

Minimising stress of weaning of beef calves

Improving animal welfare via understanding the physiological stress of weaning of beef calves, is outlined by Dr Bernadette Earley and Dr Mark McGee, Teagasc, Animal & Grassland Research and Innovation Centre (AGRIC), Grange, Co Meath



Within seasonal, grassland-based, suckler beef production systems in Ireland, calves are generally spring-born and reared with their dam at pasture for approximately eight months until the end of the grazing season in autumn when they are weaned. In addition to separation from the dam and removal of milk from the diet, the weaning procedure is generally compounded by other stressors/practices occurring around the same time, eg. change of environment (outdoors to indoors), change of forage diet (grazed grass to conserved forage with or without concentrates), and transport/marketing. Weaning therefore can be a multi-factorial stressor, in which, nutritional, social, physical, and psychological stress are combined. Physical and nutritional stressors are often present through the introduction and adaptation to a new diet and new environment, whereas, psychological stress is present in the form of maternal separation and social disruption. Bovine respiratory disease (BRD) is a major animal welfare and economic concern for the beef cattle industry. For the recently-weaned suckler bred calf, susceptibility to BRD can be a serious problem, with negative knock-on implications for markets, in particular, live export markets. Our research at Teagasc, AGRIC, Grange, set about addressing the knowledge gaps.

QUESTIONS ADDRESSED BY THE RESEARCH

- What are the physiological and immunological consequences of weaning and associated weaning practices for suckled beef calves and their dams?
- Can post-weaning management practices (ie. deferring housing and dietary changes, and, weaning calves next to the dam) alleviate the stress response in weaned beef calves?
- Can pre-weaning management practices (ie. offering supplementary concentrates) alleviate the stress response in weaned beef calves?

EXPERIMENTAL STUDIES: KEY ASPECTS

Characterised the physiological and immunological response in beef calves and cows to abrupt weaning and subsequent housing.

Examined the effects of abrupt weaning at housing on peripheral leukocyte distribution, functional activity of neutrophils, immune response genes, and the acute phase response of beef calves.

Examined the effects of post-weaning management practices – (i) abruptly weaned and housed and, offered grass silage ad libitum plus concentrates versus abruptly weaned and returned to pasture with no concentrates offered and subsequently housed and (ii) weaned and housed in the presence of the dam versus weaned and housed away from the dam – on physiological and immunological responses of beef calves.

Examined the effects of offering concentrate supplementation pre-weaning on the peripheral leukocyte distribution, functional activity of neutrophils and the acute phase protein response of abruptly weaned beef calves.

MAIN RESULTS

- Using conventional blood indicators of stress (ie. physiological, haematological and immunological variables), abrupt weaning (versus not weaning) was shown to be stressful to the suckler calf with alterations in immune function and hormonal mediators of stress still evident seven days post-weaning.
- Similarly, abrupt weaning is a stressful event for the beef cow. However, it appears that the stress response is activated to a lesser degree and for a shorter period in the cow than in the calf.
- Through the use of molecular techniques (ie. real-time [RT]-qPCR), the expression of a number of key genes regulating immune function in the calf are impaired up

to seven days after abrupt weaning. Impairment in the function of these genes could have a profound impact on the health of calves in terms of susceptibility to infection during this time and response to vaccination.

- Beef calves that were abruptly weaned and returned to familiar pasture had a less marked stress response compared to calves that were abruptly weaned, housed indoors and offered a new diet of grass silage plus supplementary concentrates. As housing was also shown to be a stressful event for beef calves, delaying this practice until after weaning reduces the magnitude of the stress response.
- Suckler calves, particularly bulls, may benefit from a weaning strategy where they are allowed visual, oral and olfactory contact with the dam but are prevented from suckling for a number of days prior to total separation.
- Single-suckled beef calves supplemented with concentrates prior to weaning had a lesser reduction in some immune cells (ie. Gamma delta T lymphocytes), started consuming meal faster when housed indoors and spent more time lying down (rather than standing and walking) post-weaning compared with non-supplemented calves.
- Reducing the cumulative effect of multiple stressors around weaning time results in a less marked stress response in the calf.

Weaning typically combines a number of physical and psychological stressors which have the potential to alter the immune state and increase susceptibility to bovine respiratory disease. Stress occurs when an animal's homeostasis

is disrupted. The stress response consists of a set of physiological mechanisms designed to return to homeostasis. Thus, the systemic reaction to a stressor encompasses a wide range of endocrinological, immunological and inflammatory responses. During periods of stress, a percentage of available nutrients from caloric intake is diverted away from processes, such as growth and muscle deposition, and has a role in stabilising other physiological processes (ie. those required for survival, eg. an immune response).

Furthermore, intake and appetite are suppressed during stressful events, with intake of nutrients by stressed livestock often compromised and below that normally consumed by unstressed animals.

Weaning under modern cattle production systems may be described as a multi-factorial stressor as it incorporates nutritional, physical and psychological elements. Calves are often subjected to an array of husbandry practices which may compound their stress at the time of weaning. Additional husbandry practices can include: frequent handling and contact with humans; mixing with unfamiliar cattle; movement to new environments whether it be indoor housing or unfamiliar paddocks; switching to different, entirely solid diets; transportation; and marketing. Some cattle may also undergo additional processing, such as vaccinations, dehorning and castration. So, it is important to fully characterise the weaning process in order to assess the potential health and animal welfare implications that weaning can have when combined with housing and social reorganisation. This will permit adaptation of herd management practices in order to alleviate stress in livestock



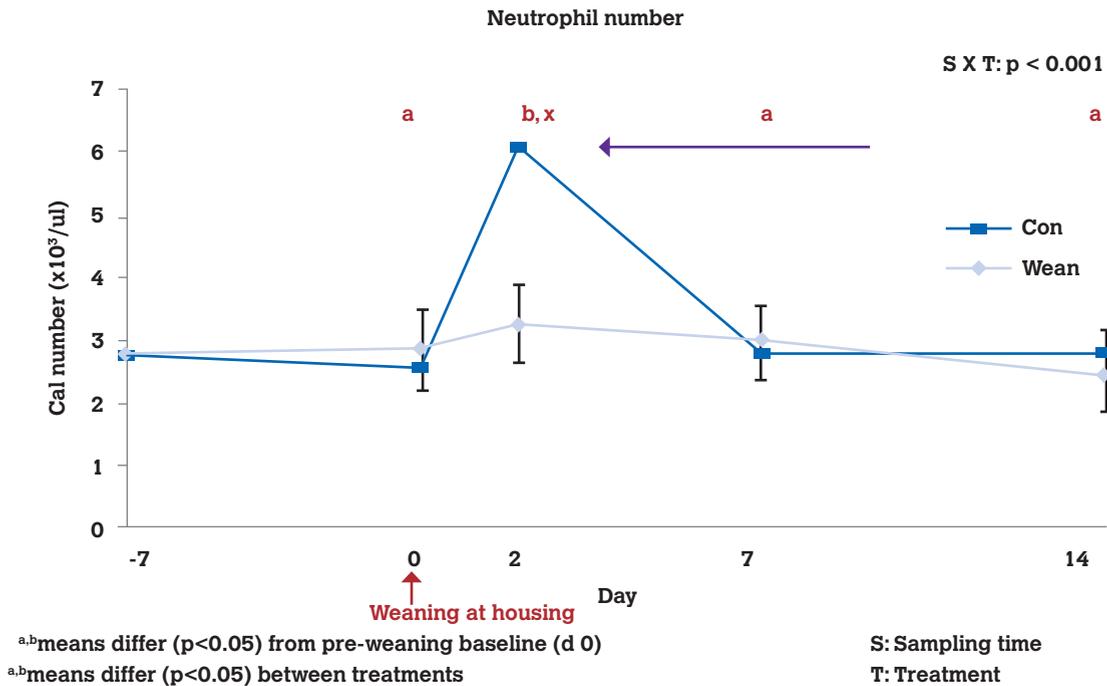


Figure 1: Neutrophil distribution in weaned and not-weaned beef calves (a neutrophil is an immune blood cell that increases in response to stress).

and avoid compromising their immune system response. Of particular importance in evaluating the prolonged effects of weaning stress are the numbers of leukocytes, including neutrophils, lymphocytes, eosinophils and monocytes in the circulation. In the present study, a number of alterations to the blood leukogram were identified. Weaning and housing have both been previously shown to increase total leukocyte number as a result of fluctuations in a number of leukocyte subpopulations, particularly neutrophils. Elevations in endogenous or exogenous glucocorticoids are reported to cause a dramatic shift in the haematological profile of peripheral blood cells resulting in leukocytosis which is marked by neutrophilia (see Figure 1) with an order of magnitude across five studies of 39% (s.e. 9.4%; Hickey et al, 2003; Lynch et al, 2010a; 2011; 2012; O’Loughlin et al, 2011; 2012, 2014). These data strongly indicate that neutrophil number is a robust biomarker to detect weaning stress in beef calves.

OPPORTUNITY/BENEFIT

The results of this research have: (i) demonstrated that, due to transitory alterations in the immune system, abrupt weaning can increase susceptibility to disease in beef calves; and (ii), identified strategies pre- and post-weaning that help reduce the magnitude of the stress response in beef calves and alleviate alterations to the immune system attributed to the weaning process.

KEY EXTERNAL STAKEHOLDERS

Suckler beef farmers, beef industry, Department of Agriculture, Food and the Marine (DAFM) and Veterinary Ireland.

PRACTICAL IMPLICATIONS FOR STAKEHOLDERS:

Weaning is a multifaceted stress that results in a transitory weakening of the immune system and this can result in increased susceptibility to diseases, such as respiratory infections. Implementing pre-weaning practices, such as feeding supplementary concentrates, and post-weaning practices, such as deferring housing and dietary changes and weaning calves next to the dam, resulted in a less marked stress response, as indicated by physiological, immunological and/or behavioural responses, in suckler beef calves.

MAIN RESULTS

- Abrupt weaning is a stressful event for calves and cows and results in transient alterations to the immune system that can be measured at both the physiological and molecular level.
- Reducing simultaneous stressors at weaning, such as deferring housing and dietary changes, leaving weaned calves in close proximity to the cow for a period of time or preparing the calf for subsequent dietary changes by feeding supplementary concentrates pre-weaning reduced physiological, immunological and/or behavioural stress responses in weaned beef calves.

The results of this research have: (i) demonstrated that, as a result of transitory alterations in the immune system, abrupt weaning can increase susceptibility to disease in beef calves; and, (ii) identified strategies pre- and post-weaning that help reduce the magnitude of the stress response in beef calves and alleviate alterations to the immune system attributed to the weaning process.

REFERENCES

Hickey MC, Drennan M, Earley B. The effect of abrupt weaning of suckler calves on the plasma concentrations of cortisol, catecholamines, leukocytes, acute phase proteins and in vitro interferon-gamma production. *Journal of Animal Science* 2003; 81: 2847-2855

Lynch EM, Earley B, McGee M, Doyle S. Effect of abrupt weaning at housing on leukocyte distribution, functional activity of neutrophils, and acute phase protein response of beef calves. *BMC Veterinary Research*. *BMC Veterinary Research* 2010a; 6: 39

Lynch EM, Earley B, McGee M, Doyle S. Characterisation of physiological and immunological responses in beef cows to abrupt weaning and subsequent housing. *BMC Veterinary*

Research 2010b; 6: 37

Lynch EM, McGee M, Doyle S, Earley B. Effect of post-weaning management practices on physiological and immunological responses of weaned beef calves. *Irish Journal of Agricultural and Food Research* 2011; 50 (2): 161-174

Lynch EM, McGee M, Doyle S, Earley B. Effect of pre-weaning concentrate supplementation on peripheral distribution of leukocytes, functional activity of neutrophils, acute phase protein and behavioural responses of abruptly weaned and housed beef calves. *BMC Veterinary Research* 2012; 8: 1

O'Loughlin A, McGee M, Waters SM et al. Examination of the bovine leukocyte environment using immunogenetic biomarkers to assess immunocompetence following exposure to weaning stress. *BMC Veterinary Research* 2011; 7: 45

O'Loughlin A, Lynn DJ, McGee M et al. Transcriptomic analysis of the stress response to weaning at housing in bovine leukocytes using RNA-seq technology. *BMC Genomics* 2012; 13: 250

O'Loughlin A, McGee M, Doyle S, Earley B. Biomarker responses to weaning stress in beef calves. *Res Vet Sci* 2014; (97) 2: 458-463



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