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Rearing dairy calves in the post-quota era



Key external stakeholders:
Scientific, Advisors, Policy makers, Farmers, Public/Consumers

Practical implications for stakeholders:

- Colostrum management on commercial Irish dairy farms is of a high standard but can be further improved by ensuring pooled colostrum is not offered to calves
- Calf health and welfare can be objectively assessed on Irish dairy farms in a feasible manner
- Hygiene practices related to calf feeding equipment can be improved, and particularly during the final six weeks of the calving season.

Main results:

- Feeding calves pooled colostrum reduces antibody (IgG) uptake compared to calves fed colostrum from their own dam or a single other cow
- Lighter born calves have a great ability to absorb immunoglobulins from colostrum than heavier born calves (> 34 kg)
- A Brix refractometer can be used to assess transition milk quality up to the third milking
- A calf welfare assessment protocol has been developed which is reliable, feasible and time efficient
- Colostrum management on commercial Irish dairy farms is of a high standard, with > 90 % success rate for achieving adequate transfer of passive immunity (TPI).
- Mean serum IgG concentration across all herd sizes exceeded the recommended threshold
- Hygiene practices related to calf feeding equipment can be improved, and particularly during the final six weeks of the calving season.
- Space allowance provided to calves is almost twice that of the minimum legal requirement and was not found to affect calf behaviour.
- Correctly treating diarrheic calves, by administering an electrolyte solution while continuing to offer milk, is of critical importance, and is associated with calf mortality on Irish dairy farms.

Opportunity / Benefit:

Welfare and management of calves is of increasing interest, and also influences performance of these animals in later life. Prior to this project the welfare status of both male and female calves on Irish dairy farms was unknown. Poor colostrum quality or substandard management, combined with poor calf related hygiene can increase disease susceptibility, culminating in a negative impact on calf welfare. The results from this study indicate colostrum management on Irish dairy farms is of a high standard, with over 90 % of calves receiving adequate transfer of passive immunity. Measuring colostrum quality would allow farmers to even further increase the rates of adequate passive transfer in calves. Furthermore, passive transfer rates in calves can be improved by using colostrum from the calf's own dam or a single other cow rather than pooling.

Collaborating Institutions:

Wageningen University (Netherlands); University of California, Davis (USA); Tyndall National Institute, University College Cork; ICBF

Teagasc project team:

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1. Project background:

Dairy calf welfare is a complex status that is influenced by a wide range of factors. Inhibited transfer of immunity in-utero results in calves being born without immunity, which must be acquired passively through ingestion of colostrum immediately after birth. Management of colostrum is therefore a factor of significant importance to calf welfare, and when managed incorrectly can predispose calves to increased risk of morbidity and mortality. In Ireland, previous studies have described colostrum management as sub-optimum. In the intervening period, the landscape of the Irish dairy sector has changed substantially. Following removal of the European milk quota system in 2015, Irish dairy herds have expanded in an effort to increase production and profitability. This expansion coupled with pre-existing standards of colostrum management, which have been described as sub-optimum, could negatively impact on calf welfare, and particularly so given the short calving period which is applied among seasonal calving systems which operate in Ireland. The aim of this project was to i) evaluate the effect of colostrum quality and management on calf health and immunity, and ii) to assess calf welfare on commercial farms and identify improvement options.

2. Questions addressed by the project:

- What is the effect of feeding pooled or single dam colostrum (own dam or other dam) and passive immunity but also what are the depletion rates of disease specific immunity
- Can a commercially available digital Brix refractometer be used to assess quality of colostrum and transition milk to determine the IgG concentrations in colostrum and first to fifth transition milkings
- Can a reliable, feasible and time-efficient welfare assessment protocol, using different indicators, for male and female dairy calves during the pre-weaning and weaning phases be developed and implemented on farm
- What colostrum and calf management practices are prevalent on commercial Irish dairy farms, and what are the associated calf mortality rates
- What are the associations between pre-weaning calf management and calf welfare and mortality on commercial dairy farms

3. The experimental studies:**Study 1**

Aiming for 120 heifer calves, 320 cows were enrolled in the study. In both January 2016 and January 2018, 160 cows (120 multiparous, 40 primiparous, each year) were enrolled. Of these cows, 119 produced heifer calves and colostrum which was used as part of the study. A complete randomised block design was applied, with a total of 119 heifer calves (59 in 2016, and 60 in 2018) enrolled in the study: 88 Holstein Friesians (HF) and 31 HF x Jersey. Calves were randomly assigned to one of the three treatments where they received i) maternal colostrum (MC), ii) non maternal colostrum (NMC), or iii) pooled colostrum (PC). Pooled colostrum was prepared by combining colostrum at equal ratios from a number of cows (two cows in 2016, and from four cows in 2018). For colostrum IgG concentration, efforts were made to ensure similar quality colostrum was provided across each of the treatment groups. Calves were blood sampled prior to colostrum feeding, 24 hours old and monthly intervals thereafter, and these samples were then analysed for antibodies to a range of diseases (IBR, BVD, Leptospirosis, Salmonella, Rotavirus, Coronavirus, PI3, BRSV).

Study 2

Indicators, both animal and resource-based, were selected by a review of existing literature and a process of expert consultation. Following the formulation phase, the protocol was then applied on five Irish dairy

farms to develop further for completeness and on-farm feasibility. After each on-farm application, the protocol was critically evaluated, and modifications were made accordingly. Upon completion of the on-farm application phase, a feasible, reliable and time efficient protocol was produced.

Study 3

Dairy herds recruited onto the study were located within an 80 km radius of Teagasc Moorepark (the area most densely populated with dairy herds in Ireland), to minimize travel time and facilitate sample processing. Herds had to be subscribed to HerdPlus, a data management and reporting system operated by the Irish Cattle Breeding Federation (ICBF) (Bandon, Co. Cork, Ireland). In Ireland, pasture-based, spring-calving production systems predominate, with the average herd containing 80 cows. Selected herds, therefore, fulfilled the criteria of operating a spring-calving, pasture-based system, with a minimum herd size of 70 cows. A hardcopy letter inviting 188 identified herds was sent to each herd owner in an attempt to recruit them onto the study. This letter outlined the objectives of the project, as well as an overview of the work involved, the expected outcomes, and the feedback participants would receive. Expressions of interest for inclusion in the study were collected by responding to a telephone number or email address, as outlined in the invitation letter. After 14 d, a reminder letter was sent to those who had not yet responded, requesting they provide a response. Forty seven herd owners agreed to participate (25 % response rate) and were contacted by telephone for details regarding expected calving start date, specific farm location, a suitable visit time (i.e., am or pm) and date.

To investigate if changes in colostrum and calf management occur as the calving season progresses, each farm was visited twice. Based on expected calving start date provided by each herd, a visit was made once early in their calving season (i.e., within 6 wk of expected calving start date), and again in the latter half of the calving season (i.e., between wk 6 and 12 of expected calving start date). The first visits occurred between 4 February and 11 March, while the second visits occurred between 13 March and 13 April.

4. Main results:

- Feeding colostrum from a single cow (MC or NMC) resulted in higher passive immunity among calves, relative to those which received PC.
- Calf bodyweight was associated with transfer of passive immunity, lighter calves achieved a higher serum IgG concentration at 24 h
- Immunoglobulin G concentrations in the first transition milk samples were relatively high and could provide adequate passive immunity to calves when fed in appropriate quantities. The sensitivity of the digital refractometer in identifying samples with low IgG concentrations in colostrum, first, second, and third transition milk was acceptable. In contrast, digital refractometry is not useful for assessing IgG concentrations in the fourth and fifth milking due to low IgG concentrations.
- Through the combined use of management, environment, and animal indicators, a reliable, feasible, and time efficient dairy calf welfare assessment protocol was developed. By completing validation on a number of measurements, this protocol could be used for large scale welfare assessments and for identifying risk factors associated with dairy calf welfare.
- Colostrum management on commercial Irish dairy farms is of a high standard, with > 90 % success rate for achieving adequate transfer of passive immunity (TPI). Serum IgG concentration was higher in calves born in smaller herds (< 110 cows), but mean serum IgG concentration across all herd sizes exceeded the recommended threshold (≥ 10 mg/mL). Colostrum quality in Irish dairy herds is generally good; however, considerable variation exists in colostrum IgG concentration. Negative implications associated with such variation could be overcome by assessing colostrum quality, a practice currently conducted on less than 15 % of Irish dairy farms. Hygiene practices related to calf feeding equipment can be improved, and particularly during the final six weeks of the calving season. This could reduce the risk of bacterial contamination of colostrum, and further increase the rate of passive immunity achieved on commercial dairy farms.
- Post-colostrum feeding practices on commercial Irish dairy farms were not associated with calf mortality rates. Space allowance provided to calves is almost twice that of the minimum legal requirement and was not found to affect calf behaviour. Group size, however, was found to influence calf behaviour, and could potentially influence calf welfare in early life. Hygiene practices were not associated with the presence of faecal pathogens. Vaccine use was not associated with calf mortality on commercial Irish dairy farms. Correctly treating diarrheic calves, by administering an electrolyte solution while continuing to offer milk, is of critical importance, and is associated with calf mortality on Irish dairy farms.

5. Opportunity/Benefit:

Welfare and management of calves is of increasing interest, and also influences performance of these animals in later life. Prior to this project the welfare status of both male and female calves on Irish dairy

farms was unknown. Poor colostrum quality or substandard management, combined with poor calf related hygiene can increase disease susceptibility, culminating in a negative impact on calf welfare. The results from this study indicate colostrum management on Irish dairy farms is of a high standard, with over 90 % of calves receiving adequate transfer of passive immunity. Measuring colostrum quality would allow farmers to even further increase the rates of adequate passive transfer in calves. Furthermore, passive transfer rates in calves can be improved by using colostrum from the calf's own dam or a single other cow rather than pooling.

6. Dissemination:

Main publications:

Barry J., E.A.M. Bokkers, D.P. Berry, I.J.M. de Boer, J. McClure, E. Kennedy (2019) Associations between colostrum management, passive immunity, calf-related hygiene practices, and rates of mortality in pre-weaning dairy calves. *Journal of Dairy Science* 102, 10266–10276.

Barry J., E. Kennedy, R. Sayers, I.J.M. de Boer and E.A.M. Bokkers (2019) Development of a welfare assessment protocol for dairy calves from birth through to weaning. *Animal Welfare* 28, 331-344.

Rayburn M.C., M. Chigerwe, J. Barry, E. Kennedy (2019) Use of a digital refractometer in assessing immunoglobulin G concentrations in colostrum and the first 5 transition milkings in an Irish dairy herd. *Journal of Dairy Science* 102, 7459-7463.

Popular publications:

Barry J., E. Bokkers, D.P. Berry, I. De Boer, J. McClure, E. Kennedy (2019) Postnatal effects of colostrum quality and management, and hygiene practises, on immunity and mortality in Irish dairy calves. ISAE 53rd Congress of the International Society for Applied Ethology: Animal Lives Worth Living p. 90

Barry J., E. Bokkers, I.J.M. de Boer, E. Kennedy (2018) An investigation of behaviours displayed by pre-weaned dairy calves in different group sizes on commercial Irish dairy farms. ISAE 2018: 52nd Congress of the International Society for Applied Ethology

Barry J., E. Bokkers, I.J.M. de Boer, E. Kennedy (2018) Colostrum and calf serum IgG concentrations on commercial pasture-based Irish dairy farms. 10th International Symposium on the Nutrition of Herbivores (ISNH)

7. Compiled by: Emer Kennedy
