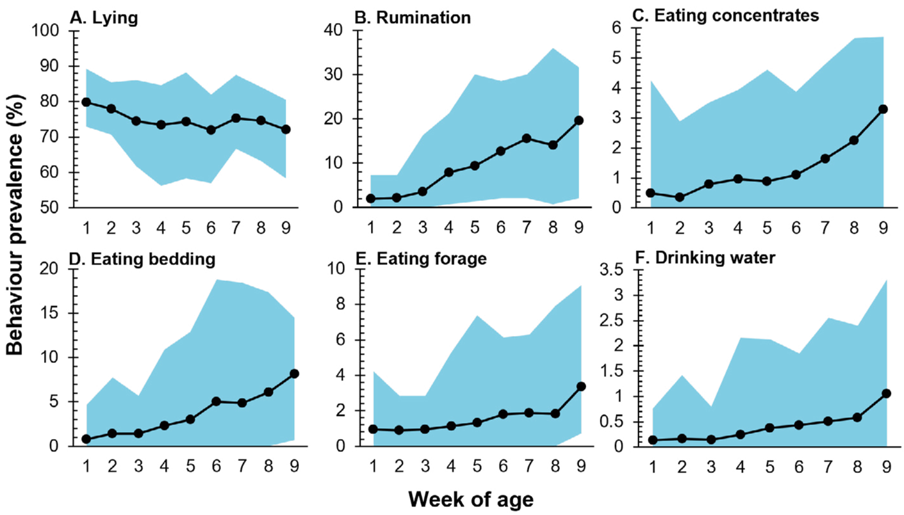

Figure 1. *Prevalence (%, black circle) of different calf behaviours recorded each week during the pre-weaning period in group-housed dairy calves. The shaded bands represent the range in observations for each week (minimum to maximum)*

Results

Age

The proportion of time calves spent lying was highest in Week 1 and had decreased by Week 3; it remained similar until Week 9 (Figure 1A). This change in lying time was expected, as newborn calves spend the majority of their time sleeping, and this decreases as they age. In comparison, the proportion of time calves spend ruminating (Figure 1B), eating concentrates (Figure 1C), eating bedding (Figure 1D), eating forage (Figure 1E) and drinking water (Figure 1F) all increased as calves aged. These behaviours follow the trends of normal rumen development; calves should have their first rumination event around 2-3 weeks of age, and from then slowly increase the amount of time they spend ruminating and eating solid feed. Gradual weaning started around six weeks of age, which coincided with an observable increase in rumination and solid feed consumption, emphasising the critical importance of weaning gradually. It should be noted that calves spent more time eating their bedding (barley straw) than they did forage (hay) from their feeder, which has implications on farmer management; if calves are eating bedding, it should be kept dry and clean.

Temperature

Low ambient temperatures (<4 °C) caused calves to increase the proportion of time spent lying (Table 1) and decrease the amount of time spent drinking water, eating concentrates, eating bedding, eating forage, and walking (Table 1). These findings highlight the importance of proper temperature management in calf housing, and the risk low temperatures may have on calf feeding behaviour and subsequent growth. If temperatures are low throughout the pre-weaning period and warming strategies (i.e. heat lamps, canopies) are not used, farmers may need to slightly delay weaning.

Table 1. *Average prevalence (%) of calf behaviours (mean ± standard deviation) at different shed temperatures made over time during the pre-weaning period in group-housed dairy calves*

Behaviour	Ambient shed temperature		
	<4 °C	4-6 °C	>6 °C
Lying	75.9 ± 5.27	76.2 ± 5.63	72.3 ± 5.78
Eating concentrates	0.8 ± 1.11	1.3 ± 1.43	1.4 ± 1.49
Eating bedding	2.7 ± 2.87	3.5 ± 3.33	4.0 ± 4.78
Eating forage	0.8 ± 0.91	1.7 ± 1.43	1.5 ± 1.57
Walking	1.5 ± 1.20	1.5 ± 1.05	2.0 ± 1.40

Conclusion

Calves in this study displayed normal levels of resting and feeding behaviour. As calves spent more time eating their bedding than the provided forage it suggests calves may benefit from additional or alternative methods of forage provision. In addition, if calves are consuming bedding, it should be kept clean and dry. During extended periods of cold temperatures, farmers may need to wean calves later to promote solid feed intake pre-weaning or improve temperature management within calf housing (i.e., providing more bedding material or installing heat lamps/canopies).

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Associations between production performance and animal welfare on Irish dairy farms

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Summary

- Farms that practised more welfare-positive practices, like using analgesic for dehorning, had higher annual milk and milk solids production
- Farms that met or exceeded the legal requirements or current recommendations for best practice had higher calf IgG and lower 28-d mortality rates
- Results suggest that farmers with higher awareness of animal welfare may have increased production and better animal health on their farms

Introduction

As the public becomes more concerned about the welfare of production animals, it has become increasingly important to both assess and identify improvements for the welfare of animals on commercial farms within the current system. On-farm welfare assessments can also be useful to inform consumers about the welfare of production animals. One objective of this trial was to estimate how cow and calf welfare-related variables were associated with measures of farm performance and animal health on Irish dairy farms. Farm-level welfare-related variables, pertaining to both cow and calf health, their physical environments, and nutrition, were collected from a convenience sample of 45 pasture-based, spring calving dairy farms in the southeast of Ireland at the end of the spring calving period (March to April) in 2023. Performance variables included 305-d projected milk yield (MY), milk solids yield (MSY) and average somatic cell score (SCS), while animal health measures included calf 28-d mortality rate, calf serum immunoglobulin G (IgG), and cow serum amyloid A (SAA). Welfare-related variables were categorised based on results from previous Irish on-farm welfare assessments, legal requirements for cow and calf housing and management, and current best-practice recommendations for Irish dairy farming. Production and health indicators were then analysed to identify associations with these welfare categories.

Results

Farm performance

On the farms visited, the average projected 305-d MY was 6460 kg, but ranged from 4385 to 7354 kg, while average projected MSY was 518 kg, with a range of 359 to 635 kg. Farms that provided pain relief to calves during disbudding were associated with higher 305-d projected MY (6662 kg; +7%) and MSY (554 kg; +12%) compared to farms that did not provide pain relief to calves during disbudding (MY: 6190 kg; MSY: 489 kg). Although there is evidence that calf health and management may have long-term effects on future cow performance, farmers that provide pain relief during disbudding may be more aware of animal welfare issues in their herd, leading to higher production.

Farms that had cubicles within or above the recommended length also had higher MY (6705 kg; +8%) compared to farms that were below the recommended cubicle length (6147 kg), while farms that fed single source colostrum had higher 305-d projected MSY (542 kg; +8%) compared to farms that fed pooled colostrum (501 kg).

Average farm SCS was 4.73, with a range of 4.54 to 4.93. Somatic cell score was higher on farms with obstructions at the entrance and/or exit of their parlour disrupting cow flow (4.74) compared to farms with no obstructions (4.67). Somatic cell score was also higher on farms that had more than two calf sheds (4.73) compared to farms with one or two calf sheds (4.68). These results imply that farm infrastructure may affect SCS.

Animal health

On the farms visited, the average calf 28-d mortality rate was 5%, with a range of 0 to 29%. Calf 28-d mortality rates were lower on farms that provided fresh colostrum (4.9%) rather than stored colostrum (11.1%). The average calf serum IgG on the farms visited was 37.5 mg/ml, with a range of 17.8 to 57.05 mg/ml. Calf IgG was higher on farms that met the minimum calf shed air space recommendation (39.2 mg/ml) compared to farms which were below the minimum shed air space recommendation (24.9 mg/mL). Current calf shed air space requirements are 7 m^3/calf for new-born calves and 10 m^3/calf for 8-week-old calves. These results suggest that farms that met current recommendations for calf management had calves of better health and welfare.

Higher levels of SAA indicate higher levels of inflammation. On the farms visited, mean cow SAA concentration was 0.86 µg/ml, with a range of 0.06 to 4.94 µg/ml. Cow SAA concentrations varied depending on the week of the farm visit, showing a decreasing trend over time. Since SAA levels peak shortly after calving, this likely reflected the increasing average days in milk of the herd at the time of each visit.

Conclusion

Farmers that practiced more welfare-positive management practices (i.e., pain management during disbudding) and followed current legal requirements or recommended best practices for cow and calf management had higher performance and healthier animals on their farms.

Acknowledgements

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Cow-calf contact systems in Ireland: summary of Moorepark research

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Summary

- Cow-calf contact had a negative effect on cow production over the full lactation
- Calves reared in the cow-calf contact systems had increased growth pre-weaning, but were in poorer health than the conventional calves
- The weaning and separation process affected the welfare of both cows and calves
- Farmers' perception of early cow-calf separation is mixed, but most are in favour

Introduction

Conventional calf rearing practice is to separate cow and calf soon (<24 hours) after birth; however, consumer dissatisfaction and researcher concern with the practice has led to increased interest in alternative calf rearing methods. Cow-calf contact (CCC) systems are calf rearing systems that allow calves to have contact with either their dam or a foster cow for a prolonged period of time (>24 hours) after birth. Little research has been performed on CCC in pasture-based systems.

Teagasc Moorepark cow-calf contact study

A study was carried out in Teagasc Moorepark in 2021 to investigate the impact of two different CCC rearing systems compared to the conventional Irish calf rearing system on dairy cow and calf production, health, labour, and welfare. Fifty-four cow-calf pairs (18 pairs/system) were balanced across the three systems: conventional, system (CONV), cow and calf separated ≤2 hours post-birth, cows milked twice-a-day, calves artificially reared indoors; full-time access system (FT), dam and calf allowed constant, pasture-based, unrestricted access and cows milked twice-a-day; and part-time access system (PT), unrestricted access at night indoors, cows grazed outdoors by day while calves remained indoors, cows milked once-a-day (0800 h). All calves were weaned at eight weeks; CONV calves were gradually weaned over 21 d, while the FT and PT calves were weaned and separated from their dams in a gradual 7-day process. From birth to three weeks post-weaning, calf health and daily labour were evaluated twice-weekly, and calf weight and cow and calf behaviour were recorded weekly. Cow production was measured weekly for the duration of their lactation. Cow weight, health, and body condition score (BCS) were evaluated weekly during the first 12 weeks of lactation and at week 35 (end of lactation). Cow and calf blood samples were taken the week before (preWS) and week after (postWS) the 7-day weaning and separation process to check for physiological markers of health and performance.

Production, health, and system-associated labour

During the CCC period, the FT and PT cows had lower parlour milk yields than CONV, due to calf intake and once-a-day milking of the PT cows (Figure 1). After weaning and separation, the FT and PT cows' milk yields increased, but never reached the level of CONV. As this persisted for the rest of their lactation, FT and PT cows' cumulative 35-week milk yields were lower than CONV, and their cumulative milk solids yield was similarly affected. Neither mastitis incidence nor somatic cell score differed between systems throughout the 35-week lactation. After eight weeks of lactation, PT cows were heavier and in better BCS than CONV and FT cows. By lactation's end, PT cows remained heavier and in better condition than CONV and FT cows, which were similar. The FT and PT calves had increased growth pre-weaning compared to CONV calves, but poorer health, behaviour, and post-weaning growth. Calving labour was higher for CONV than FT and PT systems, while weekly labour was higher for FT than CONV and PT systems. Overall, labour was highest for the FT system.

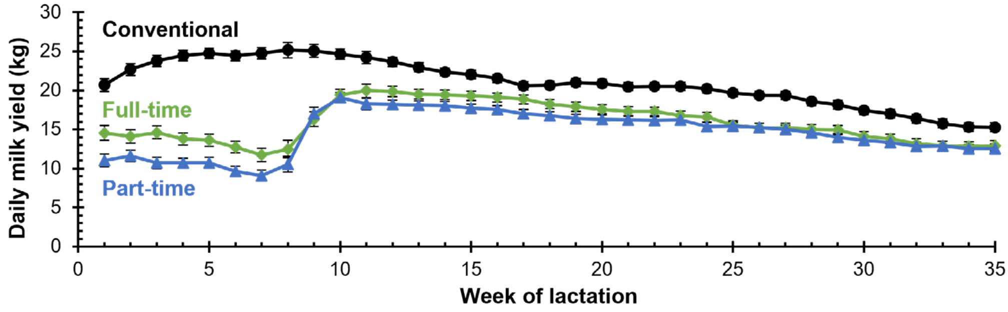

Figure 1. *Milk production over the first 35 weeks of lactation for cows with no contact (CONV), full-time, or part-time contact with their calves for an 8-week pre-weaning period*

Cow and calf health and welfare around weaning and separation

Although on the surface the cows in the CCC systems appeared to be in good health, preWS the FT and PT cows differed from each other in several physiological health parameters pertaining to diet (FT cows had higher serum calcium and magnesium levels preWS) and energy balance (PT cows had higher body weight and BCS and lower non-esterified fatty acids preWS). All calves, regardless of system, had worse clinical health scores postWS compared to preWS, indicating that weaning left them in worse health. Serum globulin was also higher postWS compared to preWS indicating that calves had more inflammation at that time. All calves expressed more positive behaviours (play and social interactions) preWS compared to postWS, implying that weaning had a negative effect on calf welfare, regardless of system.

Irish farmer perception of early cow-calf separation

A survey was completed with farmers during an on-farm welfare assessment trial to obtain their perceptions of the advantages and disadvantages of early cow-calf separation. Most appeared to consider early cow-calf separation advantageous for them, as they believed it led to better cow and/or calf health, allowed for easier colostrum management, and reduced the amount of distress experienced by the cow and calf. However, two farmers explicitly stated there were no advantages to early cow-calf separation, and these farmers delayed separation on their farm for ≥24 h post-birth and expressed that they were open to leaving cow and calf together for longer.

Conclusion

While CCC systems offer potential welfare benefits, challenges related to animal health, weaning stress, and farm practicality suggest that further research and refinement are needed before widespread adoption in Irish pasture-based systems.

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Waste milk – is it suitable to feed to calves?

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Summary

- Waste milk feeding did not impact growth, but led to increased antimicrobial resistance in young calves
- Calf growth and general health remained unaffected, but gut health showed some negative post-weaning impacts
- Waste milk feeding duration should be limited and high standards of hygiene maintained to reduce resistance spread on farms

Introduction

When dairy cows are treated with antibiotics—often for infections like mastitis—their milk can contain drug residues and must be withheld from sale. This milk, known as waste milk (WM), is commonly fed to calves. A survey of Irish dairy farms found that over half of farmers feed WM to their calves. Waste milk feeding (WMF) is associated with increased risks of calf diarrhoea, inflammation, and changes to gut bacteria that are important for digestion and immunity. A major concern with WMF is the potential for calves to develop and shed antimicrobial-resistant (AMR) bacteria. These bacteria can spread within the farm and may pose a threat to both animal and human health. Calves may act as reservoirs for AMR, especially if resistance persists as they grow older. Most research so far has only looked at short-term effects of WMF, often in indoor farming systems. A study was recently undertaken in Teagasc Moorepark to investigate the effects of feeding WM for either the entire pre-weaning period (12 weeks) or for two-weeks, from three to five weeks old, compared to calves fed milk replacer with no antibiotic residues.

Results

There was no difference in calf weights or average daily gain pre-weaning, at weaning or post-weaning.

All calves in the study received good-quality colostrum, and passive immunity was similar across all treatment groups. Overall health was high throughout the study, with most calves showing no signs of illness before, during, or after weaning. During the pre-weaning period, calves fed WM throughout showed slightly better health than those not offered WM at any point. However, faecal scores, used to assess gut health, after weaning were higher in calves fed WM when they were three to five weeks old. There were no big differences between groups in indicators of respiratory issues like cough or nasal discharge. Overall, feeding WM had limited effects on visible calf health. Antimicrobial-resistant bacteria were found on staff boots and feeding equipment used for calves fed WM (Figure 1), but not on gloved hands or pen floors. All calf groups had resistant bacteria in their faeces, with higher levels in those fed WM, especially early in life, raising concerns about resistance spread.

The study showed that feeding WM affected the gut bacteria of calves over time. Calves fed WM had bacteria with more antibiotic-resistant genes, but these decreased over time. Although the total number of species stayed highest in the control group, key differences in specific bacteria and metabolic activity were seen. Waste milk feeding may influence gut development and increase antimicrobial resistance, especially during early growth stages.

Discussion

To minimise risks linked with feeding WM, farmers should consider a few key recommendations. Firstly, ensure WM is low in antibiotic residues (day three post-treatment onwards), as even low levels can influence calf gut health and encourage AMR. While WM did not affect calf growth rates, it may still disrupt gut microbiota, especially during stressful periods like weaning—so close monitoring of calf health is essential. Given that calves fed WM shed higher levels of resistant bacteria early in life, good hygiene is recommended to reduce AMR spread on farm. Finally, since microbial changes and resistance appear to decline post-weaning, limiting the duration of WM feeding and transitioning to antibiotic free feed early may help reduce long-term risks.

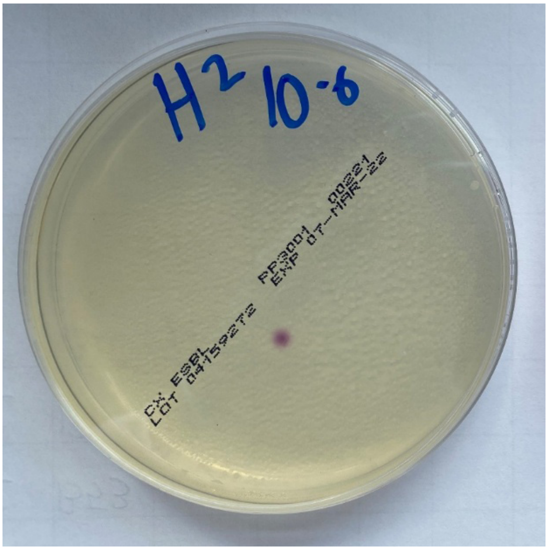

Figure 1. *Resistant isolate (seen as purple-bacterial colony on petri dish) was found in faecal samples from calves fed milk replacer containing trace amounts of Neomycin and Amoxcillin*

Conclusion

Feeding WM did not affect calf growth or overall health but led to looser faeces at weaning and post-weaning. More importantly, WM feeding contributed to the emergence of antimicrobial resistance. Feeding WM may alter the development of the faecal microbiota, though the downstream implications of this remain unclear. These findings highlight potential risks, suggesting that farmers should avoid or limit feeding waste milk to calves whenever possible.

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Colostrum quality – does very high-quality colostrum improve calf health and weight gain?

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Summary

- Higher-IgG colostrum improved passive transfer but did not significantly boost long-term growth or health
- Calf gut microbiome development was influenced more by age than by colostrum IgG levels
- Feeding two transition milk meals within 24 hours improved early life calf health, regardless of colostrum quality

Introduction

Colostrum is the first and most important feed a calf receives. It provides antibodies (mainly IgG) that protect newborn calves from illness until their own immune system develops. To give calves the best start, colostrum needs to be high in quality, and fed as soon as possible after birth (Colostrum 1,2,3 rule; AHI). Good quality colostrum has at least 50 mg/ml of IgG (antibodies; 22 % on a Brix refractometer), but new research suggests even higher levels, over 100 mg/ml, could lead to better calf health and growth, especially for dairy heifers. Colostrum also helps set up the calf's gut bacteria, which is important for digestion and immunity. A recent Moorepark study looked at whether feeding very high-quality colostrum (with more than the standard level of antibodies) would lead to better growth, health and gut development in calves. Two groups of heifer calves were compared, one group was fed high-quality colostrum (>100 mg/ml IgG) and the other was fed colostrum with ~50 mg/ml IgG. All calves were monitored closely for growth, health, and gut bacteria during the pre-weaning period. The goal was to see if higher quality colostrum leads to better-performing calves.

Passive transfer and IgG absorption

The calves in the high-quality colostrum group (Hi) were fed colostrum with an IgG content of 123 mg/ml while the colostrum offered to the 'good' group (G) was 85.2 mg/ml. As expected, calves in the Hi group had higher serum IgG levels at 24 hours (29.1 mg/ml vs. 23.8 mg/ml), placing them in the "excellent" passive transfer category, while G calves were in the "good" category based on industry standards.

However, absorption efficiency (how much IgG was actually absorbed) was lower in the Hi group. This may be due to the gut's limited ability to absorb large IgG amounts, a known phenomenon as the calf's gut "closes" within the first 24 hours. So, while Hi calves received more total IgG, their bodies did not necessarily use it more efficiently.

Growth and health

Calves in the Hi group grew slightly faster in the first five weeks, but this growth advantage did not last. By weaning and at post-weaning, weight and average daily gain (ADG) were similar across both groups. This early growth spurt may have offered some protection during a critical window when calves are most vulnerable to disease and their immune systems are still developing. However, because both groups received good-quality colostrum, health outcomes were generally positive in both.

Overall calf health scores did not differ significantly. Morbidity (disease cases) was low pre-weaning, likely due to strong passive immunity across all calves. Interestingly, Hi calves had slightly fewer cases of eye and nose discharge, suggesting some minor benefits of higher IgG levels. Inflammation marker SAA (serum amyloid A) rose after colostrum intake, as expected, but did not differ between groups and levels of all calves were consistent with healthy calves.

Microbiome development

The study also tracked how colostrum quality affected the gut microbiome, an important part of calf immunity and digestion. Surprisingly, colostrum quality did not influence microbiome diversity. Instead, calf age was the biggest factor, with gut bacteria changing naturally as calves matured and graduated from a milk based diet to solid feed. Weight was also related to microbiome differences, but this was likely a reflection of age.

Transition milk feeding

Though not a main focus, the study looked at feeding transition milk (milkings 2-6 post-calving) in the first 24 hours (meals given after the initial colostrum feeding). Calves who received two transition milk feeds (regardless of colostrum feeding treatment) were healthier, due to the greater uptake of IgG's (from colostrum and transition milk) within the first 24-hours of life. If labour allows, offering two transition milk feeds within the first 24-hours after birth could improve calf health, especially on farms with high disease rates in young calves. This has practical implications as calves born at night only received one transition milk meal due to fixed feeding times so an extra effort may be required to feed an extra colostrum feed within the first 24-hours.

Conclusion

Current guidelines for colostrum quality still stand, feeding good-quality colostrum (≥50 mg/ml IgG) is effective for calf growth and health. While higher-quality colostrum improved passive immunity and protection against infection, growth rates, health scores, inflammation levels, and antibiotic use were similar across both groups. Colostrum IgG levels did not appear to affect the calf's gut microbiome. Overall, providing clean, good-quality colostrum (>50 mg/ml) remains a practical and effective strategy for raising healthy calves.

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Heifer Rearing: achieving target weights

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Summary

- Achieving key weight-for-age targets ensures optimal fertility, milk production, and longevity in heifers
- Heifers should attain target weights at five key times between birth and calving (6, 9, 14, 15 months and pre-calving)
- Red clover silage improves winter weight gain, potentially eliminating the need for concentrate supplementation

Target weights

Achieving weight-for-age targets is a crucial performance indicator in heifer rearing systems. These benchmarks suggest that heifers should reach 30%, 60%, and 90% of their mature body weight at 6, 15 (breeding), and 24 (pre-calving) months, respectively, to enhance milk production, fertility and longevity. Recent work carried out at Moorepark has created two additional weight for age targets – these are 40% of mature body weight at nine months of age (housing) and 50% of mature body weight at 14 months of age (turn-out).

Table 1. *Target body weights as a proportion of mature body weight at key ages during the heifer rearing period*

	6 months	9 months (housing)	14 months (turnout)	15 months (breeding)	Pre-calving
Percent mature bodyweight	30	40	50	60	90

Mature herd weight can be estimated by weighing fully grown cows (third lactation or older) during early to mid-lactation (typically May/June for spring-calving herds). Ensure the selected cows are representative of the future herd to provide an accurate mature weight estimate.

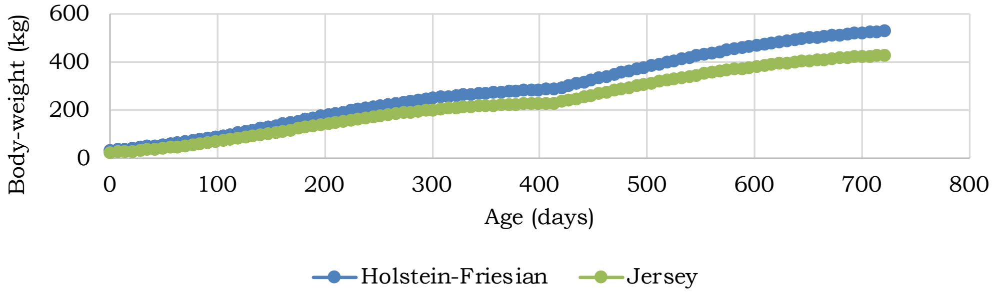

Figure 1. *Growth curves, from birth until calving, of Holstein-Friesian and Jersey heifers*

Figure 1 shows the growth curves of heifers from birth to calving and highlights that growth is not linear. It is clear from the graph that growth rate slows over the winter housing period, while high growth rates can be achieved post-turnout during the second grazing season. There are however options to improve heifer growth rates over the winter housing period.

Using red clover silage during the first winter

A recent experiment was undertaken at Teagasc Moorepark to investigate the effect of offering red clover silage to replacement dairy heifers during their first winter in comparison to grass silage diets. Heifers were assigned to one of the following treatments:

- Grass silage only
- Grass silage + 1.5 kg/day concentrate
- Red clover silage only
- Red clover silage + 1.5 kg/day concentrate

The dry matter of the red clover silage was 29.6 % while it was 31.7 % for the grass silage. The crude protein and dry matter digestibility of the red clover silage was 16.1 % and 76 %, respectively compared to 13.4 % and 72.7 %, respectively for the grass silage.

Dry matter intake was approximately 9 % higher on the red clover diets than the grass silage. This combined with the superior nutritional quality of the red clover silage led to increased weight gain (Figure 2) and attainment of target weight at turn out. The results showed that heifers offered red clover silage and no concentrate had an average daily gain (ADG) of 0.83 kg/day, which was similar to the ADG of the heifers offered grass silage and 1.5 kg/day concentrate (0.86 kg/day). This suggests that if high-quality red clover silage is provided during the winter, concentrates may not be required in the over-winter diet, and heifers can still reach their target weights both at turnout and the beginning of the breeding season.

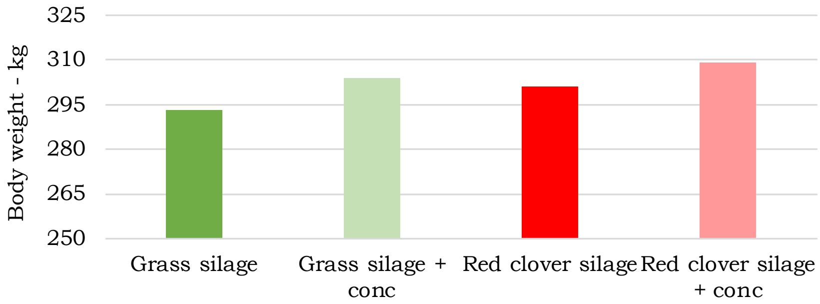

Figure 2. *Body weight of replacement dairy heifers at turnout (22nd Feb) offered either grass silage or red clover silage, with and without concentrate during the winter housing period*

Conclusion

Feeding high-quality red clover silage during the first winter can significantly improve heifer growth, enabling target weights to be met without concentrate supplementation. This supports efficient, cost-effective heifer rearing, promoting better fertility, longevity, and future milk production, while reducing reliance on purchased feeds during the housing period.

The role of fasting in calf transport: can on-board feeding improve calf welfare?

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Summary

- Fasting duration, rather than transport duration, had the greatest impact on the physiology of Irish calves undergoing transport to mainland Europe
- Using an on-board feeding system to provide milk replacer improved calf physiology but was difficult to implement

Study 1

Every year, large numbers of Irish calves are transported to destinations in mainland Europe for beef or veal production. During this journey, calves experience long transport times and can be fasted for more than 24 hours for three or more days in a row, impacting their health and welfare. Teagasc's 'MOOVE' project investigates ways to improve the welfare of unweaned calves transported from Ireland to the Netherlands. For our first study, we aimed to determine whether the transport duration or the fasting duration had the greatest impact on a calf's physiology. We established three experimental treatment groups: 1) "Irish" calves were transported from an Irish dairy farm, via an assembly centre, to an Irish rearing facility; they were transported and fasted for relatively short durations, 2) "International" calves were transported from an Irish dairy farm, via an Irish assembly centre and a French lairage, to a veal farm in the Netherlands; they were transported and fasted for long durations, and 3) "Dutch" calves were transported from a Dutch dairy farm, via a Dutch assembly centre, to a Dutch veal farm; they were transported for a short duration but fasted for a long duration prior to arriving at the veal farm. We took blood samples from all calves upon arrival at their destination farm and measured metabolites indicative of energy balance (glucose, beta-hydroxy-butyrate, and non-esterified fatty acids), dehydration (sodium and urea), and muscle fatigue (lactate, potassium, and creatine kinase).

Calves transported for long durations (only the International calves) had higher lactate and potassium concentrations than the other groups; indicative of more muscle fatigue in these calves compared to those transported for shorter durations. However, transport duration alone did not affect any other blood measurements. Long fasting durations, experienced by International and Dutch calves, negatively impacted the energy balance of calves, evidenced in lower glucose concentrations and greater signs of fat mobilisation (higher beta-hydroxy-butyrate and non-esterified fatty acids) in International and Dutch calves compared to Irish calves. International and Dutch calves also had more signs of dehydration (higher sodium concentrations) than Irish calves. We concluded that fasting duration, rather than transport duration, had a greater impact on calf physiology, despite slightly more muscle fatigue in calves transported for long durations.

Study 2

For the subsequent study, we aimed to explore whether feeding calves milk replacer by using an on-board feeding system during the ferry crossing would improve their physiological condition. We sourced a German truck and trailer with an in-built milk delivery system; each pen was equipped with a milk bar containing 20 individual two litre milk compartments, each with a rubber teat. We loaded 20 calves per pen and transported calves from an assembly centre in Ireland, via road/ferry to a lairage in Cherbourg, France, and on to a veal farm in the Netherlands. Half the calves were fed midway through the ferry journey using the on-board milk delivery system, while the other half were not fed (control group). Staff from Moorepark entered the pens to ensure all calves in the feed group drank their milk. We collected blood samples before transport at the assembly centre (Day 0), on arrival at the lairage in France (Day 1), on arrival at the veal farm in the Netherlands (Day 2), and one week post arrival (Day 9). We measured indicators of energy balance (glucose, beta-hydroxy-butyrate, and non-esterified fatty acids), dehydration (urea), and muscle fatigue (lactate). The results are presented in Figure 1.

Calves that were fed on the ferry had higher glucose concentrations and lower beta-hydroxy-butyrate and non-esterified fatty acid concentrations at the next blood sampling time point (Day 1), all of which are signs of improved energy balance. Urea concentrations of the fed calves, though not significantly different, were within normal reference limits for healthy calves at Day 1, a sign of potentially decreased dehydration as a result of feeding these calves on-board the ferry during the sea crossing. Calves fed during the ferry journey also had lower lactate concentrations at Day 1; a sign of reduced muscle fatigue. No variables were different by the time calves arrived at the veal farm (Day 2), largely due to calves experiencing an additional 24-hour fasting period before arrival.

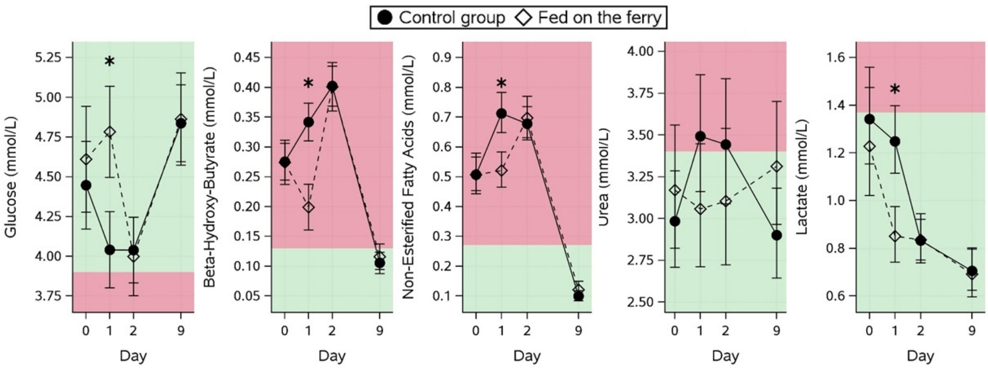

Figure 1. *Effect (± 95% confidence interval) of Treatment (control and calves fed on the ferry) on blood variables (glucose, beta-hydroxy butyrate, non-esterified fatty acids, urea, and lactate) during and after transport. Shaded areas represent areas outside (red/dark) or within (green/light) normal reference limits. * Significant difference ($p < 0.05$) between treatment groups within a day*

We concluded that feeding calves during the ferry journey improved their physiological condition, particularly variables related to energy balance and muscle fatigue. However, using the system was challenging, particularly as sea conditions were rough. More product development and research are needed before these systems can be implemented for every Irish calf export journey. If such systems are to be used commercially, calves must be fed at regular 12-hour intervals to ensure their blood metabolites remain within normal reference ranges and the impact of transport on their physiology is minimised as much as possible.

Acknowledgements

This research was funded by the Dairy Levy Trust administered by Dairy Research Ireland, Bord Bia and supported by the Teagasc Walsh Scholarship Programme.

Pre-transport feeding protocols can improve the physiological state of Irish dairy calves undergoing long-distance transport

Susanne Siegmann[1,2], **Luca van Dijk**[1,3], **Niamh Field**[1], **Katie Sugrue**[1], **Gearoid Sayers**[3], **Kees van Reenen**[2], **Eddie Bokkers**[2] and **Muireann Conneely**[1]

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Summary

- We assessed the physiological responses of calves fed different amounts of milk replacer before transportation from Ireland to the Netherlands via ferry and road
- Calves fed larger volumes of milk replacer showed less energy depletion and dehydration, but only during the first half of the journey
- Pre-transport feeding protocols have limited ability to improve calf welfare during multi-day transportation

Transport challenges calf welfare

Each spring, thousands of dairy calves are exported from Ireland to mainland Europe for rearing on beef or veal farms. These calves typically undergo multi-day journeys combining road and ferry transport. While current EU legislation requires calves to be fed at least every 19 hours during transport, exemptions for remote member states like Ireland mean these young animals are routinely fasted for longer. In practice, they may not be fed between departure from an Irish assembly centre and their next rest stop, a French control post, more than a day later, which can result in over 24 hours of fasting.

Such prolonged fasting is a serious welfare concern. It can impact calves' physiological state and result in energy loss, dehydration, and stress; conditions that increase the risk of illness and reduce the calves' chances of thriving once they arrive at their destination. It is therefore important to investigate strategies to improve calf physiology during long journeys. We designed a study to test one such strategy under real-world conditions: could feeding calves more milk replacer before the start of transport help them cope better with the physiological demands of a long journey?

Assessing different pre-transport feeding protocols

We conducted an experimental study on two commercial shipments of young male calves (68 on each shipment) that were transported from Ireland to the Netherlands (Figure 1). Calves were randomly assigned to one of two pre-transport feeding protocols at an Irish assembly centre: 1) 2L treatment: not fed the evening before transport, fed two litres of milk replacer the morning of transport or 2) 3L+3L treatment: fed three litres of milk replacer the evening before transport and again three litres the morning of transport.

During the study, we took blood samples and weighed calves at three key time points: before departure (at assembly centre), after road and ferry transport at a French lairage (~24 hours after departure), and upon arrival at a veal farm in the Netherlands (~53 hours after departure). We analysed blood samples for indicators of energy balance (glucose; NEFA (=non-esterified fatty acids); and BHB (=β-hydroxybutyrate), both of which accumulate in their blood when calves metabolize their fat reserves when not enough energy is available from food) and hydration (urea and electrolytes like sodium, potassium, chloride; their blood concentrations increase when less fluid is available to calves).

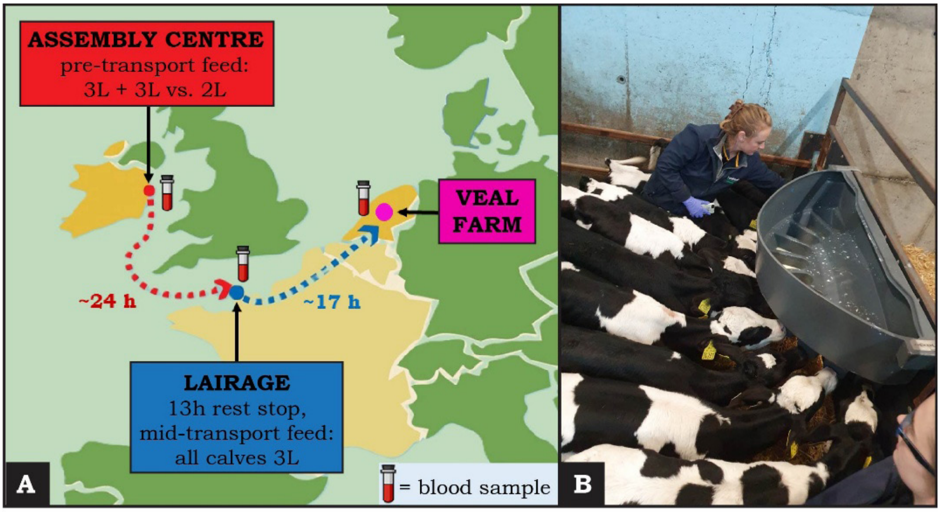

Figure 1. *A) Transport overview and B) pre-transport feeding at Irish assembly centre*

Impacts on calf energy, hydration, and body weight

Glucose levels for both treatments declined over transport while BHB and NEFA increased, indicating that all calves experienced hypoglycaemia (low blood sugar), severe energy deficits, and likely hunger. However, calves from the 3L+3L treatment had a better energy balance with higher blood glucose (3.7 vs. 3.3 mmol/l) and fewer signs of fat mobilisation (lower BHB: 0.25 vs 0.34 mmol/l; lower NEFA: 0.6 vs. 0.7 mmol/l) at the lairage after the ferry journey. On arrival at the veal farm, glucose and BHB levels did not differ, but calves that were fed more (3L+3L treatment) had higher NEFA levels (0.8 vs. 0.7 mmol/l). Most markers of dehydration increased over the course of transport for all calves, but calves fed more before transport had lower blood urea (2.6 vs. 3.7 mmol/l) and potassium (6.7 vs. 6.9 mmol/l) at the lairage in France, indicating they were less dehydrated than calves fed only two litres. There were no differences between groups in body weight or weight loss during transport.

Conclusion

Providing calves with two three litre milk feeds before long-distance transport can reduce signs of energy depletion and dehydration during the early stages of transport, offering some welfare improvement when compared to feeding only two litres pre-transport. However, pre-transport feeding protocols alone cannot fully prevent the negative effects of prolonged fasting, especially during multi-day journeys. Additional feedings during transport and rest periods are necessary to maintain functional calf physiology.

Acknowledgements

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Understanding the Colon Microbiota in Calves: A Key to Health and Growth

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Summary

- The colon microbiota is essential for digestion, immune development, and overall health
- Microbial diversity increases significantly in the first weeks of life
- Weaning triggers major shifts in microbial composition, influencing adaptation to solid feed
- Early microbial colonisation presents opportunities for targeted interventions

Introduction

Optimising calf health and performance is critical in livestock production. While early nutrition and disease prevention are well-studied, the role of the gastrointestinal microbiota, particularly within the colon, is often overlooked. Microbiome refers to the group of microbes such as bacteria, fungi and viruses that live in or on a particular environment. The colon microbiome contributes to digestion, immune function, and overall calf health. Understanding the development of the colon microbiome can guide management strategies to improve growth, disease resistance, and efficiency in both beef and dairy production.

The development and role of the colon microbiota

The calf digestive system is sterile at birth but is quickly colonised thereafter. Rumen microbial community development is widely studied, however research into the colonisation of microbes within the colon and its impact on early life digestion and immune support, has yet to be fully explained. The colon microbiome plays a major role in the breakdown of undigested nutrients and protecting against harmful microbes. A well-developed, diverse microbiota can reduce the risk of scours, a common health issue in young calves.

Weaning and microbial shifts

Weaning causes a marked increase in microbial diversity, enabling adaptation to a fibrous diet. However, abrupt dietary changes can lead to imbalances, increasing the risk of digestive issues. Proper weaning management supports microbial stability, promoting better nutrient absorption and immune function. Weaning can be a stressful period for the calf, as the animal transitions from a liquid to a solid diet. Therefore, it is essential, that the calf establishes a healthy and diverse microbiome early in life. Stress associated with weaning time can cause illness and digestive upsets, leading to slower growth rates and reduced feed efficiency.

Research at Teagasc shows that bacterial diversity in the colon increases from Day 7 to Day 96, with stabilisation occurring between Days 14 and 21. Early in life, milk-adapted microbes such as *Streptococcus* and *Escherichia-Shigella* dominate but as solid feed is introduced, fibre-digesting bacteria like *Oscillospiraceae* and *Bacteroides* become more prominent and dominate.

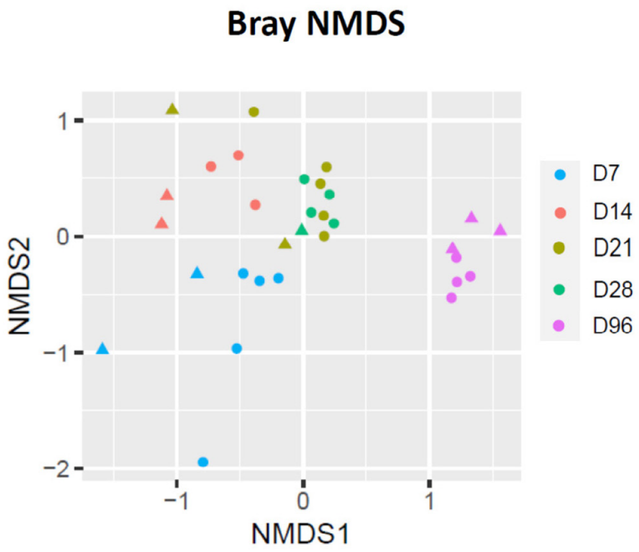

Figure 1. *Colon bacterial diversity composition from Day 7 to Day 96*

Resent research by Teagasc, highlights the differences in bacterial diversity and composition in the early life of calves. Figure 1 illustrates the similarities and differences in bacterial community composition across five different time points from Day 7 to Day 96. Each colour represents a sampling time point, and the closer the points are, the more similar their bacterial community composition. At the early time points, there is distinct clustering, meaning, the microbiota at D7 and D14 are compositionally different, suggesting rapid changes during the first two weeks of life. Whereas, between Days 21 and 28, the points are more closely grouped, indicating that microbial composition is stabilising during this period. Weaning occurred at D56, when calves were sampled again at Day 96 (post-weaning) there was a major shift in microbial structure, as can be seen with the formation of a separate cluster. This suggests that the transition to solid feed drives significant microbial restructuring. Overall, this figure highlights the clear temporal shift in colon microbiota composition, with early-life communities being highly dynamic, stabilising before weaning, and then undergoing a major shift post-weaning.

Economic and research implications

A healthy colon microbiota is essential as it enhances feed efficiency, weight gain, and disease resistance, thus, reducing veterinary costs and improving farm profitability. Future research aims to refine interventions such as probiotics, prebiotics, and maternal nutrition strategies to optimise gut development and long-term livestock performance. Advancements in microbiome research will help develop practical applications for farmers, ensuring sustainable and efficient production systems.

Acknowledgements

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Sub-clinical pneumonia during pre-weaning has long-term consequences on growth performance of replacement heifers

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Summary

- Early detection of pneumonia is challenging since clinical signs are not always present
- Heifers that experienced subclinical pneumonia early in life gained less weight pre- and post-weaning compared to healthy heifers, and resulted in lower body weights at breeding
- Thoracic ultrasonography allows for lung imaging and detection of sub-clinical pneumonia when clinical signs are absent

Introduction

Pneumonia/bovine respiratory disease (BRD) is a complicated disease that is challenging to detect and leads to serious economic burdens and animal welfare concerns. While prevalence of BRD across Irish farms varies, in 2022, BRD was responsible for 8% of calf deaths in the first 30 days of life, 34% of calf deaths from one to five months of age, and 41% of deaths from six months to one year of age (DAFM, 2023). BRD can result from an infection by multiple disease-causing agents, often beginning with a viral infection that is later followed by a secondary bacterial infection. The secondary bacterial infection increases the severity of BRD. Under research conditions, BRD is detected using clinical respiratory scoring (CRS) systems like the Wisconsin clinical score. These scoring systems generally include the assessment of the calf's ocular and nasal discharge, tilt and position of the ears/head, presence of a cough, rectal temperature and general demeanour. Unfortunately, these clinical signs, generally do not present until the onset of severe infection.

Early detection is key in managing BRD and reducing disease severity and the consequences known to impact calf welfare and farm productivity. This can be difficult when animals are experiencing sub-clinical forms of BRD. If a calf is determined to be sub-clinical, it means that there are no overtly observable signs of disease, like snotty nose, lethargy, head tilt etc. but it has been determined that the calf has BRD using some other diagnostic method. Thoracic ultrasonography (TUS) is one such diagnostic tool and has greater accuracy for BRD diagnosis compared to conventional methods such as auscultation or CRS criteria. TUS enables trained animal health professionals to take images of the lungs and determine the presence of lung lesions at the time of scanning. When diagnosing BRD using TUS, if a calf has no lung lesions, they are considered to be TUS negative (TUS-), if the calf has lung lesions (≥1cm in diameter), they are considered TUS positive (TUS+). Using the combination of CRS with TUS, BRD can be classified into subtypes

- Upper respiratory infection: CRS positive (CRS+) and TUS-.
- Clinical BRD: CRS+ and TUS+.
- Sub-clinical BRD: CRS negative (CRS-) and TUS+.

Sub-clinical BRD could be considered as a "silent" disease where the animal is sick but does not appear so and so goes untreated. While there is a lack of research on sub-clinical BRD, there are likely negative effects on animal health, welfare and farm productivity. In a recent study, Teagasc researchers conducted clinical assessments using a CRS system on dairy heifer calves (n = 60) at multiple time points from birth to first lactation. In addition, TUS evaluations were made at weaning and again at eight months of age. From these, a cohort of 20 calves were selected for evaluation of long-term growth performance and nasal and faecal microbiota analysis.

Results

Based on CRS and TUS evaluations at weaning, 10 calves were categorised as healthy (HE; CRS- and TUS-) and 10 age-matched calves as having sub-clinical BRD (SC; CRS- and TUS+). From weaning to eight months of age, calves with SC disease had reduced body weights compared with HE calves (Figure 1). During the pre-weaning period, HE calves gained 0.09 kg more per day than SC calves (HE 0.71 kg/day vs. SC 0.62 kg/day). From weaning to eight months of age, HE heifers gained 0.11 kg more per day than their SC counterparts (HE 0.65 kg/d vs. SC 0.54 kg/d). At first breeding, SC heifers were 39 kg lighter than HE heifers. The impact of SC pneumonia on body weight persisted into gestation, with SC animals weighing 55kg less than HE heifers at four months into gestation.

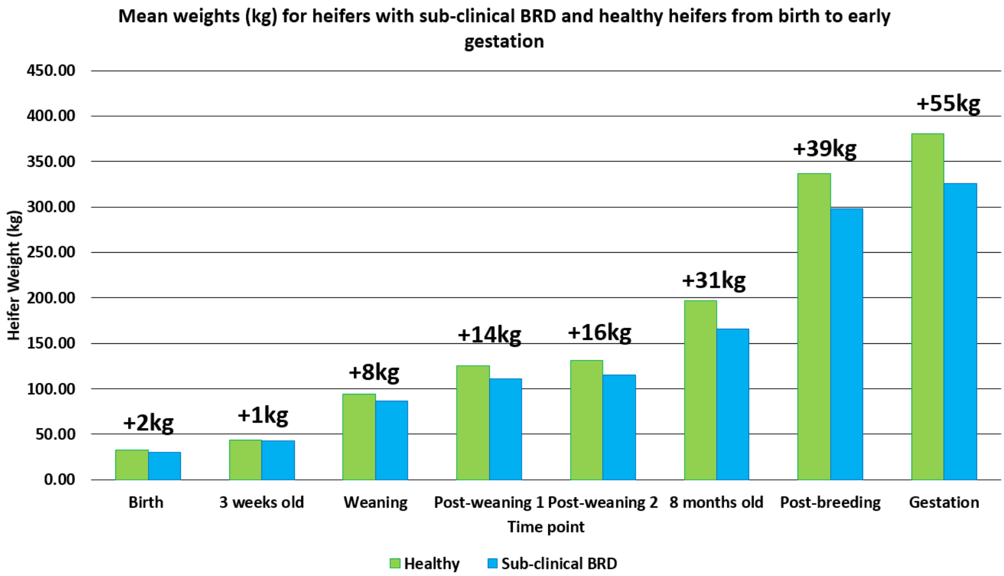

Figure 1. *Mean body weight for heifers with sub-clinical BRD and healthy heifers from birth to four months into first gestation*

Conclusion

Sub-clinical pneumonia during the pre-weaning period can have a serious impact on replacement heifer growth performance. Using clinical signs alone for the detection of pneumonia allows for sub-clinical respiratory disease to go undetected. This "silent" presentation of BRD is important as it clearly affects replacement heifer growth. Poor replacement heifer performance during early life may result in delayed age at first breeding, fertility issues, and early culling. These are all economic losses for the farm that could have been prevented through the early detection of BRD. There may be additional negative effects including prolonged health issues, and work is ongoing to investigate the impact of sub-clinical BRD on replacement heifer performance.

Acknowledgements

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Respiratory disease in dairy calves: a cross-sectional study of housing, management and environmental risk factors

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Summary

- Approximately 10% of pre-weaned calves had respiratory disease ('pneumonia') in a study of 83 dairy farms
- The study identified aspects of housing design and calf management which contributed significantly to higher rates of pneumonia on individual farms. These included, amongst others, inlet/outlet design, housing temperature, stocking rates and amount of bedding
- Farmers can reduce the risk of pneumonia in their calves by reducing pen stocking rates, improving inlet and outlet airflow and providing adequate bedding for young calves

Introduction

Bovine respiratory disease (BRD) is detrimental to the health and welfare of dairy calves. Calf housing environment is commonly referenced as one of the major contributing factors to the prevalence of BRD on a given farm. However, in a recent review of the scientific literature by the authors, the evidence base for the relationships between housing environment factors and BRD was found to be lacking in some cases and conflicting in others.

Hence, the objective of this cross-sectional study was to assess the association of calf housing design, environment and management with BRD (as diagnosed by ultrasonographic lung consolidation and clinical signs).

Over three years, 83 dairy farms in total were each visited twice, once in autumn and again in spring. These farms were recruited via one of two methods, i) random selection via the Irish Cattle Breeding Federation (ICBF), or ii) private veterinary practitioners who were asked to refer farms with known historic BRD problems.

At the first (autumn) visit, the calf housing (Figure 1) was surveyed, data loggers (continuous monitoring of temperature and humidity; and calculation of the temperature-humidity-index; THI) were installed inside the calf housing and a questionnaire survey of general calf management practices was conducted with the farmer.

At the second (spring) visit calves were examined to diagnose the presence of BRD and environmental and calf samples were collected. In total 1,640 calves (20 per farm) between four and six weeks of age were examined using thoracic ultrasound (TUS) and the Wisconsin Clinical Health Score (WCHS). Bacterial air load was quantified at three locations within the calf housing (alleyway, feeder, and middle of pen) using an impaction air sampler. Nesting scores (scale of 1 to 3;1 meaning a lying calves' legs are fully visible and three meaning a lying calves' legs not visible due to bedding) were assigned.

Two multivariable generalized linear regression models (GLR) were constructed with prevalence of TUS lesions (score three or greater; at least a single patch of lobar consolidation) and positive WCHS (aggregate score ≥5 or two or more scores ≥2) as the outcome variables, respectively.

Figure 1. *Calf housing was surveyed on 83 dairy farms nationally*

Results

The calf house survey revealed that vented sheeting was the most commonly observed inlet design (17 farms), while central ridge outlet and no outlet present were the joint most common outlet designs (29 farms each). The environmental data loggers indicated that in the week prior to calf examination in the spring, the median within-calf house air temperature was 8.8 °C and relative humidity was 76.7 %.

In total, 173 (10.5%) calves were classified as having complete consolidation of at least one lung lobe by TUS and 155 (9.5%) calves were diagnosed with BRD using the WCHS. The most frequently observed nesting score was one (on 33 farms).

Factors that were associated with calf pneumonia as diagnosed by either ultrasound or the WCHS included: the bacterial air load in the middle of the calf pen and housing temperature exceeding 20 °C in the week prior to calf examination.

Factors that were associated with calf pneumonia as diagnosed by the WCHS included: inlet design, feeding method (automatic feeder vs bucket vs teat feeder), milk type (milk replacer vs whole saleable milk vs whole saleable milk & milk replacer vs other), nesting score (score two & three protective), mechanical ventilation and calf occupied area (positively associated).

Factors that were associated with calf pneumonia as diagnosed by ultrasound included: the minimum THI in the week prior to examination (negatively associated), number of calves in the housing (positively associated), outlet design, colostrum feeding method and colostrum source).

Conclusion

This work highlighted several design and environmental factors in calf housing and in general calf management that play a role in determining the prevalence of BRD in pre-weaned dairy calves. Key factors that can be modified by farmers to reduce the prevalence of BRD include lower pen stocking rates, improving inlet and outlet airflow and providing adequate bedding for young calves. Many dairy farms might benefit from this type of comprehensive, holistic calf-management-housing BRD auditing.

Acknowledgements

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Re-emergence of Schmallenberg virus in 2024/2025

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Summary

- After an absence for six years, Schmallenberg virus infection reappeared in 2024/2025
- Typical signs in dairy herds included aborted or full-term deformed calves and diarrhoea, fever and milk drop in dairy cows
- It is predicted that this 4-6 year cycle will continue but active and passive surveillance can be used to predict 'Schmallenberg-years'

Introduction

Schmallenberg virus (SBV) was first identified in dairy cows with reduced milk yield and diarrhoea near the village of Schmallenberg in Germany in November 2011. Subsequent research established that the virus is transmitted by biting midges (*Culicoides* spp.) and can infect a wide range of animal species, primarily ruminants. In cattle, infection between ~ 80 and 150 days of pregnancy will result in lethally deformed calves (Figure 1). Following the continental outbreak in 2011, wind incursion modelling by Met Éireann and DAFM indicated that the virus crossed the continent into the south of Ireland in August 2012. The first cases were detected by DAFM in Ireland in October 2012 and cases continued into spring 2013. This outbreak conferred a variable degree of immunity on the national herd, primarily in the south. SBV vaccines were licensed in 2013 but uptake was low as there was no spread in 2013. No subsequent cases were detected until the second clinical outbreak in 2017/2018. Again, this SBV exposure immunised the national herd and no subsequent PCR test-positive animals were detected for the next six years. Then in 2024 a third outbreak began with cases detected in the spring through autumn. This history indicates that the virus is probably endemic in Ireland and each outbreak stimulates long-lasting (probably life-long) immunity. However, with our culling rate of 20-30% per year these immunised animals are gradually removed from the national herd and are replaced by naïve animals. Therefore, every 4-6 years a new outbreak occurs in this now naïve population; hence, an outbreak in 2024/2025 was likely.

Figure 1. *Schmallenberg virus causes lethal deformities in calves and lambs*

Results

The first signs of a new SBV outbreak were detected in the autumn of 2024 by the RVLs when they detected the virus in a small number of deformed calves (Table 1). The number of deformed calves increased substantially in spring 2025. These diagnoses indicated the cows were infected in the summer and autumn of 2024. All calves and lambs with deformities indicative of particular *in utero* infections were tested by PCR. These infections included Schmallenberg, Bovine Diarrhoea and Bluetongue viruses and the parasite *Neospora caninum*.

Table 1. *Bovine foetuses that tested positive for SBV in the Regional Vet Labs from autumn (1 September-31 December) 2024 to spring (1 January-21 March) 2025*

Laboratory	Autumn 2024	Spring 2025
Limerick	0	3
Athlone	0	1
Cork	0	10
Kilkenny	2	2
Sligo	0	1
Dublin	0	0
Total PCR positives	**2**	**17**

In parallel with this virus testing, XLVets, an independent group of veterinary practices (220 vets in 53 vet clinics), have been monitoring defects in calves nationally since 2021. By the end of January, 2025, XLVets had picked up an increase in reporting of certain types of deformities in calves. These defects, ankyloses and torticollis, are typical of calves infected with SBV. This trend continued through both February and March, 2025 (Table 2), supporting the results from the RVLs. Taken together, these findings confirm that there was a new outbreak of SBV in Ireland in 2024/2025 due to infection in summer/autumn, 2024. From this, it can be extrapolated that the next outbreak of SBV may occur in 2028/31.

Table 2. *Trends in calf deformities indicative of Schmallenberg virus infection based on data from XLVets (January-April, 2023-2025)*

Defects common in SBV calves	2023	2024	2025	Total
Ankylosis (rigid leg joints)	6	13	59	78
Torticollis (wry/bent neck)	1	5	33	39
Total	**7**	**18**	**92**	**117**

Conclusion

It is likely that a 4-6 year cycle of Schmallenberg outbreaks will continue in the future. These 'Schmallenberg-years' may be predicted if active and passive syndromic surveillance is conducted annually. Submission of deformed lambs to the RVLs is particularly important in this regard as SBV-infected deformed lambs are ~ 5-10-times more likely to be PCR test-positive than similarly infected calves. Additionally, serological testing of spring-born weanlings over 8-month-old during autumn/early winter in sentinel herds (or BMT samples from cows) can detect antibodies to the virus, which indicate that these weanlings were infected in the previous summer. With climate change, the midge-active season may extend into the winter months thus prolonging the risk period of infection for livestock.

Acknowledgements

The authors thank the XLVets who submitted case details to the Defect Tracker and the farmers who submitted calves to the RVLs for testing.

A national survey of bovine congenital defects recorded by farmers through ICBF over ten years

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Summary

- Farmers reported deformed cattle in their herds over a ten-year period through an ICBF on-line survey
- The three most common defects reported were blocked bowel/waterbelly (23%), multiple defects (19%) and tail defects (13%)
- Since this study, the survey has been updated to make it easier and quicker for farmers to report deformed cattle: see QR code

Updated survey

Introduction

Congenital defects are those that are present at birth. Underlying causes may be genetic, non-genetic, or in many cases, unknown. Genetic causes are of interest to our national breeding programmes. Genomic data may be used to aid the detection and management of genomic congenital abnormalities. The National Genotyping Programme (NGP) is a collaborative initiative set up in 2023 aiming to make Ireland the first country to eventually genotype the entire national cattle herd. The routine genotyping of all cattle at birth will play an important future role in the management of genetic diseases firstly by having a tissue sample for DNA testing collected at birth and secondly by having a record of DNA-verified parentage. In parallel with this genomic testing, records of abnormal phenotypes – congenital defects, are required. Routine recording of congenital defects by veterinary practitioners, pathologists, farmers, and researchers is a collective approach that can be taken to identify abnormal phenotypes. While this occurs currently on an ad-hoc basis internationally, more formal structured national recording programmes are required. This paper presents results from a longitudinal survey of congenital defects reported to the Irish Cattle Breeding Federation (ICBF). The survey was conducted over a ten-year period (2014-2023) in an attempt to survey the congenital defects occurring in the Irish national cattle population. A questionnaire survey, consisting of 33 questions was designed and formatted using an on-line platform (www.surveymonkey.com) and accessible via the ICBF website (www.icbf.com). The survey was promoted via web posts, social media and agricultural news platforms.

Results

Between 2014 and 2023 inclusive, 575 cattle with congenital defects were reported by respondents. Following the removal of duplicate reports, reports relating to non-congenital defects and reports where the defect could not be determined based on the information provided, 522 reports remained. Of the 522 unique reports (one case/report), 369 cattle born in 251 unique herds were officially registered with the Department of Agriculture, Food and the Marine (DAFM). The remaining 153 cattle did not have a valid registration with DAFM. The predominant sire breed was Friesian (FR), followed by Limousin (LM) and Aberdeen Angus (AA). The most common dam breeds were FR, LM and Charolais. Of the sire breed x dam breed categories, (dairy x dairy, beef x beef and dairy x beef), there were 235, 80 and 54 affected animals, respectively. Of the four provinces, the majority of reports (n=232; 63.0%) were for herds in Munster, with 92 (25.0%), 27 (7.3%) and 17 (4.6%) reports for herds in Leinster, Connacht and Ulster, respectively. The majority of dams were in their 3rd or higher (n=253; 68.6%) lactation when giving birth to the calf with the reported congenital defect. Breeding data were available for 248 calves of which 237 (95.6%) were sired by AI bulls and 11 were sired by natural service sires.

The three most commonly recorded defect categories (in the 522 cases) were blocked bowel/waterbelly (intestinal atresia) alone (23%), (Figure 1), multiple defects (19%) and tail defects alone (13%); these accounted for over half of all congenital defects recorded (54%). Of the 127 atresia cases recorded, 85 were registered with ICBF hence additional data were available. The majority of these calves were male and the predominant breed type was dairy x dairy. The majority of dams of these calves were served by AI and most dams of affected calves were older cows. The three most common co-defects, within the multiple defect category, were: tail defects (28% of all multiple defect cases), rigid legs (ankyloses) (20%) and intestinal atresia (20%). The third most commonly reported category of defects was tail defects, which included absence of tail, shortened tail and wry/bent tail. The majority of these calves were female (58%) and the result of dairy x dairy mating (73%) to an AI sire (91%).

Figure 1. *The most common defect recorded to ICBF was a blocked bowel*

Conclusion

This is the first national survey of bovine congenital defects in Ireland. It is also one of the largest studies documenting two of the most common cattle defects, atresia and tail defects in the world. This illustrates the power of this model of herdowner recording, supported by a national database containing demographic information on affected animals. The finding that atresia was the most commonly reported defect aligns well with previous Irish studies - submissions of cattle with congenital defects by farmers to the DAFM veterinary laboratories service (passive surveillance), an Irish dairy whole-herd calf mortality study (active surveillance), and a recent survey of bovine congenital defects conducted by Irish private veterinary practitioners (XLVets). Overall, the results of this survey were similar to findings reported in other studies and this indicates that targeting herd owners as a means to survey congenital defects is an effective approach to monitor the probable true types and frequencies of defects nationally. Following this analysis and based on feedback, the survey has been revised to make if more accessible, concise and convenient for all participants (see QR code above).

Acknowledgements

The authors thank the farmers who completed the surveys.

New insights on congenital defects in cattle submitted to the six Regional Veterinary Laboratories nationally

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Summary

- There were more deformed beef than dairy calves submitted to the Regional Vet Labs (RVLs)
- The three most common defects diagnosed were heart defects, blocked bowel and musculoskeletal defects (e.g. *Schistosomus reflexus* and dwarfism); these accounted for 94% of all cases
- This study highlights a novel model of recording animal health disorders which includes the farmer, vet, RVLs and ICBF

Introduction

A congenital defect is a structural or functional anomaly present at birth. The types of bovine defects reported in Irish herds depends on who is recording them. This may be the farmer, their vet or their vet lab; each has a different perspective and critically, a different sample of all the defects that occur. For example, while the farmer can observe defects in all of their cattle, their vet only sees those brought to his/her attention by the farmer and the vet lab only sees those cases the farmer decides to submit. Only a very small proportion of dead (~<10%) and deformed (~<1%) calves are submitted to vet labs, but these cases get the most detailed examination.

If a bovine dies on an Irish farm, by law, the farmer must report the death (but not necessarily submit the carcass for investigation) to the DAFM which operates six Regional Veterinary Laboratories (RVLs) which investigate the cause/s of death. Given this national remit, the objective of this study was to identify the most common lethal congenital defects diagnosed in cattle submitted to the RVLs and to describe their associated epidemiology.

In this retrospective study, data covering a five-year period (2020-2024) was used. From DAFM, the results of postmortem examinations on cattle which had a congenital defect recorded in the 'hereditary and congenital anomalies' field of the Laboratory Information Management System (LIMS) database and the location of the recording RVL were extracted. If a congenital defect was recorded in this LIMS field it indicated that this was the primary (majority of cases) or joint cause of death.

Epidemiological information about the calf, dam and sire [breed, sex, age-at-death, and breeding method (AI, natural service)] was extracted from the ICBF database.

In total, 202 cattle with congenital defects were recorded by DAFM of which 180 had associated data in the ICBF database.

Results

The majority of cattle (n=202) diagnosed with a congenital defect were beef (67%); the remainder were dairy (33%). Of the six RVLs with recorded cases, the highest percentage was recorded in the Sligo RVL (36%) in the north-west. The disproportionate beef calf representation probably reflects the greater value of beef compared to non-beef calves and the higher proportion of submissions to the Sligo RVL probably reflects the higher beef cattle population in its catchment area. The three most commonly affected body systems, the cardiovascular (n=127/202, 63%), gastrointestinal (44, 22%) and musculoskeletal (18, 9%) accounted for 94% of all cattle with a congenital defect.

The majority of cattle with cardiovascular defects were beef (87%). There were a similar proportion of cattle with cardiovascular defects conceived following artificial insemination and natural service. The life-span of cattle with cardiovascular defects ranged from 0 to 1,374 days (3.75 years). There was a 45:55 male to female ratio in affected calves. The most common cardiovascular defects recorded were septal defects ('hole-in-the-heart'; atrial and ventricular: Figure 1) comprising 79% of all cardiac defects reported.

Defects affecting the gastrointestinal system were the second most common defects recorded (22% of all cattle). Blocked bowel (atresia) was the most commonly diagnosed defect of the gastrointestinal system (20% of all cattle and 95% of cattle with a gastrointestinal defect). There was a 63:37 male to female ratio in atretic calves. Atretic calves were most commonly conceived following AI (70%). Almost half of all atresia cases were discovered in dairy calves (47%) though fewer dairy than beef calves were submitted for examination. The average reported life-span of a calf diagnosed with atresia was three days, ranging from 0 to 14 days.

Schistosomus reflexus (2% of all cattle) and dwarfism (2% of all cattle) were the two most commonly diagnosed defects of the musculoskeletal system which accounted for 9% of all deformed cattle.

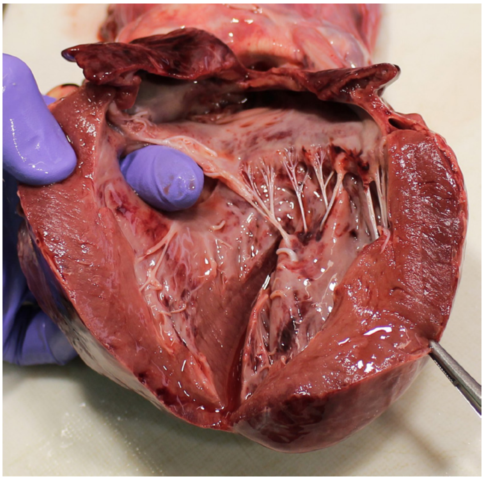

Figure 1. *Ventricular septal defect (hole-in-the heart)*

Conclusion

This study identified the previously undocumented most common lethal congenital defects in cattle submitted to veterinary laboratories in Ireland as cardiovascular defects. Most deformed calves submitted to RVLs were beef. These findings have implications for potential genetic testing for these lethal defects. The results can also be used to set up a national information infrastructure on deformed cattle. This would link farmer tagging of calves at birth, private veterinary practitioners recommending clients to submit dead calves for investigation at the RVLs and these laboratories submitting animal identification and investigation outcome information to ICBF for further research, in particular, genomic research.

Acknowledgements

The authors thank the referring veterinarians and their clients for submitting the cattle used in this study.

Management of calvings – what does the vet say?

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Summary

- The majority of vets surveyed recommended moving the cow to the calving unit at least six hours before calving (69%)
- The majority of vets recommended assisting heifers 60 minutes (41%) and cows 30-60 minutes (69%) after the foetal calf's hooves are visible
- The majority of vets use painkillers (NSAIDs) for cows at difficult calvings (94%)

Introduction

Veterinary practitioners often work in relative isolation dealing with clinical cases on their own. This can lead to 'siloing' of knowledge within vets or their practice, without reference to what knowledge, attitudes and practices (KAPs) similar vets have in similar practices nationally, or internationally. An inherent risk of this practice model is drift from current recommended best practice and failure to keep abreast of the latest developments in clinical KAPs. Ongoing mandatory continuing professional development (CPD) and participation in professional WhatsApp groups can mitigate these risks, depending on the level of engagement. In order to address these potential barriers to best veterinary practice, an international consortium in 11 European countries coordinated by the University of Lisboa, Portugal, designed a study to survey vets on their clinical practices. The results of the calving practices of Irish vets are reported here. The objective of the survey was to document current veterinary recommendations and practices and to see how these differ from 'best practice' and to feedback any potential asymmetry to respondent groups. Through numerous international iterations, a survey questionnaire was developed in multiple languages. The complete questionnaire consisted of 34 questions of which five were on respondent demographics, 11 were on calving management and 18 on postpartum reproductive management. The questionnaire was uploaded onto and was accessible via www.limesurvey.org. Irish veterinary participants were recruited through advertising (with QR code) in the *Veterinary Ireland Journal*, on the Veterinary Ireland E-distribution list and via emails to the Food Animal Group of Veterinary Ireland in December 2023 and in January 2024.

Results

In total, 64 complete questionnaires were received. The majority of respondents were male (64.1%) and over 50 years of age (53.1%). Most respondents' clients had herds of 100 cows or less (64.1%) which were dairy (48.4%), suckler (29.7%) or a similar proportion of dairy and suckler herds (21.9%). The calving management questions were a mix of vets' recommendations to farmers and their own veterinary calving practices. When asked when would vets recommend farmers to move cows to the calving unit, the majority of vets recommended more than six hours before calving (68.8%) with the remainder recommending in stage one (23.4%) or in stage two of calving (7.8%). There is a sensitive period at the end of stage one (tail up and mucous visible at vulva) when it is not recommended to move cows as this can prolong stage two of calving (calf expulsion).

When asked how long they would recommend farmers to wait after both foetal hooves were visible before assisting heifers, most vets recommended after 60 minutes (40.6%), with the remainder recommending after 30 minutes (31.3%), 120 minutes (21.9%), 15 minutes (3.1%)

or other (3.1%). Similarly, when asked how long they would recommend farmers to wait after both foetal hooves were visible before assisting cows, most vets recommended after 60 minutes (34.4%) or 30 minutes (34.4%), with the remainder recommending after 120 minutes (14.1%), 15 minutes (12.5%) or other (4.7%). Though case-specific, it is generally recommended that neither heifers nor cows should spend more than 120 minutes in stage two of calving ('2 feet-2 hour' rule of thumb) and earlier assistance (after approximately 60 minutes) if no progress, has recently been recommended. While the vast majority of vets used a calving jack (92.2%), only 1.6% used a calving pulley. In the absence of mechanical calving aids, the majority of vets would use a maximum of two people to pull the calf (84.6%). It is generally recommended that not more than two people should pull a calf out and while calving jacks are widely used currently, their future routine use may be under consideration.

When asked what criteria they used to decide to perform a caesarean section, the majority of vets used foetal oversize (98.4%), inability to correct dystocia and delivery *per vaginum* (93.8%) or uterine torsion (51.6%). A minority of vets used lack of progress after 15 minutes of calving assistance (48.4%), lack of progress 30 minutes of calving assistance (17.2%) or other, e.g., deformed foetus or embryo transfer foetus. Whether or not to perform a caesarean section is very much a case-specific decision.

The vast majority of vets administered non-steroidal anti-inflammatory (NSAID) drugs to cows at difficult calvings (not further defined) (93.8%; Figure 1). Of those vets who did use NSAIDs, the vast majority used these painkillers after calving (91.7%) with the remaining vets using them either before (6.6%) or during difficult calvings (1.6%). The most commonly used NSAIDs contained meloxicam (Endocam, Loxicom, Metacam, Rheumocam), (61.8%) followed by flunixin (Finadyne), (26.3%), ketoprofen (Ketofen, Netofek), (10.5%) & carpofen (Rimadyl), (1.3%). Non-steroidal anti-inflammatory drugs are now increasingly recommended after difficult calvings to assist cow recovery and improve welfare.

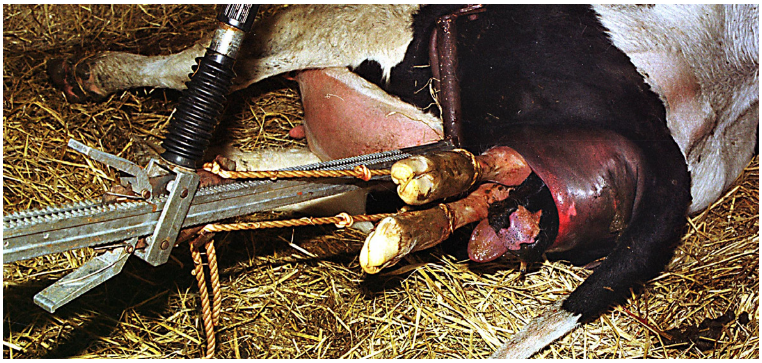

Figure 1. *The majority of vets now administer painkillers at difficult calvings*

Conclusion

Overall, these findings indicate that Irish vets are up-to-date with current recommended best practices in calving management. However, the survey did also, not unsurprisingly, find wide variation amongst vets. For example, the wide variation in recommended assistance times for both heifers and cows. This may reflect the wide variation encountered by vets in individual calving circumstances and personal experience. The high uptake of NSAID usage at dystocia by vets is encouraging, though milk/meat withdrawal periods need to be observed. Current research in Moorepark is investigating effects of NSAID administration on pain management at calving.

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Abomasal disorders in dairy calves – why do some farms have more problems than others?

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Summary

- Abomasal disorders include abomasal ulcers (stomach ulcers), abomasitis, abomasal torsion and abomasal bloat
- These disorders are of increasing concern to dairy farmers in pre-weaned dairy calves
- Teagasc has funded a new research project to address the herd-level risk factors associated with abomasal disorders in spring-calving dairy herds nationally

Introduction

Dairy farming in Ireland has changed dramatically in the last decade. The abolition of the EU milk quota in 2015 led to an increase in the national dairy herd size. Coincident with this ongoing expansion, labour has become less available on dairy farms. In this time Irish dairy herd fertility has improved substantially with more herds now achieving compact calving patterns. Additionally, higher milk prices have led to increased use of milk replacer to feed calves.

These, now embedded, changes have had downstream effects on how dairy farmers currently manage their calves. Larger herds, calving more compactly, with reduced labour, has led to a move away from individual bucket feeding and penning of calves towards managing calves in groups in larger pens with group feeding of milk replacer becoming the norm, whether via automated or mob feeders.

Given this rapid transition in calf feeding and management it is perhaps not surprising that some issues have arisen regarding calf health. One of these issues is abomasal disorders. Abomasal disorders include abomasal ulcers (stomach ulcers; Fig 1.), abomasitis, abomasal torsion and abomasal bloat. These disorders occur in calves in all enterprise types (dairy, suckler, veal and beef). However, in Ireland, they are an increasingly reported problem in pre-weaned dairy calves, by comparison with other EU countries/GB & NI. Abomasal disorders are among the third most common causes of young calf mortality in Irish regional vet lab reports; however, it is currently not clear why this is the case. Internationally, much of the research on abomasal disorders stems from research in veal calves. However, given that our management, feeding, genetics and environments for calf rearing are unique, we need to determine why abomasal disorders are a particular problem in Ireland.

Figure 1. *Abomasal ulcer in a pre-weaned dairy calf*

New research study

Teagasc has launched a new project to investigate abomasal disorders in pre-weaned dairy calves. The primary goal is to identify herd-level risk factors associated with these disorders and assess whether implementing targeted recommendations can reduce their incidence on affected farms. The study involves both "problem" and "control" farms sourced through XLVets Ireland, the country's largest veterinary practice group. Problem farms are those where an artificially-reared dairy calf has been clinically diagnosed with an abomasal disorder or confirmed via veterinary lab results. Control farms, with no recorded cases over the past three years, are randomly selected from the same practice for comparison. When a suspected case arises, the vet follows a standard operating procedure (SOP), including a detailed history of calf management and clinical examination of affected calves. Samples of milk or milk replacer and water are collected, and a tailored management plan is recommended. If a calf has died, a postmortem is either performed on-farm (with permission) or the carcass is submitted to a regional vet lab. Control farms undergo the same SOP. At the end of the calving season, all farms are revisited to assess the effectiveness of interventions and to monitor any changes in health status across both groups.

Conclusion

This new study, to be run over two years, presents a unique opportunity for farmers with either abomasal disorder problems in their calves or farmers without such problems to avail of detailed veterinary investigation of calf health on their farm. We encourage all clients of XLVets Ireland to discuss this opportunity with their local vet.

Acknowledgements

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Detection of Neospora caninum in aborted bovine foetuses: a comparison of three diagnostics tests

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Summary

- *Neospora caninum* was an uncommon cause of abortion in herds with samples submitted to the Cork Regional Vet Lab
- Agreement between the three different diagnostic tests (foetal serology, histopathology and PCR testing) for *N. caninum* was poor in this sample set
- A combination of histopathology and the new *N. caninum* PCR may yield the best diagnostic results

Introduction

Neospora caninum is widely accepted to be one of the major causes of bovine abortion worldwide. Numerous diagnostic tests can be used to diagnose exposure to the parasite (by detecting antibodies), the presence of the parasite (by detecting the antigen or parasitic cysts) and lesions associated with the presence of the parasite (by detecting tissue inflammation consistent with *N. caninum* infection). Each test may produce a different result. In addition, each also has advantages and disadvantages regarding sample matrix suitability, cost, labour input and test characteristics. Hence, multiple tests may be used in investigatory protocols to maximise diagnostic yield while balancing these test merits and demerits. The primary objective of this study was to determine the animal-level prevalence of *Neospora caninum* determined by three diagnostic tests in a cohort of bovine foetuses submitted to a veterinary diagnostic laboratory.

The foetuses enrolled in the study were submitted to the Regional Veterinary Laboratory in Cork during the peak abortion risk season (September 2022 to February 2023). All foetuses submitted during this period were enrolled in the study (n=363). The foetuses ranged in estimated gestation length from 129 days to 277 days (Figure 1). *N. caninum* foetal fluid/serum antibody ELISA testing was carried out using the IDEXX *Neospora caninum* Antibody Test Kit – this was a commonly used method of diagnosis prior to this study. A PCR assay for *N. caninum* was carried out on brain swabs using LSI VetMAX *Neospora caninum* Detection Kit (ThermoFisher) – this is a new diagnostic test not used prior to this study. Histopathological diagnoses were made by the individual research officer assigned to the case – this has always been a standard diagnostic test.

Figure 1. *Foetuses submitted to the Cork RVL were tested for Neospora*

Results

The PCR results were available for all foetuses. Seventeen (4.7%) were *N. Caninum*-PCR-positive, three were inconclusive and 343 were negative (Table 1). Antibody ELISA results on blood or thoracic fluid were available for 326 foetuses. Four (1.2%) were positive, one was inconclusive and the remainder were negative. Histopathology results were available for 90 foetuses. Of these, five (5.6%) had lesions consistent with *N. caninum* infection, one was inconclusive and the remainder were negative. Twenty-one foetuses (5.8%) were categorised as positive by at least one of the three tests. No foetus was positive in all three diagnostic tests.

Table 1. *A comparison of laboratory diagnostic tests for Neospora caninum in bovine foetuses (no.) submitted to the Regional Vet Lab, Cork*

Test result	PCR	ELISA	Histopathology
Positive	17	4	5
Inconclusive	3	1	1
Negative	343	321	84
Total (no.)	363	326	90

Conclusion

It was concluded that differences between results from diagnostic tests for *N. caninum* can contribute to differences in apparent animal-level prevalence of the parasite in bovine foetuses. Agreement between the different diagnostic tests for *N. caninum* was poor in this sample set. The 5.8% overall positivity rate was lower than an apparent prevalence of between 9 and 23% reported internationally in the existing literature over the last two decades. The results from this study can be used by veterinary pathologists to inform investigatory protocols for suspected abortion due to *Neospora caninum*. To maximise sensitivity, it may be that both PCR and histopathology are necessary. Examination of foetal serum for antibodies to *N. caninum* does not appear to add sufficiently to the diagnostic yield to warrant routine testing for foetal *N. caninum* antibodies, as was carried out prior to this study.

Acknowledgements

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Mycoplasma bovis serostatus in dairy youngstock: a longitudinal, herd-level prevalence and risk factor study

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Summary

- Approximately a third of dairy herds nationally had *Mycoplasma bovis*-seropositive heifers
- Between a quarter and a third of the heifers in these positive herds were *M. bovis* seropositive
- The risk of sero-positivity was higher in farms with more than three land parcels, where cattle were purchased, with shared airspace between calves and older stock and where waste milk was fed to calves

Introduction

Mycoplasma bovis is a significant pathogen causing arthritis and mastitis in adult cattle, while pneumonia, arthritis and otitis are primarily associated with infections in calves. Since its first detection in Ireland in 1994, *M. bovis* has become endemic and is now considered a major cause of youngstock morbidity and mortality. The herd-level prevalence of *M. bovis* in Irish dairy herds has recently been estimated at 45% using bulk tank milk testing.

Despite the reported morbidity and high herd prevalence, the seroprevalence (exposure to the pathogen as determined by the presence of antibodies in an animal's blood) of *M. bovis* in Irish dairy calves and youngstock has not previously been investigated. Thus, the aim of this study was to provide *M. bovis* seroprevalence estimates for replacement dairy heifers during the rearing period and to determine herd-level risk factors associated with seropositivity in youngstock (replacement heifer) cohorts.

In total, 120 dairy herds were recruited to a wider national longitudinal study to assess the animal health risks associated with contract-rearing. The recruited farms were distributed across all four provinces and 19 of the 26 counties of the Republic of Ireland. The majority of recruited herds were classified as spring-calving (92%).

A single cohort of heifer calves born in spring 2018 was followed longitudinally until the end of their first lactation in 2021 (Figure 1). Between spring 2018 and autumn 2019, farms were visited three times for sample collection. The first visit occurred when heifers were approximately one month old, conducted on their farm of origin. Subsequent visits for home-reared heifers remained at the farm of origin, while for contract-reared heifers, visits were subsequently carried out on the contract-rearing unit. The second and third visits occurred when heifers were approximately 12 months old in spring 2019 and 20 months old in autumn 2019. Approximately 6,500 heifers were enrolled initially, with data available for 5,532 heifers across all three visits after losses due to sales, farm drop-out and mortality.

At the farm visits, blood samples were taken from 10 randomly selected heifers on each farm. Serum samples were analysed by a commercial accredited laboratory (Farmlab Diagnostics, Roscommon, Ireland) using the *M. bovis* ID Screen® *Mycoplasma bovis* antibody ELISA (IDVet, Montpellier, France). There was no *M. bovis* vaccine available in Ireland when the study was conducted; there is now (2025). To assess the biosecurity status of study farms (and thus risk factors associated with *M. bovis*), all participating farmers completed a questionnaire relating to biosecurity and management practices on their farms.

Figure 1. *Heifers were sampled from birth to calving for Mycoplasma bovis*

Results

In total, *M. bovis* ELISA results were available for 105 herds across all three farm visit periods. The median herd size was 141 cows (range 60-633 cows) with a median heifer cohort size of 41 heifers (range 10-137 heifers). The randomly selected sampled heifers were the same age as that of the total heifer cohort at each visit. In total, approximately 3,200 samples were collected across all three farm visit periods. The mean *M. bovis* apparent animal-level seroprevalence (within the positive herds) during each visit period was 20.1, 29.2 and 36.1%, respectively. The mean *M. bovis* apparent herd-level seroprevalence (>3 positive animals/herd) during each visit period was 31.4, 32.4 and 42.9%, respectively. Risk factors for *M. bovis* seropositivity included purchase of cattle, managing more than three land parcels, and shared airspace between calves and older animals. Conversely, more colostrum feeds reduced the risk of seropositivity, while feeding waste milk showed a trend toward increased risk of seropositivity.

Conclusion

This longitudinal study is the first Irish study focused specifically on youngstock *M. bovis* seroprevalence, offering a unique perspective that contrasts with previous studies, which have primarily focused on the adult (lactating) cow cohort. Internationally, similar studies have highlighted *M. bovis* seroprevalence in confined systems, but this research expands the understanding of pathogen dynamics within pasture-based, spring-calving dairy enterprises. This longitudinal study highlights the dynamic nature of *M. bovis* infection in cattle herds, with seroprevalence rising over time as heifers aged and were repeatedly exposed, suggesting that ongoing transmission within the herd plays a significant role in maintaining infection, which may complicate disease control efforts. These findings suggest the importance of robust biosecurity measures, including limiting cattle purchases, improving calf management and enhancing colostrum feeding practices, to control the spread of *M. bovis*.

Acknowledgements

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Development and use of a novel biosecurity audit tool for pasture-based dairy farms – BioscoreDairy

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Summary

- The first pasture-based biosecurity risk assessment tool (BioscoreDairy) has been designed by a team of researchers from Teagasc, UCD and SRUC
- This risk assessment tool uniquely includes both a questionnaire and a cattle movement audit
- It is currently being used in three projects to monitor dairy farm biosecurity status with Teagasc, AHI and DAFM

Introduction

Biosecurity risk assessment tools are important to identify deficits in animal health management practices. The Department of Agriculture, Food and Marine (DAFM) launched the National Farmed Animal Biosecurity Strategy (NFABS; 2021-2024). This strategy builds on the National Farmed Animal Health Strategy with a focus on preventing infectious diseases in farmed animals. In support of the NFABS, a new project began in Moorepark and University College Dublin in September 2022. As part of the project, an Irish biosecurity risk assessment tool has been developed and implemented on dairy farms across the country. This risk assessment tool is now known as BioscoreDairy and has been used on spring calving dairy farms over the past two years.

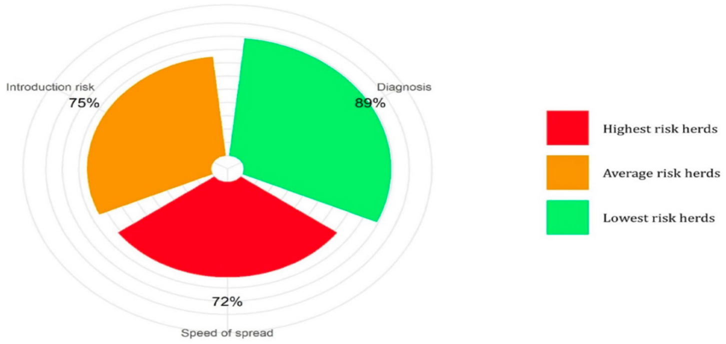
Development of BioscoreDairy

BioscoreDairy is the first risk assessment tool specifically designed for pasture-based dairy production systems. It uniquely combines a comprehensive biosecurity questionnaire with a detailed audit of cattle movements. Specialised software (Conjointly) was used to process a panel of experts' opinions to assign scores to responses within the questionnaire. Developed as a farmer-friendly tool, BioscoreDairy is intended to be completed by farmers themselves, on a mobile phone, computer, tablet, or other device, at their convenience.

This risk assessment contains two parts: the questionnaire and the animal movements of the herd. The questionnaire covers 53 different biosecurity practices, with 75 questions divided into four sections: 1) risk of disease entry (bioexclusion), 2) speed of disease spread (biocontainment), 3) diagnosis and 4) herd resilience and vaccination. The first three sections are included in the scoring process.

The results per section are displayed using a "traffic light" visualisation. This is to identify low/moderate/high risk within each section, where low risk is represented with green, moderate with amber and high risk with red. These are bench-marked using the average score among the herds within the study population as seen in Figure 1.

Purchasing of animals is one of the primary routes of disease transmission into a herd. Where animals are purchased, it is advised that the number of source herds is kept to a minimum.



	Your herd	Average herd
Diagnosis	89	76
Introduction risk	75	74
Speed of spread	72	78

Figure 1. *BioscoreDairy scores for three sections of farm biosecurity (maximum score per section is 100%) using an example herd and the average for the study population of herds*

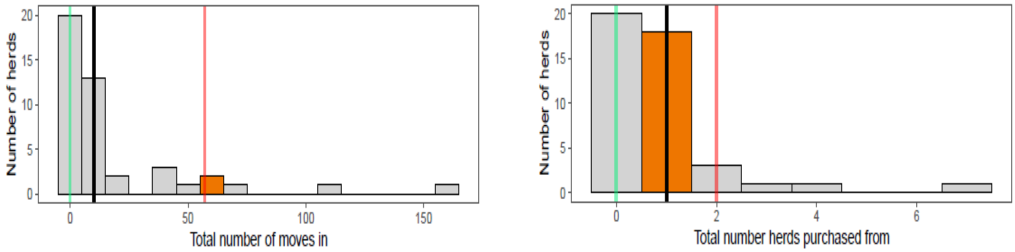


Figure 2. *Example from BioscoreDairy report of a summary of animal movements into a herd within 12 months. This displays the number of animal movements in Chart 1. The number of herds the animals were purchased from is displayed in Chart 2. For both charts, the green line represents the low risk with the red suggesting the highest risk. The black line indicates the average herd in the study population, while the amber block displays the individual herd's position*

Use of BioscoreDairy

BioscoreDairy is being used in three projects. Firstly, it is being used to compare the biosecurity status of two AHI herd health groups (see accompanying paper by O'Donovan *et al.*, in this book). Secondly, it is being used in a Teagasc eProfit Monitor (ePM) study (described below). Thirdly, it is being used in the DAFM Biosecurity-TASAH for 2025-26.

BioscoreDairy has been implemented on 59 Teagasc ePM farms to monitor the effects of providing biosecurity recommendations after the BioscoreDairy results are reported back to the farmers. This involves sending the BioscoreDairy tool to farmers, followed by a series of three farm visits. During these visits, the results of the assessment are reviewed with the farmer and recommendations are discussed and prioritised collaboratively. The objective of this study is to analyse the impact of improved biosecurity through assessment and intervention on herd health, production and economics. This will be achieved by longitudinally analysing farm performance for these outcomes both before and after BioscoreDairy administration and recommendations (intervention group) and by comparison with a comparable control group of farms (non-intervention group).

Conclusion

BioscoreDairy, designed for pasture-based dairy farms has been developed and is now being used in a series of projects nationally. It also has potential to be modified for use in other pasture-based enterprises – suckler and sheep farms.

BioscoreDairy - First results from AHI herds nationally

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Summary

- A new biosecurity risk assessment tool, BioscoreDairy, was used to audit farms in two AHI programmes; Irish Johne's Control Programme and Parasite TASAH
- Farmers involved in the Irish Johne's Control Programme (IJCP) had better BioscoreDairy scores than those involved in the Parasite TASAH
- Cow vaccination rates were variable between diseases: highest for leptospirosis but low for BVD

Introduction

The biosecurity status of dairy farms involved in two of Animal Health Ireland's herd health programmes were assessed as part of an ongoing PhD project in Teagasc Moorepark. All farmers involved in the Irish Johnes Control Programme (IJCP) and the Parasite TASAH (P-TASAH) Programme were invited by email to complete BioscoreDairy, an online biosecurity risk assessment tool (see accompanying paper in this book by O'Donovan *et al.*, on the development of this risk assessment tool). The tool is designed as a farmer-facing, pasture-based tool consisting of 75 questions taking approximately 15 minutes to complete and a separate cattle introduction audit using movement data from the Animal Identification and Movements (AIM) database. This paper highlights the biosecurity scores and recommendations for the top three areas of concern within the three scored sections of the BioscoreDairy questionnaire: i) risk of disease entry, ii) speed of disease spread and iii) diagnosis of disease. It also reports on the adoption rates of practices in the fourth, non-scored section: vaccination. Scores were generated for each answer within each of the three sections to produce three section-level scores (maximum 1.0) per farm.

Results

One hundred and fifty farmers completed the survey. The IJCP group had better biosecurity scores than the P-TASAH group with the exception of disease diagnosis (Table 1). Both groups had worst biosecurity scores for speed of disease spread within farm.

Table 1. *BioscoreDairy scores for two AHI programmes Irish Johnes Control Programme (IJCP; n = 99) and the Parasite TASAH (P-TASAH; n = 51) Programme (higher scores mean better biosecurity; maximum score = 1.0)*

Biosecurity risk section	IJCP	P-TASAH
Risk factors for disease introduction	0.92	0.70
Speed of spread of disease once in the herd	0.29	0.27
Early/ongoing diagnosis to reduce impacts of disease	0.54	0.63

The recommendations for both AHI groups were the same for the speed of disease spread and diagnosis sections. However, the risk of disease entry recommendations varied. The most common recommendation for the IJCP group was about quarantine period while for the P-TASAH group it was about slurry importation (Table 2).

Table 2. *Most frequent recommendations made as a result of the BioscoreDairy audit within the two AHI groups (where the cells have been merged this means that the same recommendation occurred most frequently for both groups).*

Biosecurity risk section	Recommendation	
	IJCP	P-TASAH
Risk factors for disease introduction	Improve quarantine practices for introduced animals	Reduce/eliminate importation of cattle/pig slurry
Speed of spread of disease once in the herd	Use a dedicated pen for sick animals	
Early/ongoing diagnosis to reduce impacts of disease	Increase use of post-mortems to investigate animal mortality	

From Table 3, it can be seen that the farmers in the IJCP group carried out more routine cow vaccinations than the P-TASAH group. Overall, leptospirosis was the most vaccinated against disease, with 68% of farmers vaccinating against this disease. This was closely followed by IBR at 63% and salmonellosis at 53% of farmers.

Table 3. *Proportion of farmers who carried out cow vaccinations against specific diseases per AHI group*

Disease	Overall (%)	IJCP (%)	P-TASAH (%)
Leptospirosis	68.1	76.1	53.9
IBR	62.7	69.0	51.3
Salmonellosis	52.7	57.8	43.6
Calf diarrhoea	43.6	47.9	35.9
BVD	26.4	25.4	28.2
Clostridial diseases	7.3	11.3	0
Respiratory diseases	7.3	7.0	7.7
Other diseases	0.9	0	2.6

Conclusion

This preliminary analysis of results suggests that farmers involved in the Irish Johne's Control Programme scored higher in their BioscoreDairy audit than those involved in the Parasite TASAH. Areas of concern were the speed of disease spread within farm, use of quarantine, use of sick pens, importation of slurry and conduct of postmortems. While vaccination rates for some diseases were high, e.g. leptospirosis, rates for other important diseases were much lower, e.g. BVD, reflecting decreasing national herd prevalence.

Acknowledgements

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Biosecurity

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Summary

- Effective biosecurity involves exclusion and containment methods
- Responsibility for good biosecurity is spread across the food chain
- When good biosecurity practices are implemented routinely and effectively, they reduce the risk of disease introduction and/or spread within and from a farm
- The development of the second National Farmed Animal Biosecurity Strategy, building on the significant progress of the first, is underway

Introduction

The good health status of our farmed animals is fundamental in the continued success of the Irish livestock sector. The ability to raise our defences in the face of a specific threat is important, but it is equally important that effective and routine farm biosecurity practices are put in place and are practised consistently. Farm-level biosecurity can be described as the combination of both management and physical measures which reduce the risk of the introduction, development and spread of disease to, from, and within a farm. Practising good biosecurity on farm is key to protecting and improving animal health, welfare and productivity, as well as ensuring good public health through reduced antimicrobial and antiparasitic medicine usage, reduced transmission of zoonotic disease and improved environmental health. Ultimately, good biosecurity helps underpin sustainable and productive agricultural practices in Ireland.

Actions that farmers can take to improve dairy farm biosecurity

Steps individual farmers can take to protect their dairy herd include:

- Keep up to date with current advice on reducing disease. The Dairy Cow Biosecurity Code of Practice can be found here: *Dairy Cow COP (https://assets.gov.ie/static/documents/biosecurity-code-of-practice-for-dairy-cattle.pdf).*
- Implement risk reduction measures to avoid disease introduction when purchasing new animals to your herd, such as ensuring an equal health status to your own herd, pre-movement tests where possible and quarantine and on-farm testing before introduction to your herd if not.
- Minimise the possibility of direct contact with cattle from other herds by ensuring boundary fences are well maintained.
- Ensure that feed is bought through registered operators with good hygiene protocols in place.
- When purchasing straights from other farms, seek assurances in relation to contamination and storage of the feed.
- Avoid bringing manure/slurry from other farms. If this is unavoidable, use only on low-risk fields.
- Avoid disease introduction through semen by only purchasing from bulls with a known health status. Only import semen from outside of Ireland if it is in compliance with required testing and certification rules.
- If sharing equipment, establish a protocol for cleaning and disinfecting equipment/material.

- Encourage contractors, especially slurry/manure contractors, to cleanse and disinfect their equipment prior to arrival on farm. At a minimum, contractor's machinery should be clean on entering and exiting the farm.
- Record all visitors and vehicles that enter the holding, and ensure visitors are aware of farm hygiene protocols.
- Implement a robust pest control programme.
- Inspect cattle regularly to ensure the early detection of sick animals. Diseased animals are a major source of pathogens for other animals, so biosecurity measures and procedures need to be adapted to the health status of the herd.
- Be aware that the time around calving is critical for both calves and dams due to the temporary decrease in immunity in the cows and the inherent low immunity in the newborn calf prior receiving colostrum.
- Where death of an animal occurs on the farm, an infectious agent may be the cause of death and could pose an infectious risk to other animals. Dead animals (and placenta where applicable) should be removed as quickly as possible and ideally sent for post-mortem diagnosis where the cause of mortality is unclear.
- Ensure access to clean water through thorough cleaning of pipes, appropriate drainage, yearly testing, and methods to reduce wild animal access.

National Farmed Animal Biosecurity Strategy 2025-2030

The second National Farmed Animal Biosecurity Strategy (2025-2030) is currently being progressed, building on the first National Farmed Animal Biosecurity Strategy (2021-2024), with stakeholder input of critical importance in its development. It will emphasise the ABC of biosecurity:

A: Awareness

B: Behavioural Change

C: Consistency

Conclusion

The introduction and spread of infectious disease are ever-present risks to Irish dairy herds. Ineffective biosecurity practices can lead to increased mortality, production losses and public health hazards. Good biosecurity practices, implemented effectively and routinely, reduce the risk of disease introduction and spread, focusing on prevention rather than cure.

Bluetongue: what are the risks for Irish farmers and what can we do about it?

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Summary:

- Bluetongue is a serious disease of cattle, sheep, goats and camelids
- It is caused by a virus which is transmitted between animals by biting midges (*Culicoides* species), which are present in Ireland but no cases have been detected in Ireland at the time of writing
- Temperature plays a key role in bluetongue transmission; midges become more active around April as the summer approaches, and less active from October
- Three things Irish farmers can do to reduce risk to their herds: (1) Do not import cattle or sheep into Ireland. (2) Do not directly import semen or embryos into Ireland for use on the farm. (3) Report any suspect cases of bluetongue to your Regional Veterinary Office promptly, so that (if the suspect case is confirmed) onward spread to other farms across Ireland can be halted before it is too late

Introduction

Bluetongue is caused by bluetongue virus (BTV), and infects ruminant animals (such as sheep, cattle, goats and deer) and camelids (such as llama and alpaca). Although Ireland is currently bluetongue free, the virus could spread to Ireland through import of infected animals, infected foetuses, germinal products or wind dispersal of infected midges from infected areas. Several different serotypes (variations) of bluetongue virus are currently circulating in Europe. The quicker we detect the first case, the better our chances of stopping it spreading widely. This could mean a huge difference to cattle and sheep farmers across Ireland. Bluetongue does not affect human health or food safety. However, it does have a huge impact on farmers whose animals become infected, due to the financial and emotional stress involved.

What do infected animals look like? The clinical signs of bluetongue:

Cattle or sheep infected with bluetongue can develop a range of clinical signs. These may include some or all of the following: fever, inappetence (loss or lack of appetite), drop in milk yield, reddening of the mucus membranes, sores on the nose, gum and dental pads, swelling of the face, lips and tongue (i.e. "blue tongue"), breathing difficulties if the tongue swells, drooling, discharge from the eyes and/or nose, lameness due to coronitis (inflammation and swelling at the top of the hoof) and abortion or deformities in offspring/foetuses. In severe cases, death can result. Sheep are more likely to show obvious and more severe clinical signs of bluetongue than cattle if they become infected, and mortality rates can reach 30-70%.

How do midges spread bluetongue?

Bluetongue is a vector borne disease; it is carried and spread by infected biting midges (*Culicoides* species). These midges are present in Ireland and are generally most active between April and November. Infection is spread when a biting midge bites an infected animal and subsequently transmits the virus by biting another susceptible ruminant host. Temperature plays a key role in bluetongue transmission and gives rise to the seasonality associated with the virus. Warmer temperatures throughout the summer and into the autumn months, increase the risk of bluetongue transmission during this time. In the late summer to autumn period, midge numbers are at their highest and temperatures are still high enough for the virus to replicate in infected midges. Once bluetongue virus enters the midge population, eradication becomes very difficult requiring high vaccination uptake levels maintained over a period of several years. If a vaccine is not available for a given serotype, eradication is not usually feasible.

How could bluetongue come to Ireland?

During the warmer months when midges are more active and the virus can replicate in them (roughly April to November), infected midges could be blown on the wind from Britain or France across the sea. The virus could spread to Ireland through the import of infected animals. Bluetongue can also be spread by germinal products (ova, semen, embryos) collected from infected animals. This can happen in cases where the animal is not showing obvious clinical signs at the time of collection. For this reason, the import of germinal products poses a danger of importing bluetongue virus.

A summary of the current restrictions on the movements of live animals and germinal products into Ireland

Great Britain (GB) to Ireland (IE):

- Import of live ruminants from Great Britain (GB) to the island of Ireland (IE & NI) remains suspended.
- Germinal products (semen, ova, embryos) may be imported from GB into Ireland once the relevant animal health requirements for bluetongue virus can be certified.

Other EU Member States to Ireland (IE):

- Livestock or germinal products from other EU Member States may be imported only if specific bluetongue certification requirements are fully met.
- The Department will not compensate for bluetongue cases from imported animals or germinal products detected after entry sampling.
- Bluetongue outbreaks in some EU Member States may prevent animals from meeting Ireland's certification requirements for importation.

Vaccination against bluetongue virus

Vaccination against bluetongue virus is a key control measure and is necessary for disease eradication. Licensed bluetongue vaccines are commercially available for bluetongue serotypes 1, 4 and 8 which can help to facilitate intra-EU movement. The recent use of BTV3 vaccines in EU Member States and in Great Britain were authorised under emergency circumstances as a disease control measure, where BTV3 is circulating. These BTV3 vaccines do not guarantee that animals will not become infected; however, they do reduce the severity of the disease and so they are of great benefit to livestock farmers in reducing the impact of an outbreak of bluetongue. No BTV3 vaccines have yet determined an immunity period guaranteed in the specifications of the vaccine. It is important to note that, for this reason, animals vaccinated using any of the currently available BTV3 vaccines do not meet the certification requirements for intra-community trade. This means that livestock vaccinated using BTV3 vaccines cannot enter Ireland. In Autumn 2024, several outbreaks of serotype 12 (BTV12) were detected in the Netherlands with a single confirmed outbreak in Great Britain. No vaccine is available for this new strain.

Further information on bluetongue

Please consult the following resources for further information on bluetongue virus:

- Dept of Agriculture Food and the Marine website, European Commission webpage on Bluetongue, Bluetongue - WOAH - World Organisation for Animal Health

Imperfect tests looking for an invisible disease: understanding diagnostics and challenges in bovine tuberculosis eradication

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Summary

- Cattle infected with *Mycobacterium bovis* bacteria can take many years to show clinical signs of tuberculosis (bTB), but in the interim they can spread the disease
- A skin test picks up most but not all infected animals. False positives are rare, occurring in only 0-3 cases per 1000 animals tested
- The skin test is sometimes more sensitive than factory detection, when visible lesions have not yet developed, so truly infected animals will be skin test positive, yet not have lesions at the factory
- Because the less sensitive skin test misses some infected cattle (calls them negative), the more sensitive blood test (GIF) can be used to detect these additional animals; however false positives are more likely with the blood test

Introduction

Bovine TB (bTB) can take many years to cause noticeable clinical signs in cattle, like weight loss, coughing, diarrhoea, enlarged lymph nodes, decreased milk production, or death. However, in countries with an active eradication program, most cattle are removed before the onset of these clinical signs. Even in the absence of noticeable clinical signs infected cattle can spread the disease. Due to the asymptomatic nature of bTB, the ability to detect infected animals and herds relies on the accuracy of the diagnostic tests available.

How is the usefulness of a diagnostic test measured?

The ideal diagnostic test would perfectly distinguish infected from non-infected cattle, however, in practice perfect tests rarely exist. Diagnostic performance is measured in sensitivity (SE), the proportion of truly infected cattle that will test positive, and specificity (SP), the proportion of truly uninfected cattle that will test negative (Table 1).

Table 1. *A test result can mean different things depending on whether an animal is truly infected or not*

Classification of diagnostic test results based on infection status		
Reality[1]	Test outcome[2]	Classification
Infected	Positive	True Positive (TP)
Infected	Negative	False Negative (FN)
Not Infected	Positive	False Positive (FP)
Not infected	Negative	True Negative (TN)

[1]Reality refers to the actual infection status of the animal; [2]Test outcome refers to the result of the diagnostic test used to evaluate the infection status of the animal

The tests used in the Irish bTB eradication program

The skin test, using standard interpretation (classified as positive when there is a ≥4 mm difference in skin lump sizes), is used for annual herd testing (Figure 1). A severe interpretation is used in high-risk scenarios, to increase the sensitivity of the skin test. In herds with a bTB breakdown, the blood test (GIF) can be used to detect additional infected cattle that might be missed by the skin test.

Because the skin test has a very high specificity (Table 2), it is more suitable for mass testing due to the consequences of a positive test (e.g. culling, movement restrictions etc.) of a positive test. However, in high-risk scenarios, the more sensitive blood test (GIF) can be used to detect infected cattle missed by the less sensitive skin test.

Figure 1. *Skin reactions in animals that tested negative (≤1 mm difference in lumps), inconclusive (lumps differing 1-4 mm), or positive (≥4 mm difference in lumps) following the application of the skin test*

Table 2. *Test performance of the skin test and the blood test (GIF)*

Test	SE (%)	False negatives (per 1000 infected animals)	SP (%)	False positives (per 1000 healthy animals)
Skin (std interpretation)	50-80	200-450	99-100	0-3
Blood test (GIF)	67-92	80-330	88-98	20-120

Often cows with positive skin reactions (reactors) may not have visible lesions when slaughtered. It is likely that the animal was slaughtered before it could develop visible lesions. False positives are very unlikely when using the skin test. Therefore, herd owners should be confident that animals that are skin-test positive, despite the lack of visible lesions at slaughter, are truly infected.

Conclusion

The bTB eradication program relies on diagnostic testing. Choosing an appropriate test for different scenarios is challenging due to the trade-off between specificity and sensitivity. Some cattle that test negative on the skin test are possibly infected but almost all cattle that test positive on the skin test are highly likely to be truly infected. The blood test (GIF) can be used to detect the skin test-negative, but truly infected cattle, and help clear infection from herds once it is found. Nonetheless, the sensitivity of the blood test (GIF) is variable, and it may still miss some truly infected cattle. Currently, no consistently better performing alternatives are available for widespread use under field conditions.

Evaluation of herd-level tests for Johne's disease on Irish dairy farms

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Summary

- Herd-level testing for *Mycobacterium avium* subspecies *paratuberculosis* (MAP) is the pillar of most Johne's disease control programmes internationally
- This study estimated the herd-level sensitivity (HSe) and specificity (HSp) of herd environmental sampling (HES) on dairy farms in the IJCP
- The HSe of HES was low (0.37) but the HSp was high (0.99); the low HSe may be due to, amongst other factors, low infection prevalence due to the IJCP

Introduction

Johne's disease is a bacterial infection of cattle and other ruminants caused by the bacterium *Mycobacterium avium* subspecies *paratuberculosis* (MAP). Testing to identify infected animals and herds and to facilitate control of the spread of infection both within and between herds is a pillar of most Johne's disease control programmes, in addition to risk assessments and biosecurity measures. Herd-level testing is necessary to identify infected herds that require biocontainment interventions and to provide herd assurance in confidence of freedom in test-negative herds. Currently, the majority of Johne's disease control programmes (including the Irish one; Irish Johne's Disease Control Programme – IJCP) only utilise samples collected directly from cattle (blood, milk, faeces) for testing. However, collecting faeces samples from the environment of the cattle (herd environmental sampling; HES) is a potentially useful herd test for MAP infection. But a challenge for all Johne's testing programmes is the imperfect sensitivity (Se) and specificity (Sp) of available diagnostic tests for MAP.

Hence, the objective of the current study was to estimate the herd sensitivity and herd specificity of environmental sampling for Johne's disease in Irish dairy herds.

To do this, herd environmental sampling (HES) and the standard herd testing regime [whole-herd ELISA with ancillary faecal PCR (sELISA + fPCR)], were conducted on 122 dairy herds in the IJCP during the winter housing period. Statistical modelling was used to estimate HSe, HSp and prevalence of MAP in the absence of a gold standard reference test.

Results

The apparent within-herd, animal-level prevalence (aWHP) based on blood (sELISA) positive and inconclusive results was ~2%. Based on blood and faeces (sELISA + fPCR) results, 15% of herds were positive for MAP. Of the 731 HES, ~2% were positive and of the 122 herds, ~5% were positive for MAP on HES.

The HSe and HSp were determined using the data from the 100 herds with complete sampling data for both test methods; 15 were positive on sELISA + fPCR, and five were positive on HES-PCR. Out of the 15 herds positive on sELISA + fPCR, HES-PCR identified three herds as infected. The other two herds that were positive on HES-PCR were negative on sELISA + fPCR. One herd had an inconclusive result for HES-PCR and two herds had inconclusive results for sELISA + fPCR. These herds were excluded from further analysis. Table 1 summarises the results of both tests for the remaining 97 herds.

Table 1. *Results of herd-level testing using environmental (HES-PCR) and animal (sELISA + fPCR) sampling for MAP in 97 dairy herds*

Environmental samples	Blood & faeces samples (sELISA + fPCR)		Total
HES-PCR	Positive	Negative	
Positive	3	2	5
Negative	12	80	92
Total	15	82	97

Using these data, the statistical models estimated HSe and HSp of HES to be 37% and 99%, respectively. The HSe was lower than expected. Possible reasons for this include the low dairy herd-level prevalence and animal-level prevalence of MAP in Ireland. Prevalence of MAP affects estimation of diagnostic test characteristics such as HSe and HSp. Also, infected animals may shed less MAP in faeces in late lactation (when the samples were collected in this study) and so reduce the sensitivity of the test. In addition, many Irish farmers cull non-pregnant or non-productive cows at the end of their lactation. This could have led to infectious animals leaving the farm before environmental sampling (HES) occurred during winter housing, thereby reducing the environmental contamination on farm at the time of sampling. Thirdly, biocontainment measures implemented on study farms may have influenced the amount of environmental contamination present, in particular culling of confirmed infected or suspect animals. All study herds were recruited from the IJCP, and therefore were more likely to have had control measures in place to reduce the burden of infection compared to the average Irish herd. This could have contributed to a reduction in sensitivity (HSe) of the test.

Conclusion

The herd-level sensitivity (HSe) of herd environmental sampling (HES) for MAP was lower than expected for dairy herds enrolled in the IJCP. The HSe might be higher in a different cohort of herds (e.g., herds in the general population) and with different analytical methods. Thus, HES may have potential applications for surveillance in beef herds, or in dairy herds that are repeatedly test-negative using the standard whole-herd test in the IJCP. Further research on HES for MAP is planned.

Roundworm control in dairy production systems

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Summary

- Grazing cattle are exposed to a variety of different roundworms, which negatively affect animal health and productivity
- Gut and lungworm control depends on minimising exposure to these parasites through grazing management and judicious use of wormers
- Gut worms resistant to drugs we use to control them have been identified and farmers should ensure the products they are using are effective on their farm

Introduction

One of the consequences of the grass-based dairy production system in Ireland is the continuous exposure of livestock to various internal parasites. A variety of different internal parasites can infect cattle but roundworms (stomach/gut worms and lungworm) are among the most problematic. Transmission of roundworms is heavily influenced by age, grazing pattern and weather conditions and so the risk varies from farm to farm and from year to year.

Gut worms

Grazing cattle consume gut worm larvae, which develop in the gastrointestinal tract. Adult worms lay eggs which are passed out with the dung. The larvae can survive for many months on pasture and so worms are generally a greater problem in the second half of the grazing season as the number of larvae on pasture accumulates. A number of different gut worm species infect cattle but the two economically important species are *Ostertagia* which is found in the abomasum (4th stomach) and *Cooperia* which is found in the small intestine. *Ostertagia* is generally more damaging. In autumn/winter a change in the life cycle of *Ostertagia* can occur when larvae enter a period of hibernation in the gut wall. In spring the larvae can emerge resulting in severe disease in some animals (type II Ostertagiosis). As Type II disease is caused by larvae, not adult worms, there are no worm eggs in the dung.

Cattle develop immunity to gut worms over time. Calves are the most susceptible; heavy infections result in scour and ill-thrift but more commonly gut worms cause appetite suppression and reduced growth rates. Yearling heifers and cows usually have sufficient immunity to prevent clinical disease and, if well-managed, should rarely require treatment. However, if they encounter a substantial gut worm challenge it can impair growth, reproductive performance and milk yield. Reducing infection from pasture is key to maximising production and reducing anthelmintic inputs. Newly re-seeded paddocks or silage after grass tend to have lower numbers of parasite larvae. Grazing different age groups (calves, heifers, cows) across the grazing platform can also reduce the parasite challenge. However, the grazing management options available depend on the farming system.

Control of gut worms is achieved by the administration of broad-spectrum wormers. Despite the large number of products on the market, there are currently only three classes of wormer available for the control of gut worms. These are benzimidazole (commonly known as white wormer (1-BZ)), levamisole (commonly known as yellow wormer (2-LV)) and macrocyclic lactones (commonly known as clear wormer (3-ML)). Within the macrocyclic lactone class are a number of related wormers, including ivermectin, moxidectin, doramectin and eprinomectin. Of note, levamisole is not suitable for animals producing milk for human consumption while only eprinomectin has a zero milk withdrawal, further limiting the choice of wormers in dairy production systems. The route of wormer administration is also important. Use of oral and injectable wormers results in less variation in drug uptake than pour-ons. With pour-ons there is more variation in ingestion by licking and absorption due to hide thickness, hair length, dirt and weather conditions. Recent work has demonstrated widespread anthelmintic resistance in gut worms on Irish cattle farms. The percentage of tested farms with resistance is shown in Table 1.

Table 1. *Number of farms tested for anthelmintic (wormer) resistance and the % of farms with resistance*

Wormer class	No. of farms tested	% farms with resistance
Benzimidazole (1-BZ)	15	60%
Levamisole (2-LV)	11	18%
Macrocyclic lactone (3-ML) Ivermectin	21	100%
Macrocyclic lactone (3-ML) Moxidectin	11	73%

Farmers interested in checking the efficacy of wormers against gut worms on their farm can sign up on the Teagasc website for the MARCS project. https://www.teagasc.ie/animals/amr/research/marcs-project/

Lungworm

Lungworm, or 'hoose' is one of the most important parasitic diseases. Lungworm larvae also reside on pasture and are picked up by grazing cattle. Ingested parasites move from the gut to the lungs where they lay eggs that are coughed up and swallowed. The eggs hatch in the gut and larvae are passed out in the dung. The larvae are carried out of the dung pat by rain or on the spore of a fungus which grows on cattle dung. Infective lungworm larvae also build up on pasture over the grazing season. Lungworm outbreaks are unpredictable and often linked to grazing patterns and weather. Clinical signs include coughing and difficulty breathing, particularly when animals are moved. If left untreated it can result in deaths of naïve animals. Immunity to lungworm develops over time and the greatest risk is in the first grazing season. However, if immunity wanes or cows are exposed to very high challenges, lungworm can cause disease in older animals. This usually presents as a severe cough and drop in milk production caused by a strong immune response to worms in the lung (known as re-infection syndrome). The wormers used to control lungworm are the same as those used for control of gut worms although anthelmintic resistance in lungworm is believed to be rare. However, there has been limited testing for resistance in lungworm in Ireland. Lungworm is one of the few parasitic diseases for which a vaccine is available to prevent disease (Huskvac). The vaccine consists of two doses of inactivated lungworm larvae given four weeks apart and can be given to animals eight weeks and older. The use of wormers around vaccine administration must be avoided.

Conclusion

Good parasite control requires preventative strategies such as grazing management combined with treatment, when warranted. Anthelmintic resistance has been detected in gut worms and good parasite control depends on knowing what products work on your farm. Testing can be carried out via the Teagasc MARCS project.

SCIP: A new approach to tackling lameness in Irish dairy herds

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Summary

- Lameness affects up to 32% of Irish dairy cows impacting cow welfare and is estimated to cost the sector over €129 million annually
- Many farms lack a structured plan to prevent, detect and treat lameness effectively
- The SCIP programme offers practical tools and expert support to help farmers improve hoof health and herd performance

Understanding the challenges of lameness on Irish farms

Lameness is one of the most serious and costly health issues in Irish dairy herds. It causes significant pain and discomfort to cows, reduces fertility, lowers milk yield, and often leads to premature culling. The condition also places extra pressure on farm labour, drives up veterinary costs, and can be deeply frustrating to manage, taking a toll on farmer morale and overall job satisfaction. In addition to the clear cost to cow welfare, lameness is causing huge financial losses across the Irish dairy sector. The current estimated cost of lameness in a 100-cow, 6,000-litre herd with a 10% lameness prevalence is approximately €8,570 per year. Scaled nationally, this equates to an annual loss of around €129.4 million. These figures reflect both the direct costs of treatment and reduced production, and the hidden costs of reduced fertility and increased culling.

A recent Teagasc study found 10% of cows lame at a given visit, while the worst-performing 20% of herds had lameness prevalence rates of between 15% and 32%. Despite its scale and impact, there is currently no coherent national strategy in Ireland to tackle lameness in dairy cows in a way that supports the economic, environmental, and social sustainability of the sector. This contrasts with countries like the UK, where lameness is a central focus of their welfare strategy. In fact, one of the six goals of the UK Dairy Cow Welfare Strategy 2023–2028 is that "every farm will have a proactive lameness management plan in place to optimise foot health." This kind of structured, national approach is missing in Ireland, which highlights the urgent need for coordinated action and farm-level support to deal with this persistent issue.

The main causes of lameness on Irish dairy farms include white line disease, sole bruising and ulcers, digital dermatitis (also known as Mortellaro's disease), and overgrown hooves. These conditions are influenced by a variety of risk factors, which fall into four broad categories: environment, management, nutrition, and the cow herself. Environmental risks include poor-quality roadways, dirty conditions, inadequate cubicle design, and limited space in collecting yards or at feed barriers. Poor cow handling, infrequent mobility scoring, inconsistent foot bathing, and the introduction of infected animals are key management issues. Nutritional factors also play a role; thin cows lose the protective fat pad in the hoof, and sudden changes in diet, especially rapid increases in concentrates, can lead to acidosis and laminitis. Some cows are naturally more at risk due to stress around calving, early lactation, prior lameness episodes, age-related hoof changes, or genetics. Underlying all of this is a common problem on many farms: the absence of a structured, consistent lameness control plan. Without a clear approach to prevention, detection, and treatment, lameness remains an ongoing challenge; this is exactly what the Sound Cow Innovation Programme (SCIP) aims to address.

Sound Cow Innovation Programme (SCIP)

The Sound Cow Innovation Programme, known as SCIP, is a new initiative designed to help Irish dairy farmers tackle lameness in a more effective and structured way. Developed through a partnership involving Animal Health Ireland, Teagasc, University College Dublin, the Irish Cattle Breeding Federation, and professional hoof health experts, SCIP is grounded in science but built around practical actions that can be applied on real farms.

At the heart of the SCIP programme is a commitment to regular monitoring and proactive management of hoof health. Farmers who join the programme will be asked to carry out mobility scoring of their cows once a month. These scores will be recorded using a dedicated mobile app or web-based tool, allowing trends to be tracked over time and helping to identify cows that need attention before problems become severe.

Each participating farmer will work closely with a trained vet or hoof trimmer to develop a lameness management plan that suits their herd. This plan may involve adjustments to trimming schedules, foot bathing routines, housing conditions, or treatment protocols. Farmers will also receive support and training to build confidence in identifying lame cows and taking prompt, effective action.

The SCIP programme is designed to be supportive, not prescriptive. It recognises the day-to-day pressures farmers face and aims to build on what is already working well. It brings together the latest knowledge, user-friendly digital tools, and expert guidance to help farmers take small, manageable steps that lead to real improvements in animal welfare and farm performance.

By taking part in SCIP, farmers can expect to see benefits such as improved cow comfort, fewer lameness-related losses, and reduced need for antibiotics through earlier intervention. The programme also offers the chance to contribute to the development of national best practice in lameness control, with the long-term goal of reducing lameness levels across the Irish dairy sector. Looking ahead, SCIP has the potential to form the basis of a wider national initiative.

Conclusion

Lameness remains one of the most pressing health and welfare issues in Irish dairy herds, affecting not only cows but also farm efficiency, profitability, and morale. While the causes are well understood and practical solutions are available, the lack of a national strategy and structured on-farm plans means the problem often goes unmanaged. The Sound Cow Innovation Programme (SCIP) offers farmers a practical, supported way to take control of lameness through regular mobility scoring, improved hoof care, and expert guidance.

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Pain management to improve the welfare of freshly calved and lame dairy cows

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Summary

- Calving and lameness are painful experiences that may compromise cow welfare
- Non-steroidal anti-inflammatory drugs (NSAIDs), such as ketoprofen, can provide pain relief and reduce inflammation in lactating dairy cows
- Studies are ongoing at Teagasc to establish the effect of NSAID administration in lame and freshly calved dairy cows in an Irish, pasture-based system

Introduction

As the Irish dairy industry evolves to meet consumer expectations, there is an increasing focus on sustainability and animal welfare. Public concern is particularly focused on preventing pain and suffering in farmed animals, with chronic pain recognised as a major contributor to stress and poor welfare. Implementing effective pain-reduction strategies is crucial for both animal health and consumer satisfaction.

Calving is a painful experience for cows, while lameness is another major concern, and a potential source of chronic pain. Recent Teagasc research found the prevalence of lameness on Irish dairy farms to be 7.9% during the grazing season, and 9.1% during housing. Lameness not only impairs welfare but also negatively affects the economic sustainability of dairy farms by reducing milk production and fertility. While NSAIDs are widely used to treat conditions like pneumonia and mastitis, their use for pain at calving and from lameness is less common. Recent UK research shows routine NSAID use post-calving and for lameness lowers the lifetime probability of lameness and culling risk. One study found that cows treated with ketoprofen post-calving produced 5% more 305-day mature equivalent milk yield, compared to controls. Despite these benefits, NSAID use in Ireland remains low, as shown in a recent Teagasc survey of farmers and vets. Currently, two Teagasc-led studies are investigating the benefits of NSAID use in dairy cows in a pasture-based system.

Investigating ketoprofen administration in freshly calved dairy cows

An ongoing Teagasc study aims to explore whether administering NSAIDs (ketoprofen) to dairy cows after calving improves their health, welfare, and milk production throughout lactation. 213 treated cows will be compared to 213 untreated cows using daily milk records and biweekly mobility scores (a visual assessment tool that ranks cows on a scale from 0-3, to determine their mobility) to assess effects on production and determine if cows receiving ketoprofen at calving are less likely to become lame.

A subset of 42 cows underwent further testing to assess stress, inflammation, energy balance, and welfare post-calving. Rectal temperatures were recorded to examine changes around calving. Compared to their pre-calving baseline, cows experiencing a moderately difficult calving (2) showed a significant temperature increase at 14 days post-calving, while easy calving cows (1) showed a significant and consistent decrease in temperature following calving (Figure 1). Activity sensors (IceQube®; Figure 2), and video monitoring were used to track cow activity and behaviour post-calving.

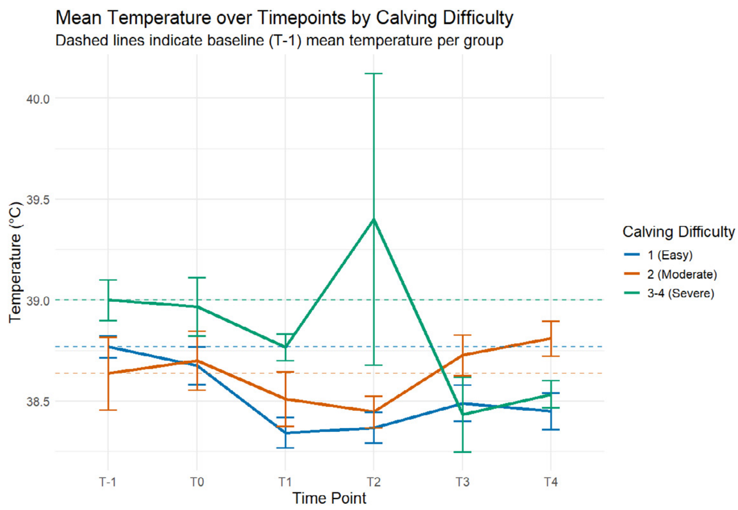

Figure 1. *Changes in rectal temperature over time by calving difficulty group, shown as differences from baseline pre-calving temperature (T-1). Timepoints: T0 = calving, T1 = 24 hrs post-calving, T2 = 48 hrs post-calving, T3 = 7 days post-calving, T4 = 14 days post-calving*

Figure 2. *Cow with IceQube® leg mounted activity sensor with Velcro strap*

Investigating ketoprofen administration in lame dairy cows

A second study will examine whether administering NSAIDs (ketoprofen) to lame cows improves their recovery, boosts milk yield, and reduces recurring lameness. Lame cows (scores 2 or 3) on three farms will be trimmed and either treated with ketoprofen or not. Recovery will be monitored using mobility scores at 7 and 14 days post-trimming, with lameness causes recorded.

A subset of 21 cows from each treatment group will undergo blood sampling to assess the impact of lameness on stress, inflammation, and welfare in both groups. Lame cows will also wear IceQube® activity sensors to track their activity levels, standing, and lying times during the lameness recovery period.

Conclusion

These ongoing Teagasc studies aim to provide evidence regarding the benefits of using ketoprofen to manage pain in dairy cows after calving and when lame. By improving cow welfare and productivity, this research supports the development of best practices that enhance both animal well-being and the sustainability of Irish dairy farming.

Milk Fever – What is happening on Irish dairy farms?

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Summary

- Milk fever and subclinical hypocalcaemia are characterised by low calcium concentrations in blood. The former leading to clinical symptoms such as a "downer cow" and the last without clinical symptoms
- Calcium concentration is low for up to 33 days post-calving in a considerable proportion of cows
- Mineral concentrations of grass silage and minerals being fed to dry cows could be impacting their ability to re-establish blood calcium concentration after calving

Introduction

Low blood calcium (Ca) concentrations are associated with milk fever and subclinical hypocalcaemia. Milk fever is associated with clinical symptoms, commonly seen as a "downer cow". Conversely, subclinical hypocalcaemia is not associated with clinical signs and its diagnosis requires a blood test. In a recent survey of Irish dairy farmers, 15.7% (82/522) reported having significant (regularly treating severe cases with some cows lost/culled) or routine (regularly treating cows to control issues) problems with milk fever in their herds. Most farmers (77%; 401/521) reported treating ≤3% of their herd on an "average" year for milk fever. Subclinical hypocalcaemia was reported as a significant or routine problem by 9.4% (49/522) of farmers. The diet provided to the cow during the dry period can influence cows' ability to maintain blood Ca concentration post-calving. Particularly, dietary concentrations of Ca, phosphorus, magnesium and potassium can interfere with cows' Ca balance post-calving. The difference between cations (positively charged ions) and anions (negatively charged ions) in the diet is referred to as the dietary cation-anion difference (DCAD). A low to negative DCAD has been widely reported as successful in the prevention of milk fever in other dairy production systems across the world as it favours optimal conditions for Ca mobilisation and resorption. A low to negative DCAD can be achieved by feeding less cations (potassium and sodium) than anions (chloride and sulphur). Potassium is typically high in pasture, however, there is no recent data describing mineral concentrations of grass silage typically fed to dry cows in Irish dairy farms. Hence, the overarching aim of this research was to describe cows' blood Ca dynamics around calving and the mineral composition of grass silage fed to dry cows in spring-calving, pasture-based Irish dairy farms.

Transition period research

During the 2023 spring-calving season, 27 commercial dairy farms from nine counties were enrolled in this study. Depending on herd size 18 to 25 cows from each herd were blood sampled (total of 563 cows) at each of three farm visits (during the dry period, ~2 weeks and ~4 weeks post-calving). Ca concentrations were determined from the blood samples. Cow parity was collected from herds' ICBF profiles and cows were categorised as 1st, 2nd – 3rd or ≥4th lactation. Samples of grass silage fed to dry cows were collected during the dry period visit and were analysed for mineral composition. Dry cow mineral labels were also collected during the dry period visit on 24 of the 27 farms.

Blood Ca dynamics

Average Ca concentration remained stable until seven days before calving (2.01 mmol/l), whereby concentration began decreasing, reaching its lowest point at two days post-calving (1.91 mmol/l) (Figure 1), and increasing thereafter until 33 days post-calving (2.13 mmol/l). No difference in blood Ca dynamics between cow age groups was observed. Ca concentration remains lower than what is reported for other dairy production systems and for a considerable proportion of cows for up to 33 days post-calving, suggesting some difficulties on the re-establishment of blood Ca concentration post-calving.

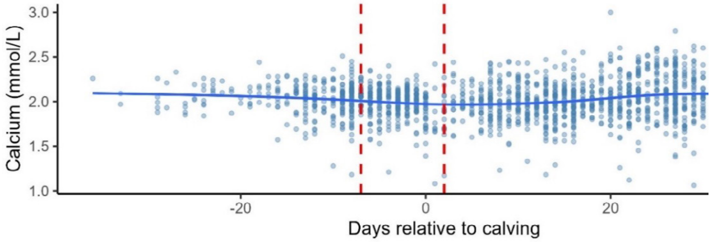

Figure 1. *Calcium concentration (blue dots), smoothed trend line (blue horizontal line) and points of change in calcium concentration (red vertical lines) for 563 spring-calving cows from 27 dairy herds.*

Dry cow grass silage mineral concentrations

Strategies to prevent milk fever during the dry period described in other production systems include oversupplying Ca (>1.2% dry matter (DM)) to help meet demand post-calving or undersupplying Ca (below maintenance levels, 0.43% DM) to prime cows' Ca mobilisation mechanisms. Grass silage samples had on average an intermediate (0.61% DM) Ca concentration (range = 0.40 to 0.99% DM), which has not been proven to contribute to milk fever prevention. Furthermore, 7% (2/27) of farms provided grass silage which was below cows' requirements for maintenance of Ca concentrations. Magnesium concentration (range = 0.11 to 0.23% DM) was lower than recommended for milk fever prevention (>0.4% DM) in all grass silage samples. Most grass silage samples (70%; 19/27) were within the phosphorus concentration recommended for milk fever prevention in other production systems (≤0.3% DM; range = 0.20 to 0.40% DM). Average grass silage potassium concentration (1.99% DM) was just within the milk fever prevention recommendation (<2.0% DM), however 44% of samples were above this recommendation (range = 0.88 to 2.99% DM). Grass silage DCAD [(sodium + potassium) – (chlorine + sulphur); range = 17.50 to 48.61 mEq/100g DM] was much higher than the recommendation (-10 to -15 mEq/100g DM) for milk fever prevention in other production systems, potentially reducing the ability to mobilise Ca postpartum.

All farmers in this study fed grass silage and a mineral supplement to dry cows. Mineral supplements were provided in the form of powder (88%; 21/24), liquid through water troughs (8%; 2/24) or a lick bucket (4%; 1/24). Dry cow mineral labels showed that 71% (17/24) of farmers provided minerals containing 0.73 to 10.2% of Ca while the remainder had undisclosed amounts of added and/or background Ca (29%; 7/24). All dry cow minerals provided by farmers contained magnesium (range = 0.5% to 50%) and phosphorus (range = 0.2 to 14%). None of the dry cow minerals contained potassium.

Conclusion

Blood Ca concentration begins to decrease before calving and reaches its lowest concentration at two days post-calving in agreement with research from other production systems. Mineral composition of grass silage fed to dry cows should be tested and dry cow mineral supplementation scheme adapted accordingly to favour positive Ca balance postpartum. Subsequent research will describe the impact of low blood Ca concentration on cows' performance and evaluate management strategies to favour postpartum recovery of blood Ca concentration.