**Application**

Test procedures and cut-off values have a major impact on the interpretation of failure of passive transfer (FPT) of immunity and its associated factors in suckler beef and dairy beef calves.

**Introduction**

Calves with FPT have an increased risk of respiratory disease, diarrhoea, poor growth performance, and death. Studies describing the factors associated with passive immunity and FPT in Irish suckler beef and dairy calves are limited. The study objective was to assess dam and calf characteristics, and herd-level and calf-level management practices associated with passive immunity and FPT, determined by different blood tests and cut-offs, in Irish spring-born suckler beef and dairy calves.

**Material and methods**

Data obtained (face-to-face questionnaire) from herd-level (66 suckler beef farms [391 calves], 77 dairy farms [674 calves]), and calf-level (9 suckler beef farms [377 calves], 8 dairy farms [916 calves]) studies conducted in spring 2015 and 2016, respectively, were used (Todd et al., 2018). Total IgG (ELISA, ELISA-IgG), total protein (clinical analyser, TP-CA) and total solids (BRIX refractometer, TS-BRIX) were determined in calf serum collected within 1 to 14 days post-birth. Calf FPT status (yes/no) was defined using the cut-offs for classification of morbidity/mortality in Irish suckler beef and dairy calves (current cut-offs (CC); Todd et al., 2018), and published literature cut-offs (LC). The CC for ELISA-IgG was ≤ 9 and ≤ 12 mg/mL, for suckler and dairy calves, respectively, and the TP-CA and TS-BRIX were ≤ 60 g/L, and ≤ 8.4%, respectively, for both suckler and dairy calves. The LC were identical for suckler and dairy calves (ELISA-IgG < 10 mg/mL; TP-CA < 52 g/L; TS-BRIX < 8.4%). Pearson correlations between the three tests were determined. Mixed multivariable linear and logistic regression models with farm as random effect were used to assess the dam and calf characteristics, herd-level and calf-level management practices associated (*P*<0.05) with passive immunity and FPT, determined by different blood tests and cut-offs.

**Results**

There were positive correlations between the different serum passive immune measures (*P*<0.05) in the herd level and calf-level studies (suckler beef: ELISA-IgG *vs.* TP CA, *r* = 0.75 – 0.86; ELISA-IgG *vs.* TS-BRIX, *r* = 0.72 – 0.80; TP-CA *vs.* TS-BRIX, *r* = 0.91 – 0.95; dairy: ELISA-IgG *vs.* TP CA, *r* = 0.79 – 0.85; ELISA-IgG *vs.* TS-BRIX, *r* = 0.76 – 0.80; TP-CA *vs.* TS-BRIX, *r* = 0.92 – 0.95).

*Herd-level study:*

Suckler beef calves reared on farms that did not immunise the dams against diarrhoea pre-calving (*vs.* practiced vaccination) had lower passive immune measures based on ELISA-IgG and TS-BRIX but were associated with greater odds of FPT using the CC for all tests and the LC for ELISA-IgG (Table 1). Dairy calves born to primiparous dams (*vs.* multiparous) had lower serum TP-CA and TS-BRIX concentrations and were more likely to have FPT using the CC for TP-CA and TS-BRIX only. Male dairy calves (*vs.* female) had lower passive immune measures based on TP-CA and had greater odds of FPT using the CC and LC for ELISA-IgG and TP-CA, possibly reflecting differences in colostrum management practices. Length of dry period had no effect on passive immune measures in suckler beef and dairy calves (*P*>0.05); however, dairy calves born on farms with a dry period ≤ 8 weeks (*vs.* > 8 weeks) had an increased likelihood of FPT using all cut-offs except the LC for TS-BRIX.

*Calf-level study:*

Suckler beef calves born during the peak calving season (*vs.* early) had lower passive immune measures based on ELISA-IgG test and greater odds of FPT using the CC and LC for ELISA-IgG only (Table 1). Suckler beef calves that consumed colostrum more than 2 h post-birth (*vs.* within 2 h) had lower passive immune measures based on all tests and greater odds of FPT using all cut-offs except the CC for TS-BRIX. Suckler beef calves with perinatal problems (*vs.* no perinatal problems) had lower passive immune measures based on all tests and were more likely to have FPT using all cut-offs. In dairy calves, perinatal problems were only associated with lower serum TP-CA concentrations. Dairy calves born to primiparous (*vs.* multiparous) had lower passive immune measures based on all tests, and a greater likelihood of FPT based on the CC for ELISA-IgG and TP-CA, and the LC for ELISA-IgG. Calving supervision was not associated with any passive immune measures (*P*>0.05); however, the odds of FPT using all cut-offs were lower when calving was not supervised (*vs.* present at calving). Feeding stored colostrum (*vs.* fresh) increased the likelihood of FPT based on the LC for TP-CA and TS-BRIX.

**Conclusion**

This study indicates that the factors associated with passive immunity and FPT varied depending on the tests and the cut-offs used to define FPT, possibly attributed to differences in sensitivity and specificity between tests and cut-offs. Furthermore, different factors were identified in suckler beef and dairy calves.

**Acknowledgement**

DAFM Stimulus Funded project (€asyCalf 11/S/131). RRMH is a Teagasc Walsh Scholarship recipient.

**References**

Todd, CG., McGee, M., Tiernan, K., Crosson, P., O’Riordan, E., McClure, J., Lorenz, I., and Earley, B. (2018). Preventive Veterinary Medicine, 159, 182–195.

Table 1. Factors associated with (*P*<0.05) passive immune measures and failure of passive transfer (FPT) of immunity defined by different blood tests and cut-offs in suckler beef and dairy calves.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Suckler beef** | | | **Odds ratio1** | **Dairy** | | | **Odds ratio1** |
|  | **ELISA-IgG** | **TP-CA** | **TS-BRIX** | **ELISA-IgG** | **TP-CA** | **TS-BRIX** |
| **Herd-level study** |  |  |  |  |  |  |  |  |
| Dam diarrhoea vaccination pre-calving (no *vs.* yes) | P, CC, LC | CC | P, CC | 1.7 to 2.0 | NS | NS | NS |  |
| Dam parity (primiparous *vs.* multiparous) | NS | NS | NS |  | NS | P, CC | P, CC | 1.7 to 1.9 |
| Calf sex (male *vs.* female) | NS | NS | NS |  | CC, LC | P, CC, LC | NS | 1.5 to 2.4 |
| Length of dry period (≤ 8 *vs.* > 8 weeks) | NS | NS | NS |  | CC, LC | CC, LC | CC | 1.7 to 2.1 |
| **Calf-level study** |  |  |  |  |  |  |  |  |
| Time of birth relative to calving season (peak *vs.* early) | P, CC, LC | NS | NS | 2.5 to 3.8 | NS | NS | NS |  |
| Time of first colostrum feeding (> 2 h *vs.* within 2 h post-birth) | P, CC, LC | P, CC, LC | P, LC | 2.3 to 10.1 | NS | NS | NS |  |
| Perinatal problems (yes *vs.* no) | P, CC, LC | P, CC, LC | P, CC, LC | 3.6 to 4.5 | NS | P | NS |  |
| Dam parity (primiparous *vs.* multiparous) | NS | NS | NS |  | P, CC, LC | P, CC | P | 1.5 to 1.6 |
| Calving supervision (not supervised *vs.* present at calving) | NS | NS | NS |  | CC, LC | CC, LC | CC, LC | 0.6 to 0.7 |
| Type of colostrum feeding (stored *vs.* fresh colostrum) | N/A | N/A | N/A |  | NS | LC | LC | 2.8 to 5.0 |

P – Passive immune measures; CC – Current cut-offs; LC – Literature cut-offs; NS – Not significant (*P*>0.05); N/A – Not applicable; 1Odds ratio for FPT.