The impact of calf health on future performance

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Enteritis and pneumonia are common causes of calf ill health and death, with approximately one third of Northern Ireland dairy producers in a survey conducted by the Agri-Food and Biosciences Institute (AFBI) and the College of Agriculture, Food and Rural Enterprise (CAFRE) indicating that they had problems with these conditions. Figure 1 shows causes of mortality in neonatal (up to four weeks old) calves submitted to AFBI and the Department of Agricuture, Food and the Marine (DAFM) veterinary laboratories in Ireland during 2011 (All–island Animal Disease Surveillance Report 2011, AFBI/DAFM). Enteric infection is the most common post mortem diagnosis in neonatal calves in Ireland, and at least some of the cases of bacteraemia and septicaemia recorded will be a sequel of primary enteric infection. Pneumonia likewise is shown to be important on an all-island basis. Data from the AFBI Hillsborough herd has shown that scour not only increased the mortality rate of pre-weaned calves by 3%, but that it also had a significant negative impact on future animal performance, with a 12kg reduction in live weight seen at 18 months (Table 1). With age at puberty in heifers linked to physical development, reduction in growth rates can lead to a delayed age at first service and subsequent first calving, thus impacting on animal productivity and profitability.

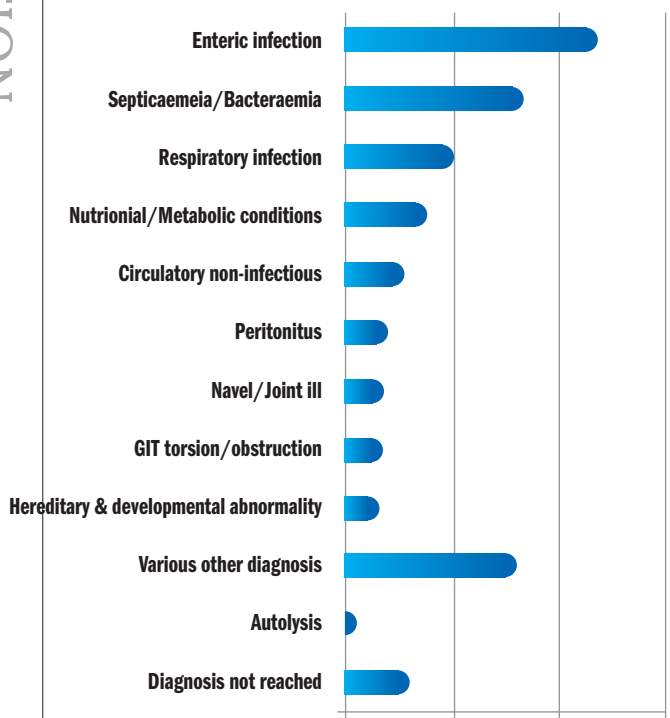

Figure 1: Shows causes of mortality in neonatal (up to four weeks old) calves submitted to AFBI and the Department of Agricuture, Food and the Marine (DAFM) veterinary laboratories in Ireland during 2011 (All–island Animal Diseases Surveillance Report 2011, AFBI/DAFM).

Photo 1: Significant permanent lung damage caused by pneumonia.

Table 1: Impact of pre-weaning scour on dairy heifer performance (AFBI Hillsborough herd data).

Parameter	No Scour	Scour	Significance
Live weight (kg)			
12 months	270	265	**
18 months	439	427	***
% mortality	Base	+3%	*

As with scour, pneumonia impacts not only on husbandry demands and veterinary costs, but also on future animal performance (see Photo 1 as an example of lung damage caused by pneumonia pathogens). Dairy heifers in the AFBI Hillsborough herd which had calfhood pneumonia experienced reduced growth rates through to calving, resulting in a 13kg difference at the point in calving ($P<0.05$). In terms of production, although there was no reported difference in first lactation milk production in calves that only required a single treatment for pneumonia, a reduction of approximately 5% in first and 10% in second lactation milk yields (Table 2) was found in those heifers which required multiple treatments for pneumonia during calfhood. This data highlights the importance of preventing

pneumonia and, in particular, persistent reoccurring pneumonia in young calves if they are to achieve their growth targets and production potential.

Table 2: Impact of persistent calfhood pneumonia on the performance of dairy herd replacements (data from AFBI Hillsborough herd).

Parameter	No Pneumonia	Multiple episodes of pneumonia	Significance
1st lactation yield (kg) Milk	7204	6867	*
Fat	284	272	0.06
Protein	241	227	*
2nd lactation yield (kg)			
Milk	8933	8084	**
Fat	354	318	**
Protein	305	270	**

MINIMISING THE RISK OF CALFHOOD MORTALITY/MORBIDITY

Good management practice improves welfare and performance. Never is this more clearly seen than in calf rearing. The Farm Animal Welfare Council (FAWC) list the 'Five freedoms' as follows:

- Freedom from hunger and thirst;
- Freedom from discomfort;
- Freedom from pain, injury or disease;
- Freedom to express normal behaviour; and,
- Freedom from fear and distress.

Clearly, each of these is a very important feature of any calf rearing system. Failure to provide any one of these requirements not only compromises welfare but reduces production and increases the levels of infectious disease. Care and attention to detail mean that many calf mortalities should be preventable, and that should be the objective of health planning in this area.

THE IMPORTANCE OF COLOSTRUM

There are multiple factors which can affect the risk of calfhood disease and mortality, such as minimising

Photo 2: Severely affected larynx in a case of calf diphtheria emphasising the importance of hygiene of feeding utensils.

pathogen exposure through cleanliness/hygiene (see Photo 2 as an example of the impact of unhygienic feeding equipment), effective ventilation and adequate pen space. However, one of the primary factors in the prevention of diseases such as scour and pneumonia is effective colostrum management. Effective colostrum management is vital. Calves receiving insufficient intake of colostral antibodies in the first 24 hours of life are much more likely to experience ill-health or die during the pre-weaning period, this is confirmed by the fact that low levels of colostral antibodies were recorded in many of the calves which underwent post mortem in Northern Ireland in 2010.

Aside from the increased risks of death and ill health, a number of studies have found calves with less than adequate immunity or lower colostrum intakes had 40% higher veterinary costs, 17% lower liveweight gains from birth to three months and were on average 17 days older at slaughter (Table 3). In addition, calves who received 4L v 2L of colostrum within one hour of birth had approximately 10% and 15% higher milk yields during first lactation and second lactation respectively highlighting the long-term impact of colostrum management and calf immunity. The importance of calf health was also highlighted by Heinrichs and Heinrichs (2011) who conducted a study involving almost 800 heifers on 21 farms in the US and found that for each day a heifer was ill within the first four months of life, the first lactation yield of milk, fat and protein decreased by 126kg, 4.1kg and 5.2kg respectively.

Table 3: Effect of calf immune status on long-term animal performance

	Immune status	
Parameter	**Low**	**High**
Live weight gain 0-28 days (kg/day)	0.15	0.27
Age at slaughter (months)	20.1	19.5
Veterinary costs ($/calf)	24.51	14.77
1st lactation milk yield (kg)	8952	9907
2nd lactation milk yield (kg)	9642	11294

Sources: Berge et al (2009); Dawson & Moss (2009); Faber et al (2005); Vann et al (2001).

COLOSTRUM MANAGEMENT

Quality and Quantity

Feeding between 3-4L (10% of birth weight) of good quality colostrum within two hours of birth along with follow-up feeds during the first 24 hours will help to ensure that calves receive an adequate quantity of antibodies to help fight off infection. The emphasis must be placed on feeding good quality colostrum, particularly in the first feedings, as calves that are fed poor quality colostrum will never achieve an adequate level of immunity. Studies undertaken in the US (Kehoe et al., 2007) have shown that, in practice, colostrum quality varies widely and therefore so does the volume of colostrum required by the calf to theoretically achieve an adequate quantity of antibody intake as demonstrated in Table 4.

Using a colostrometer to identify and reject poor quality

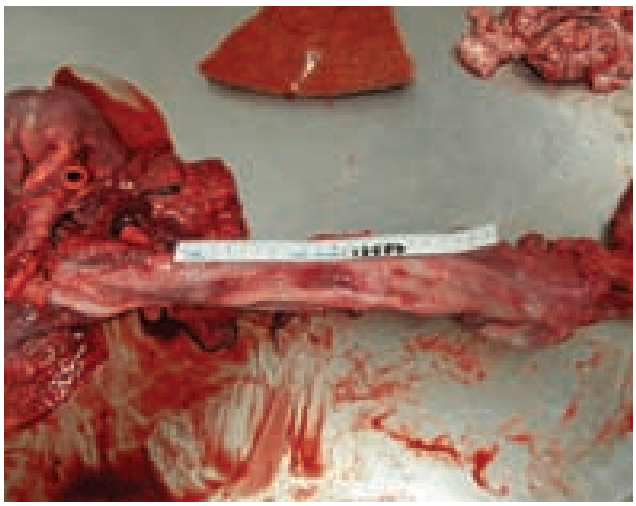

Photo 3: Oesophageal bruising caused by inappropriate use of oesophageal feeder – emphasise appropriate training in use of oesophageal feeders.

colostrum as a first feed and ensuring each calf receives 3-4L of average or better quality colostrum within hours of birth will undoubtedly help ensure that calves receive adequate levels of antibodies to give them a good start in life. If sufficient good quality colostrum is not available from the dam, supplements/replacers may be used but remember that these, unlike natural colostrum, do not contain specific antibodies against the infectious agents present in the herd. The use of pooled colostrum is to be avoided unless donor cows are accredited free of Johne's disease and have not produced BNP (Bleeder) calves. Although in the example in Table 4 the required immunoglobulin G (IgG) intake was 120g this was based on obtaining the minimum blood IgG concentration of 10g/l. As a rough rule of thumb, the target IgG intake for a typical Holstein calf is between 150-200g within the first 2-3 hours of life.

Table 4: Impact of colostrum quality on theoretical volume required by the calf within first hours of life to achieve an adequate immunoglobulin G (IgG) intake.

Colostrum quality	
Birth weight	40 kg
Plasma volume (~9% of weight)	3.6 litres
Minimum IgG Plasma concentration	10 g/L
Efficiency of absorption	30%[a]
Required IgG intake	120 grams
Effect of colostrum quality on volume required	
Excellent (94.8 g IgG/L)[b]	1.3 litres
Average (41 g IgG/L)[b]	2.9 litres
Very poor (13.5 g IgG/L)[b]	8.9 litres
Target (50+ g IgG/L)	2.4 litres

a reported in literature to vary from 20-40%
b colostrum qualities reported by Kehoe et al., 2007 from 55 dairy farms in USA

Colostrum quality is a vital element in the prevention of calfhood disease. Many factors have been associated with colostrum quality and the absorption of IgGs by the calf. These include: length of the dry period; dry cow nutrition

and vitamin/mineral status; degree of prepartum milk leakage; time from calving to colostrum collection/feeding; calving difficulty and general stress around calving etc. At AFBI Hillsborough, colostrum quality is routinely assessed for quality using a simple colostrometer. These simple devices, very much designed for on-farm use, enable the identification of poor quality colostrum (better estimate than visual assessment). Colostrum of poor quality is not fed during the first feeds but used for follow-up feeds when the calf is 2-3 days of age. Care must be taken when using colostrometers as temperature (recommended 22°C), milk fat and non-Ig proteins can influence the reading. Hand-held refractometers have been reported as an alternative (Bielmann et al., 2010) and possibly more accurate and robust technique for assessing colostrum quality with a Brix score of 22% proposed as the cut-off for identifying good quality colostrum.

Feeding Method

Colostrum feeding method often causes debate amongst calf-rearers with some producers adamant that suckling from the dam is the only option. Relying on suckling from the dam alone increases the risk of calves not receiving adequate colostrum intakes. Indeed, one dairy study reported 61% of calves left to suckle the dam did not achieve an adequate IgG intake compared to only 11% of stomach-tubed calves (Besser et al.,1991). Artificially feeding calves through a teated bottle or oesophageal feeder ensures calves receive a pre-set quantity of colostrum. Some argue that the apparent efficiency of IgG absorption (AEA) is lower with these artificial feeding methods and this may well be true, but a guaranteed high IgG mass intake compared to an uncertain level of intake with suckling from the dam overrides any minor difference in AEA. As for teated bottle versus stomach tube there does appear to be a difference in AEA but only at low feeding rates. The AEA, when calves were fed 1.9 L of colostrum per fed via teated bottle, was greater than when calves were fed the same volume through a stomach tube. However, when ≥3L of colostrum was fed in the first hours of life no difference in AEA was detected between feeding methods and all calves had adequate blood IgG concentrations (Godden et al., 2009; Elizondo-Salazar et al., 2011).

As research moves forward, on-farm based techniques for assessing colostrum quality will evolve but what is clear is the importance of colostrum quality cannot be emphasised enough. The attitude of 2L of colostrum will be grand is not longer acceptable. With many producers boosting specific antibody levels to the most common scour-causing pathogens, e.g. E.coli K99/Rotavirus/Coronavirus, through dam vaccination prior to calving, it is critically important that this boosted colostrum is actually received and utilised by the calf if vaccination plans are to be of any benefit. Quality, quantity and quickness are all vitally important.

New Study

The Department of Agriculture and Rural Development in Northern Ireland and AgriSearch, a farmer levy body, have recently commissioned AFBI to establish the level of colostrum quality variability on commercial farms and to investigate causal factors. The project aims to test colostrum quality from a range of dairy herds in Northern Ireland that are reflective of dairy herd genetics and management regimes. The data collected will be used to investigate the impact of genetics, nutrition, vaccination and parity factors on colostrum quality. A detailed examination on levels of specific antibodies and their effectiveness will be performed which will aid in the assessment of the effectiveness of vaccination programmes on commercial farms. While on-farm work is carried out, studies to develop optimum vaccination programmes and colostrum administration techniques to ensure high levels of effective antibodies during the disease challenge period will be conducted at Hillsborough.

SUMMARY

Calf and young stock mortality and morbidity significantly impacts on the profitability and sustainability of livestock enterprises in Ireland. For those calves that survive periods of ill health early in life, long-term performance can suffer. Although many factors contribute to calf health such as housing, ventilation, vaccination programmes and hygiene, effective colostrum management is the cornerstone for successful livestock production. Through simple tests on the quality of colostrum offered and the immune status of calves, effective colostrum management protocols can be developed to improve calf survival and long-term productivity.

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Reader Questions and Answers

1. TARGET IGG INTAKE FROM COLOSTRUM FOR A 40KG HOLSTEIN CALF

a) 0-50g
b) 50-100g
c) 100-150g
d) 150-200g

2. PERCENTAGE OF DAIRY PRODUCERS IN NORTHERN IRELAND THAT RELY ON SUCKLING FROM THE DAM AS THE MAIN METHOD OF DELIVERING COLOSTRUM TO THE DAM

a) 73%
b) 64%
c) 82%
d) 50%

3. WHAT IS THE COMMONEST CAUSE OF NEONATAL DEATH DIAGNOSED ON POST-MORTEM EXAMINATION OF CALVES IN IRELAND?

a) Pneumonia
b) Enteritis
c) Metabolic disease
d) Septicaemia

4. WHICH OF THE FOLLOWING IS NOT A CAUSE OF NEONATAL ENTERITIS IN CALVES

a) E.coli K99 infection
b) Cryptosporidiosis
c) Rotavirus
d) Coccidiosis

ANSWERS: 1.D, 2. A, 3. B, 4. D